Our Greener Home Energy Toolkit: DIY Home Energy Solutions for Johnson City, TN

Emma L. Massick

School of Sustainability, Arizona State University

MSL: Master of Sustainability Leadership

Dr. Jay Beeks

April 12, 2020

Executive Summary

Overview

This project is the creation of a toolkit that will include essential items and a workbook to allow residents of Johnson City and the surrounding areas to participate in "Do It Yourself" (DIY) energy-efficient upgrades around their homes, whether they rent or own. Included in the toolkit will be several items that the user can keep for themselves, such as lightbulbs, faucet aerators, and weather-stripping material. There will also be items that need to be returned to the library after a specified amount of time, such as light meters, thermometers, and water and energy testing equipment, as well as a workbook with tips and tricks explaining how to perform energy and water efficiency checks around the home.

The Problem Scale and Scope

Tennessee residents use more energy at home than almost every other state in the United States. This project seeks to bring this amount down so that the people in the community will use less energy and pay less for the energy they consume annually. This project seeks to bring education to the residents of Eastern Tennessee and permanently lower the energy use in this community by creating better habits.

Urgency and Timeline

This project is undergoing final preparations and will begin distribution before the end of 2020. A website is under development and the workbook and materials for the toolkits are being fabricated and gathered. This project helps to fulfill sustainable development goal number seven, which is "Ensure access to affordable, reliable, sustainable, and modern energy", and goal number four, "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." Because these goals have a deadline of 2030, it is important to get started on projects that will fulfill their needs.

Strategy and Solution

This project is based on prototypes that have had success in other regions in the United States. There is a similar energy use toolkit program in place in San Jose, California that has expanded to more than thirty public libraries and they are seeing success as a result. By implementing a similar strategy here but adapting it to the needs of this community, this area will reap the same benefits as other programs.

Introduction

This study examines the creation of a sustainability toolkit that can be implemented in many communities, beginning with Johnson City, Tennessee. This project began in 2019 and will continue to grow indefinitely. For this project, a toolkit that will allow the public to have access to the tools and information they need in order to make their homes more energy-efficient will be created. It will be stocked in the local library in Johnson City Tennessee for free use to the public, as long as they have a library card, they can check out the toolkits. The toolkits will be used by the public, then returned to the library so that they can be restocked and checked out again. This study looks at the market, business and organizational research and the infrastructure of the project. Methods of research included looking at how the need for a change came about, who will benefit, existing similar programs and how they will be used in conjunction with this project, current organizational structures attached to the project, current team infrastructure and what resources are needed to fill the voids. Findings include what financial resources will be required and how they will be acquired, as well as resources that are currently available for this project and what is still needed in order for this project to be successful. As a result of this project, at least two libraries in the Johnson City area will be stocked with several energy toolkits for free and a partnership for future project expansion will have been established. This study looks at the process and what was learned during the implementation of the project.

Our Greener Home Energy Toolkit: DIY Home Energy Solutions for Johnson City, TN

Market and Business Research

The average American home uses 11,000 kWh of energy every year (Umasolar, 2019). This is enough energy to brew 1 cup of coffee for every single person in Rhode Island (Kästle, n.d.)! Because the average American consumer uses so much energy per year, they should have access to ways to decrease their overall energy use and save both money and energy, yet there does not seem to be one easily accessible place to go to get that information (WSJ, 2013). This toolkit would provide the consumer with this information as well as tools to get them started on their own home energy conservation project. The toolkit will also include information about energy rebates, rooftop solar guidelines, potential tax breaks and other benefits for the consumers. Project leaders will partner with local community leaders, libraries, and local government so that this kit can be kept up to date and accessible for everyone in the community.

ThinkTennessee reports that Tennessee residents pay $240 more than the average American household in energy costs annually, even though they have some of the lower energy prices in the country (ThinkTennessee, 2018). Tennessee residents are using too much energy and paying too much for it. This project seeks to bring this amount down to a lower level so that the people in the community will use less energy and be able to save more money because of it. This is a mutual benefit for the community and the environment and stands out as a great opportunity to influence change.

This project will result in the creation of a home energy Do It Yourself (DIY) toolkit, stocked at local libraries and community centers in Johnson City, TN, as well as an online version that community members can use without needing to leave their homes. This kit will include several tools and objects to get the consumer started in making small changes to their homes that will help them save money and energy. These items will include energy-efficient light bulbs, weatherization equipment, a low flow showerhead, faucet aerators, and energy meter readers and other tools for measuring energy and water use in the home, and a publication that teaches them how to best use these items. Within the kit, there will be some items that the public can keep when they check it out, such as the light bulbs and weatherization equipment, and other

items that will need to be returned upon check-in, such as light meters, thermometers, and water and energy testing equipment. A breakdown of equipment costs can be found in Appendix A (see figure A1 and A2).

The equipment from the toolkit that will be kept by the consumer needs to be replaced after the toolkit is checked back into the library and replenished before the next check out is able to occur. This is discussed in later sections. The online component will be the same as the workbook included within the kit, however the online user will have to gather materials on their own as opposed to picking them up already included within the kit.

