

**Increasing Engagement in the Mirboo North Community Energy Hub
Melbourne Project Center**

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Abstract

The Mirboo North Community Energy Hub (MNCEH) is a community-driven initiative designed to promote sustainability solutions. Its founding business case was prepared by Primaform, a partner in the Snowy River Innovation (SRI) group. The goal of this project was to increase community engagement in the MNCEH, particularly in the dairy farming and agroforestry sectors. Based on interviews and surveys, we identified successful community engagement strategies to recommend to the MNCEH. We also found that Mirboo North and district lacked a trusted source of energy information. We created a prototype website for the MNCEH to serve as an information source and community engagement tool.

Acknowledgements

We would like to thank our project advisors, Professor Dominic Golding and Professor Andrea Bunting, for their guidance throughout our entire project. We also thank them for making the connections that gave our team the opportunity to work with Snowy River Innovation. We appreciate them for giving us the chance to work on a communication project that contributed towards a greener future.

We would like to thank our main sponsor director, Peter Young, for his time, knowledge, and extensive efforts towards our project. We greatly thank Mr. Young for his recommendations and arrangements to talk with many important interviewees. We greatly appreciate his efforts that have allowed our project to operate smoothly.

Our team thanks John MacDonald and DesignInc for providing us the convenient workspace and the resources necessary to complete our project. We also thank them for their benevolence and making us feel welcome. In addition, we would like to thank Geoffrey Andrews and his company, Genesis Now, for providing us with further resources and space to work on our project. We appreciate the expertise that Mr. Andrews has shared with us on the topic of energy efficiency.

We would like to thank Ian Southall for arranging our stay in Mirboo North. We thank him for providing us with a diverse itinerary during our time in Mirboo North that helped propel our project forward. We would also like to extend our thanks to Gayle Margaret and Diana Mueller for their time and recommendations towards our project. We would also like to thank Graeme Wilson for spending time with us and sharing his experiences. We would like to thank the Mueller and Canizzo families for their hospitality and providing our team with overnight accommodation in Mirboo North. We thank the Mirboo North Community Energy Hub committee for making our stay in Mirboo North enjoyable and for their feedback on our project.

We would also like to thank the dairy farmers and horticulturists of Mirboo North and district for their time and providing us with information that we could use in our project. We thank the various owners of small-scale sustainability operations in Mirboo North and district who shared their strategies to become more energy efficient. We appreciate the many interviewees from various community energy projects and renewable energy installation companies for their time and sharing their experiences.

Executive Summary

Growing population, economic development, and energy-intensive lifestyles have resulted in a rise in the global consumption of energy, primarily from fossil fuels. Fossil fuel consumption causes a variety of adverse environmental effects at the local and regional levels, such as increased air pollution which can have hazardous effects on public health. On a global scale, increased carbon emissions contribute to climate change. Considering the consequences of burning fossil fuels as a primary energy source, many individuals, organizations, and governments around the world are advocating for a shift towards a more widespread use of energy efficient practices and renewable energy technologies. Solar, hydro, bio, wind and geothermal energy sources are possible solutions to aid in the reduction of fossil fuel usage. Although numerous efforts are underway to encourage rural and urban communities in Victoria to adopt energy efficient practices and renewable technologies, gaps in knowledge and the costs associated with implementing these technologies have prevented many from achieving their goals. Snowy River Innovation (SRI), a collaborative venture involving five companies that create sustainable solutions, has undertaken a strategic planning exercise in Mirboo North and district that resulted in a three year blueprint for the development of the Mirboo North Community Energy Hub (MNCEH).

Our group's primary goal was to explore ways to increase community engagement in the implementation of the MNCEH, particularly in the dairy farming and agroforestry sectors. We hoped to achieve this goal by providing the MNCEH committee with recommendations on community engagement strategies. We looked at comparable projects within Australia as well as projects regarding community engagement in other countries in order to identify engagement strategies applicable to Mirboo North. We collected and analyzed data on energy efficient practices and renewable energy technologies with an emphasis on their relevance to the dairy farming and agroforestry sectors in Mirboo North. Our group visited Mirboo North and district to gain a better understanding of the goals, interests, and concerns that the dairy farmers and horticulturalists had regarding their energy consumption. We collected information from Ellinbank Dairy Research Facility, dairy farms, horticulture farms, and small-scale, sustainable home and business operations in Mirboo North and district. We also interviewed several members of current sustainable energy projects in Melbourne and regional Victoria including: the Yarra Energy Foundation (YEF), Castlemaine 500 (C500), Locals Into Victoria's

Environment (LIVE), Moreland Energy Foundation Ltd. (MEFL), and Going Solar. We synthesized the information from these visits and interviews to provide SRI and the MNCEH with recommendations on how to increase community engagement and proceed with their website development.