Success Stories

This project is inspired by PG&E's Energy Watch Home Energy Savings DIY Toolkit that is in place in San Jose, California and some surrounding cities (PG&E, 2017). This toolkit has been in place since 2014, and Florence Wong and Tina Gonterman, who currently help run the program are willing to assist in the research of this project. Lindsey Bales, who was a key player in the implementation of the toolkits at the local level, has also expressed interest in helping with this project's implementation. Project leaders will be able to work with them and use this as a resource in the future of the project.

Regional Considerations

This project is not necessarily regionally specific in the long term but will be to start with. The first iteration of the project will be planned for the libraries in Washington County in eastern Tennessee, however, the project will be built with an online component that allows for scaling to larger areas. If the project scales, it would require more capital and a bigger team in order to implement it in a larger area. The Washington County/Johnson City area has 19 public libraries. This project would be launching in this area, so the regional considerations that need to be in place are the energy efficiency tools, laws, and benefits that are already in place in that area and how they can be integrated with this project in order to provide the maximum benefit to the people who will be using the toolkit.

Organizational Research

The energy toolkit that this project design is based on was built for an area with a much larger coalition of libraries that the kit would be distributed to. This area had more than 30 public libraries within a 50-mile radius. In the Johnson City area, there are far fewer public libraries to

reach out to, 19 within the same measure of a 50-mile radius. Appendix C (see Figure C1 & C2) shows maps comparing the two geographical regions in terms of library populations. The organizational structure of the project would need to be scaled down to meet the needs of this area. This project is loosely based on the Silicon Valley project, their structure would need to be adapted but their current organization would not be affected, as they are only a part of this project as a standby mentor.

The stakeholders that are currently identified come from a diverse group of people. The main group is the decision-makers at the Johnson City Library. Thus far, key team members are Jo Elaine, who works at the library, and Julia Turpin, the director of administration at the library (JCPL, n.d.). They will work with project leaders to implement the physical aspect of the project once a prototype is in place, the timeline will be covered in more detail below. Another key group of stakeholders will be BrightRidge Energy, the main utility provider in the area. Research has shown that they have a free home energy audit program, but it does not appear to be very thorough. They also have partnered with other companies in the area to do these audits which may become stakeholders later on in the life of the project. Finally, several key players in the team at the moment are some of the team members in San Jose, California that helped implement a similar program at libraries in California. This team includes Tina Gonterman, Florence Wong, and Lindsey Bales. They have graciously agreed to help by explaining the steps they took in implementing their project and their knowledge will be utilized to help strengthen this project.

Eventually, this project would need a team of people in place in order to keep it going. Supplies for the toolkit would need to be refilled and updated after checkout, so someone would be needed for maintenance and upkeep. This could be someone who oversees the program from the library, as well as a supplier for refills. As noted above, the toolkit will contain some items that will need to be replenished after the toolkit has been returned to the library. This list is available in appendix A. It will be the responsibility of these team members to refill the toolkit so that it is full of supplies when the next person comes to check it out. The Johnson City library already has a program in place where wi-fi hotspots are available for check out and need to be recalibrated upon return. The toolkits work in a similar fashion and will be integrated with the same system as the hotspots. There is going to be a listing in the library database online to inform library customers when the kits are available for checkout, and whether they can request to check one out or hold their place in line if it is not available.

Future Planning

To bring this vision to life, project sustainability leaders will need to appear credible and trustworthy in the stakeholders' eyes. This will be achieved by working with the stakeholders directly and incorporating their vision and the needs of their organization or organizations alongside the vision and needs of the project. One way to achieve this two-way communication is to establish a secure list of achievable goals and milestones. The base goal of this project is to have at least one toolkit stocked in at least one library by the end of the year 2020. With additional partnerships and financial backing, more toolkits would be able to be stocked at more libraries, resulting in partnership goals and eventual goals. This is broken down in Figure 1 below, while additional project goals and progress appear in Appendix B (see Figure B1).

Figure 1

Toolkit project goal breakdown table

Goals	Price by number of toolkits	Total
Immediate		
1 kit at 1 library	$76.59/kit x one kit	$76.59
2 kits at 1 library	$76.59/kit x two kits	$153.18
With Partnership		
1 kit at 4 libraries	$76.59/kit x four kits	$306.36
2 kits/4 libraries	$76.59/kit x eight kits	$612.72
Eventual		
1 kit at 19 libraries	$76.59/kit x nineteen kits	$1455.21
2 kits/19 libraries	$76.59/kit x thirty-eight kits	$2910.42

Note. Toolkit prices based on evaluation from table appearing in Appendix B, as stated above.

The energy savings toolkits will incur costs in several ways. First, they will have to be purchased and put together. The cost breakdown has been included below. This will cost $76.59 per kit initially, but once each kit is put together, it will only cost $13.37 to refill the kit once it is checked out and returned. At the beginning of the program, the goal is to have two kits at each of the four libraries local to Johnson City. It would incur a cost of $612.72 to put two kits in each of these four libraries. As a stretch goal, there are 19 libraries in Washington county, and if each library had 2 kits, this would cost $2910.42. Another cost associated with this project is the cost of putting together and printing the learning materials that come with each kit. By creating a digital version of the information book, this would keep both costs and waste down. If the consumer wanted a paper version of the workbook, they could print it themselves, or use the online version. Costs may additionally be lowered by future partnerships, and cost analysis will be adjusted pending those changes.

An additional cost for this project is the cost of creating a website with access to the toolkit's informational booklet and other associated how-to materials. A website has been created using wordpress.com and the project manager had the knowledge and ability to set this up at no additional cost. The domain to host the website has a yearly cost of $18.00 currently. This will renew at the same cost point on January 18, 2021 if it is determined that there is a need for this domain to continue in the future.

Value

The information packet that will be available online and within the toolkit will provide information about the money that implementing energy and water-conserving measures can have for the customers, as well as rebates, financing, workshops, and other helpful money-saving items that may be available. By looking at these data points the value can be estimated. In addition, because this kit can be checked out from the library, the consumer is not paying anything out of pocket, so they are already providing value to themselves, and by keeping the kit in stock, the library is providing value for their customers. The library or local utility company will be paying for the upkeep and replenishment of the kits as they get checked out and returned. This will be discussed in future planning meetings between the project team and stakeholders and will be adjusted when needs arise.

Data Collection

In order to collect and audit the data from this project, circulation records from the library will be examined. This toolkit will be checked out just like a library book, the library will have circulation records. These records will be used to determine how many toolkits to put in the library in the future, as well as create future cost projections. Per the San Jose library district, each kit was checked out an average of 30-40 times over the course of a year (SJPL, 2019). This area is smaller so the demand will not be as high, but actions will be based on the data that is provided after some use.

Materials and Technology

In order to implement the project, online materials and an online version of the toolkit have been curated and advertising for the energy savings toolkit to the public needs to be put in place. Informational posters may also be printed out as advertising once the library has re-opened after the COVID-19 pandemic subsides.

The creation of a test kit to show to the libraries required materials to be purchased. In order to create a prototype toolkit to show to libraries, it incurred a cost of $76.59, the price of one toolkit. The example toolkit is included in the cost analysis of total toolkits produced, so this is not be an extra cost to the project.

Miscellaneous

An anticipated challenge of this project is the small team size. The toolkit that inspired this project was backed by a large utility company and had access to many people as well as funding. A small local team of people who are enthusiastic about this project is helpful, but they do not have as much power as the utility company. This challenge is reaching out to local utility companies and government and seeing if they would be interested in partnering with me for this project. Brightridge is a local utility company that has many helpful resources on their website available to the public (Brightridge, n.d.). This is something that was not anticipated, so it still needs to be researched. Another opportunity may come from the Tennessee State Department of Energy. They sometimes have funding for projects such as this. At the time of this writing, there are no grants available but there are several that will be opening in the near future and they will be utilized when available. When further challenges arise the project team will be able to handle them. Because this project stands to reach many members of the community and provide a

benefit for the state in the reduction of energy costs statewide, there is a good chance of this project getting funding from these resources.

A plan has been researched and created for the elements that will be included in this toolkit. The workbook is currently in progress. Elements of the workbook and a general layout and example of format can be found in Appendix E (see Figures E1-2). This workbook, available in print and online, will include details about what is available in each toolkit and how each of these tools can be used to reduce energy use in the home or place of business. The website where these online components are available is http://www.ourgreenerhome.org and screen captures of the webpage can be found in Appendix D (see Figures D1 and D2).

Mission Statement

> "To connect community members to reliable information about household energy savings for use today".

This reflects the outcome that project organizers are aiming to create at the close of the project. It reflects the goals of the project and highlights the projected impact of the project.

Vision Statement

> "Creating a community empowered to take their energy use back into their own hands".

Keeping these important statements in mind will help team members and stakeholders keep a focus on what they are striving for with the completion of this project. A good mission and vision statement tell the public what an organization does and reminds the people within the organization what they are doing. This is important to keep at the threshold during all phases of this project.

A SWOT Analysis for this project has been completed and shows a deeper look into the strengths, weaknesses, opportunities, and threats of the successful implementation of this project. This analysis covers the project from beginning to end and may cover problems that have since been eliminated. This SWOT Analysis can be found in the following (see Figure 2).

Figure 2

SWOT Analysis

Strengths: ● Products like this one are already in place in California and several other locations and are running successfully. Access to a lot of data from the California project, as well as support from key stakeholders in that project has been granted and met with excitement for this project. ● There is not currently a project like this in the libraries in Tennessee, which points to this being a need.	Opportunities ● The county currently does not have a program like this in place, there is a hole for this project to fill. ● Brightridge, a major local utility company has a focus on clean/green energy and energy conservation and may be an asset to this project and they have helpful resources on their website (Brightridge, n.d.). ● Tennessee office of energy may be able to help with funding, contacts and other helpful information.
Weaknesses ● The California based toolkit project was put together by a large company with lots of financial backing (PG&E, 2017). The project team may receive a grant or gather a small team of supporters, but do not have a corporation backing them up at this time.	Threats ● This project requires upkeep over time, project leaders need to make sure there is someone in place or at least a system in place to assure that this happens.

Note. An analysis of the strengths, weaknesses, threats and opportunities pertaining to the project. Each of the four categories include one or more bullet points and sources for information shown.

The next step will be to continue to build the project plan and start to put together the learning materials for this project and build the proposal. Once a solid project proposal and presentation are in place, the local utility companies, the energy department of Johnson City, as well as Tennessee's department of energy, libraries, and community centers, can be contacted and the project team will learn if they would be interested in partnering and funding the project.

Goals and Planning

The necessary steps that will need to be taken to complete this project have been split into three categories, the steps that have already been completed, the steps that are currently being implemented and focused on, and the future plans that have been laid out but will not be tended to at the moment. These steps can be viewed in Appendix B (see Figure B1).

By keeping these goals in mind and adhering to a timeline, there will be a sense of urgency instilled in the project team. This will be done by using "communicate the vision" and "empower others to act on the vision" from Kotter's model. By communicating the vision with everyone involved in the project, others will be shown how important this project is for the community, which will generate excitement and create momentum to keep the project moving forward. In choosing strong and determined people to fill roles for this project, the team will empower others to act. In order to engage with and uphold the expectations of the stakeholders, the project team will make sure to be constantly "learning more about their interests and expectations, engaging them in productive dialogues and keeping the channels of communication open" (Hitchcock & Willard, 2015).

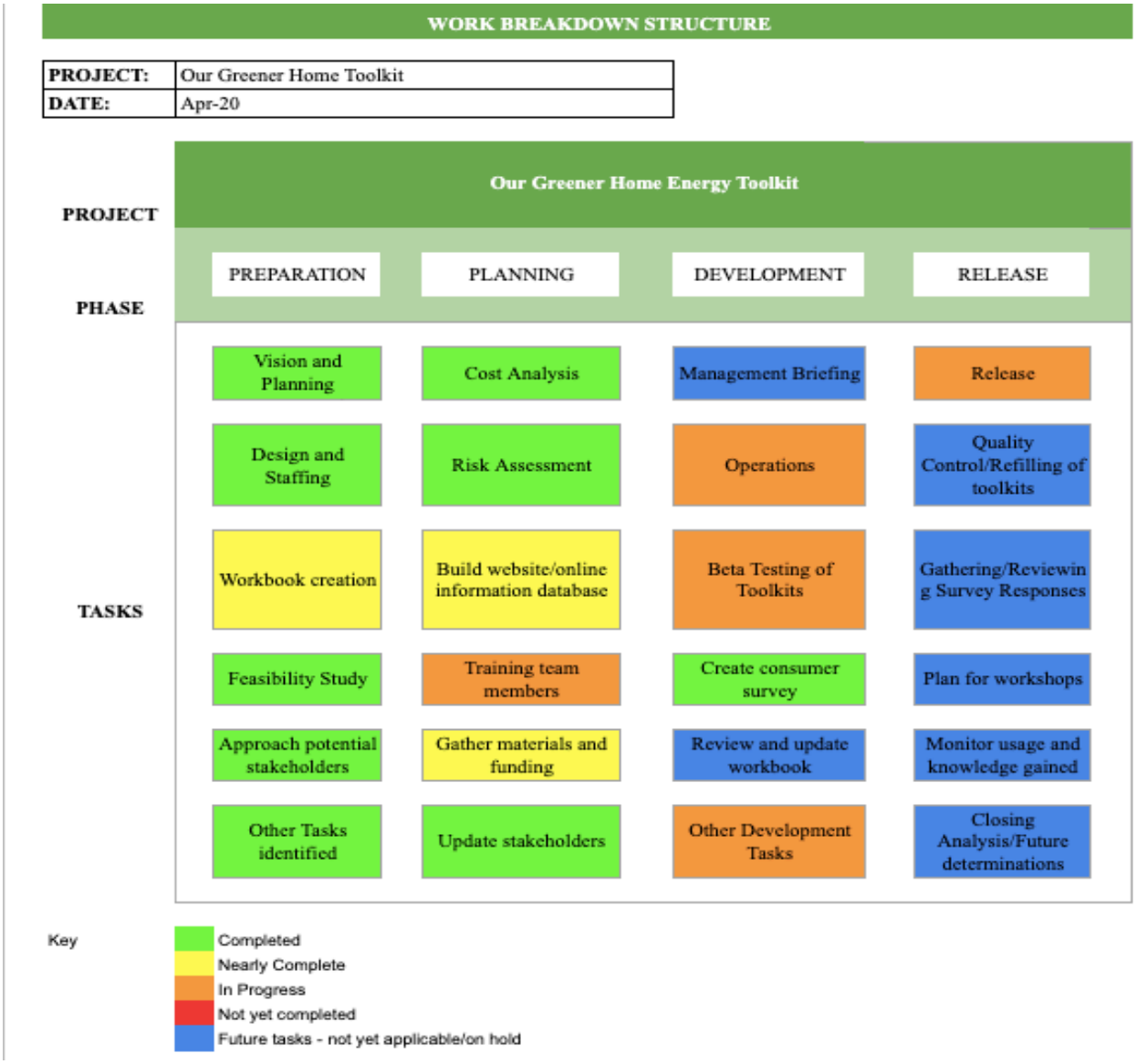
The Strategic Objectives for this project are based on the sustainable development goals 7, "Ensure access to affordable, reliable, sustainable and modern energy"; 4, "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"; and 13, "Take urgent action to combat climate change and its impacts" (Sustainable Development Goals, n.d.). By keeping these in mind, the goals of the project are to 1. Increase community knowledge on energy and water efficiency in the home, 2. Develop partnerships between local utility companies and public information centers, 3. To decrease energy use in Eastern Tennessee through community education.

For the time being, focusing on the short-term wins that can be created will be the main focus. The workbook is in progress and will be shortly, there will be at least one meeting with a decision-maker at the library to propose the idea and start the project at the ground level, and team members in California will be contacted so that research can be continued to find out the best practices that worked for them. The goals and agenda of the library will be compared with the goals of this project and hopefully, another small win can be created by finding places that the two agendas can work together seamlessly.

The timeline and dates of the project depend heavily on the stakeholders' timelines in their own organizations, but they can be guided to create a timeline that can fit their schedule without pushing this one to the wayside. Some of these elements can be found in the following (see Figure 3), the project's work breakdown structure.

Figure 3

Work Breakdown Structure



Note. Figure shows work breakdown structure (WBS) current as of Spring 2020. Previous WBS' from December 2019 and March 2020 can be found under Appendix F (see Figures 1&2).

Conclusion

A study in Lithuania found that "community-based social marketing is [a] useful tool to enhance energy savings due to behavioral changes in local communities" (Streimikiene and Vveinhardt, 2015). The approach used in the study focused on the importance of using previously formed community networks in order to strengthen the message of energy use reduction and more conscious energy use in the home. This project addresses a need in the community of Johnson City, and it shows potential to be successful when fully implemented.

Lessons Learned

Through the implementation of this project there have been several important lessons learned. First, I learned that it is always a good idea to find a good project team when one is implementing a project. It is very stressful to try and put together a project by oneself and when a team of people is involved and they all have various connections, it helps to move the project along faster and with more success. Second, asking others for help and input can bring unique perspectives to issues and help one think outside the box. There were several ideas that I implemented that were suggested by third parties, which ended up shaping the final product. Third, I learned to be flexible and to go with the flow. Things do not always work out according to plan, and it is a good idea to accept change and be willing to let it happen.

Future Promises

At the time of publishing, this project is paused due to COVID-19 concerns and the participating library being closed indefinitely. The project will continue implementation after this passes and the library reopens to the public. In the meantime, the online elements will continue to be developed and the workbook will be polished off and completed. Once the library portion of this project is back in session the plan will commence as previously expected. This project will be hosted at the library for the rest of the year 2020 and after that, the project team will determine future plans based on the success of this version. If there is positive feedback for this project, similar projects at other libraries can be implemented, using the original toolkit and the findings of a year of testing as a guide.

References

Brightridge. (n.d.). Resources. Retrieved from https://www.brightridge.com/resources

Hitchcock, D. E., & Willard, M. L. (2015). The business guide to sustainability: practical strategies and tools for organizations. New York: Routledge.

Kästle, K. (n.d.). Population of the US States and the principal US territories. Retrieved from https://www.nationsonline.org/oneworld/US-states-population.htm

Massick, E. (2019, July 7). [Energy Toolkit Cost Breakdown]. Feasibility Study Draft.

McNall, S. G., Hershauer, J. C., & Basile, G. (2011). *The business of sustainability : trends, policies, practices, and stories of success*. Retrieved from https://ebookcentral-proquest-com.ezproxy1.lib.asu.edu.

PG&E. (2017). *Silicon Valley Energy Watch Do-It-Yourself Home Energy Saving Toolkit User Guide* [PDF]. Pacific Gas and Electric Company. https://www.sanjoseca.gov/DocumentCenter/View/32051

SJPL. (2019, July 3). Informational Interview About History of Energy Toolkit [Telephone interview].

State of Our State 2018 Policy Brief: Environment and Energy (pp. 1–6). Southern Environmental Law Center. Retrieved from https://thinktennessee.org/wp-content/uploads/2018/08/State-of-our-State-Policy-Brief_-Environment-and-Energy-UPDATED.pdf

Sustainable Development Goals. Sustainable Development Knowledge Platform. (n.d.). Retrieved September 29, 2019, from https://sustainabledevelopment.un.org/?menu=1300.

ThinkTennessee. (2018). State of Our State 2018 Policy Brief: Environment and Energy.

Streimikiene, D., & Vveinhardt, J. (2015). Community based social marketing for implementation of energy saving targets at local level. Amfiteatru Economic, 17(39), 723-734.

UMASolar. (2019, March 13). How Do Solar Panels Help Save You Money? Retrieved from https://www.umasolar.com/blog/do-solar-panels-really-save-you-money/

https://clinchpowell.net/content/our-story

WSJ. (2013, November 14). The Best Way for Americans to Reduce Their Energy Use. *Wall Street Journal.* Retrieved from https://www.wsj.com/articles/the-best-way-for-americans-to-reduce-their-energy-use-1384443632

Appendix A

Toolkit Items and Price List

Figure A1

Toolkit Items to Keep Price Breakdown

Items to keep					
Item	Pieces per kit	Price per kit	Price Total	Price per unit	Lot
'Detect a leak' Tablets	1	0.54	10.80	0.54	20
LED light bulb(s)	2	2	24.08	1	24
Outlet sealers	5	0.75	14.99	0.15	100
Low-flow showerhead	1	2.07	2.07	2.07	1
Faucet Aerator	2	0.38	7.88	0.19	40
Outlet timer	1	6	11.99	6	2
Total Return Items		13.37	73.44		
30 check-outs/year		401.10			

Figure A2

Toolkit Items to Return Price Breakdown

Items to return			
Item	Pieces per kit	Price per kit	Price Total
Toolbox	1	10.52	10.52
Energy meter	1	13.99	13.99
Thermal leak detector	1	33.60	33.60
Fridge thermometer	1	3.33	19.99
Drip Gauge	1	0.99	0.99
Water Flow rate bag	1	0.79	0.79
Total bring-back items	6	63.22	79.88
Price per kit total		76.59	

Appendix B

Project Goals and Progress Report

Figure B1

Timeline of Project

Completed Steps	Timeline
○ Researching and getting to know the area of Johnson City including residents and key decision-makers of the area. ○ Meeting with San Jose key players and finding out what worked and what did not work for them in their toolkit project ○ Begin to gather materials for a prototype toolkit	● Spring of 2019 semester, moving into the Summer of 2019 ● Fall of 2018 and Spring of 2019, Series of phone calls and email threads. ● A toolbox, light bulbs, and some weather stripping implements have been gathered thus far.
Current Focus – In progress	
○ Creating a workbook and toolkit prototype to present to the library decision-makers ○ Setting up initial meetings with the library team and BrightRidge team. ○ Continuing interviews and research with San Jose team members. ○ Building a website with an interactive version of the workbook that is available in the kit.	● Estimated time 3-6 months depending on the responsiveness of library and BrightRidge ● Initial meetings happening now. ● Ongoing through the entire timeline ● Website is currently undergoing setup as of Spring 2020.
Future Plans	
○ Invite a test group to use prototype kit(s) and give feedback before launching project - beta testing ○ Launching the toolkit for public use at the library and/or community centers ○ Finance details	● Summer of 2020, depending on library availability and need. ● 6 months to one year from now, once the toolkit has been tweaked and adjusted based on community response and need. ● 6 months-1 year from now (again, depends on the library's needs and how the collaboration works)

Appendix C

Map Data of Library Availability

Figure C1

Washington County Tennessee Library map

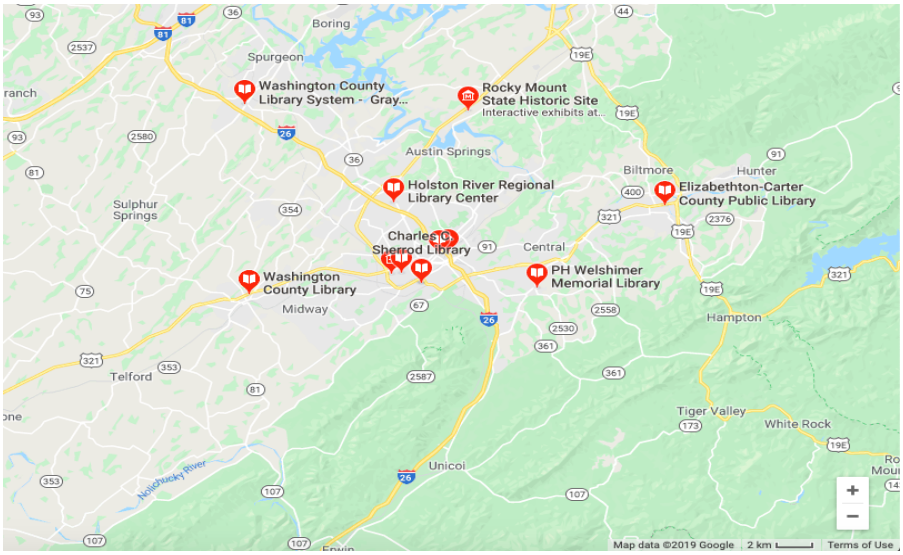
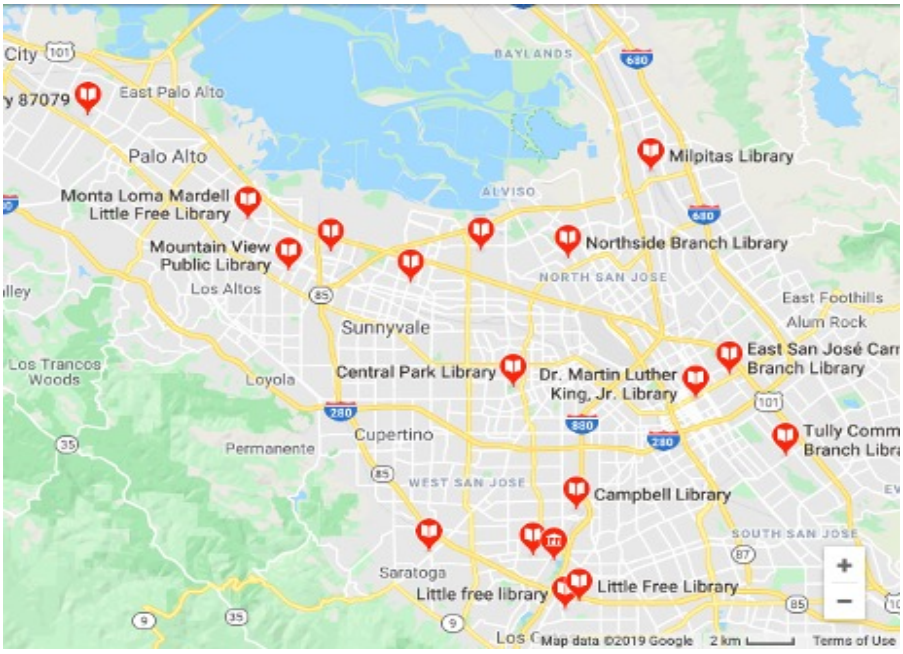


Figure C2

Santa Clara County, California Library Availability Map

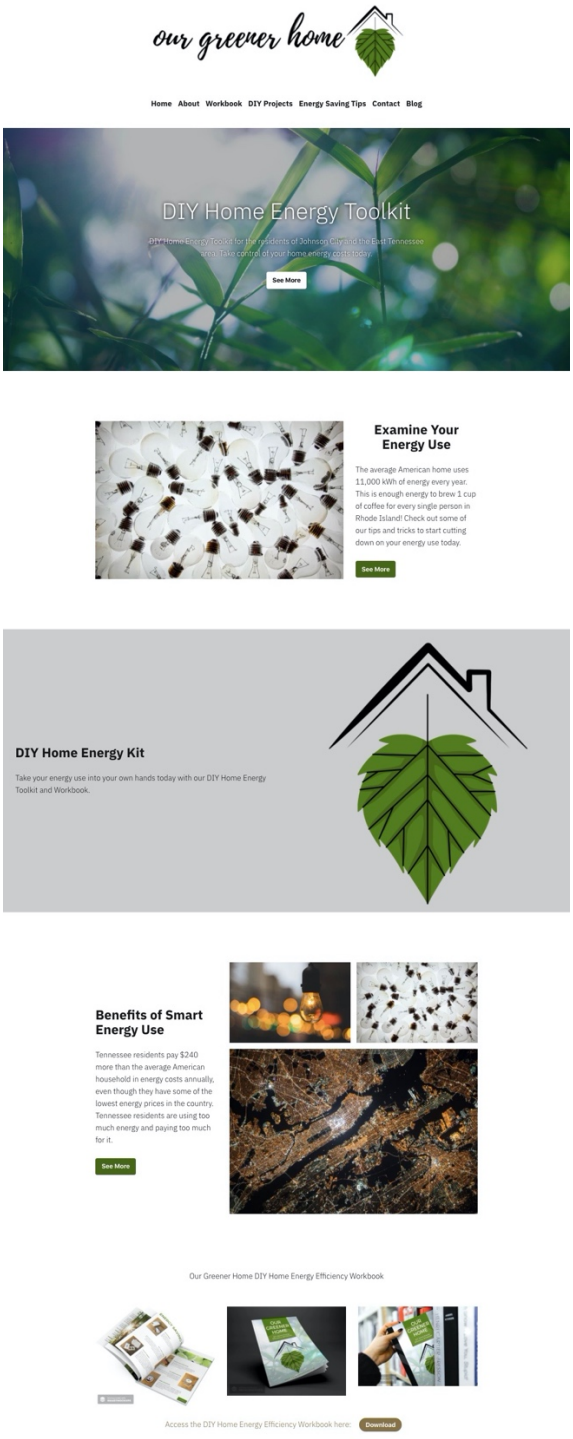


Appendix D

Greener Home Website

Figure D1

Screen capture image of website: www.ourgreenerhome.org



Appendix E

Greener Home Toolkit Workbook

Figure E1

Images of workbook page layout

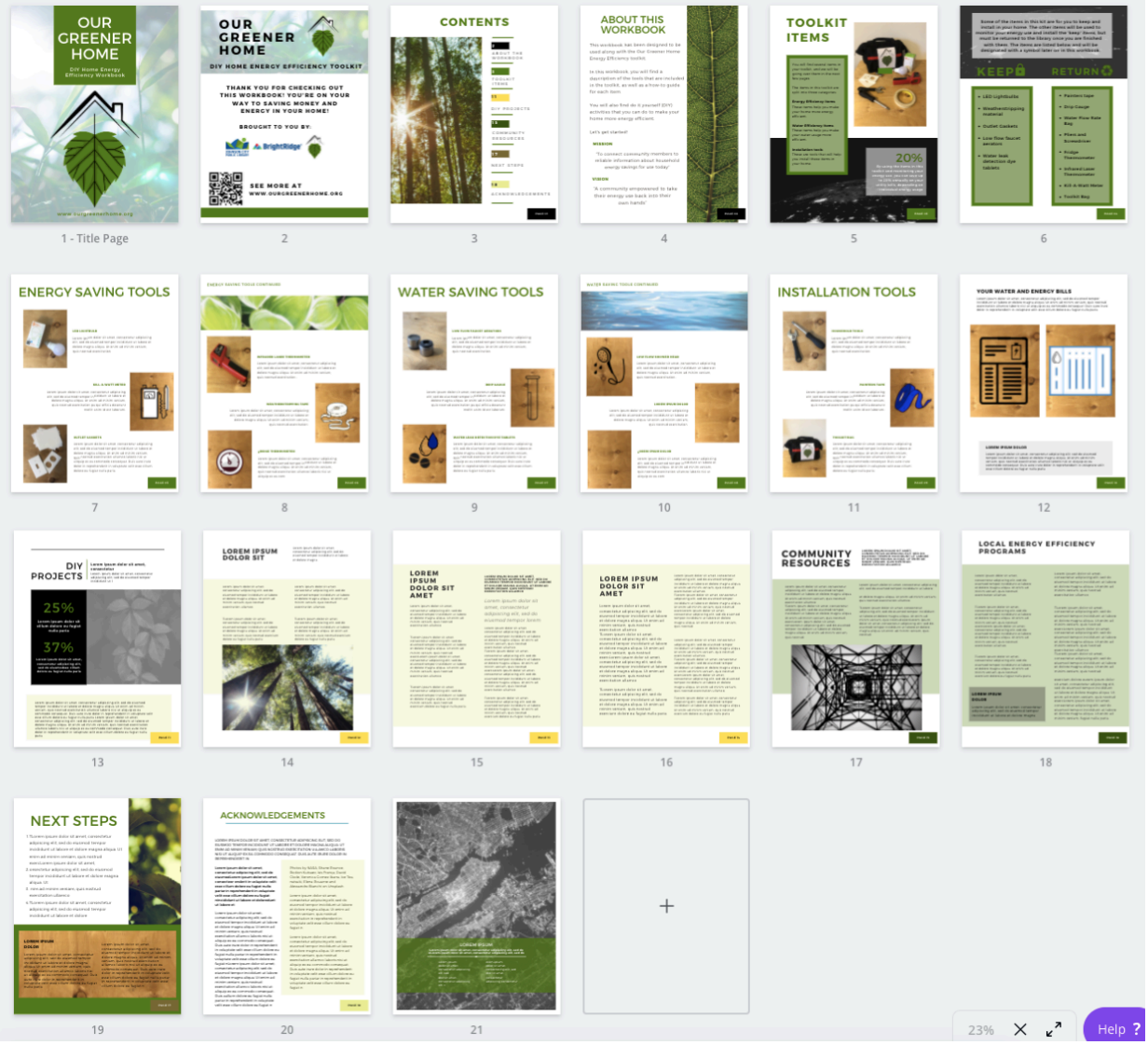
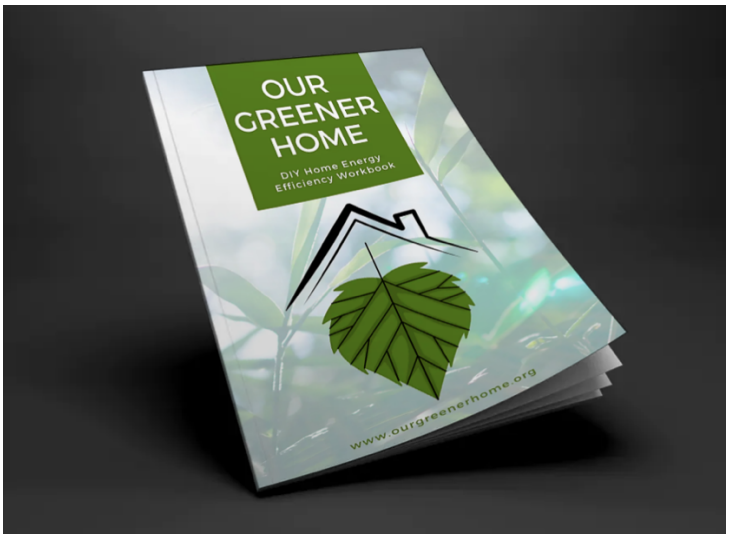


Figure E2

Workbook Mockups

Workbook mockup images used for marketing purposes



Appendix F

Past Work Breakdown Structure Documents

Figure F1

Work Breakdown Structure December 2019

Figure F2

Work Breakdown Structure March 2019