Findings

Through our research, surveys, interviews, and discussions we compiled information on successful community engagement strategies and gaps in knowledge that we recommend be addressed in the Mirboo North and district community. From our conversations with leaders in various community energy projects, we determined that community engagement strategies are most likely to be successful if they develop community trust, use multiple communication channels, effectively manage participant expectations, and use engaging, dynamic websites.

Establishing a trusted relationship with the community was the most discussed aspect of successful projects. Trust was acquired by ensuring transparency in all transactions and allowing the community members to express their interests and concerns. From our conversations, we found that projects that displayed a sole interest in assisting the community were well embraced. Outreach to community leaders was an effective way to use word of mouth as a communication vehicle because community members were likely to trust and listen to well-known and respected members of the community.

The second most discussed aspect of successful projects was that multiple communication strategies were necessary to reach the broadest audience. Word of mouth was the most common form of communication, and in a small community such as Mirboo North it could be an extremely effective method for spreading project news. Websites were also heavily used to convey information and project updates. The websites that included interactive components were better suited to gain return visitors than those that remained static. In addition, print communication such as newspapers and pamphlets allowed community members to access written text to learn more about project updates. It is vital to have multiple forms of communication to reach all members of the community with different communication preferences and levels of access.

Through discussions with various dairy farmers and horticulturists, we were able to identify some of the issues that many of them were facing with incorporating energy efficiency practices and installing renewable energy technologies into their operations. The four main

barriers that were common amongst these groups were: misinformation, the upfront costs of renewable energy and storage systems, concerns about the local electricity distributor, SP AusNet, and the quality of certain technologies.

Gaps in knowledge and misinformation were presented as barriers preventing residents from progressing towards more sustainable energy usage. Farmers were not likely to invest in renewable technologies if they did not understand the feasibility or financial practicality of incorporating these technologies into their operations. Due to the complexities of the topics and lack of trusted information sources, it seemed unlikely that the farmers would extensively search for the information themselves. Often a large part of the issue was that farmers lacked the time to perform the necessary research to make an informed product selection.

Various dairy farmers and horticulturists indicated they were hesitant to install renewable energy technologies and storage systems because they believed that the upfront costs were too high. Some associated such high initial investment costs with a long payback period. This made investing in renewable technologies appear less financially attractive.

The MNCEH asked our team to establish content for their website, which will be developed by a website designer. To provide recommendations to the MNCEH on their future website, we developed and evaluated a prototype website. We visited the websites of various organizations to help us gather ideas for engaging content and layouts that would be visually appealing on the MNCEH prototype website. We distributed electronic surveys and met with MNCEH members to obtain their feedback on how the prototype website could be improved.

We structured the website to act as an energy roadmap to visitors as it guided them through the various steps of sustainability. The prototype website we developed contained various features that could enhance the viewers' learning experience. We displayed diagrams of the electricity supply network, renewable energy systems, and energy storage systems. We created two energy efficiency quizzes: a beginner's quiz and a challenge quiz. We incorporated these to provide users with a more interactive learning experience. A forum was also included on the site to allow community members to communicate directly with one another. In addition, we made the website smartphone optimized since an increasing percentage of the population access the internet with mobile devices.

Conclusions and Recommendations

Analysis of our findings enabled us to develop a series of conclusions and recommendations for the MNCEH. The feedback we obtained from discussions with various people and organizations in Australia, along with the information from our preliminary research, was synthesized into more prominent, succinct themes. Community energy projects increase awareness about energy consumption, greenhouse gas emissions, and climate change. Through investigating community energy projects, we discovered that it is key to: establish a trusted relationship with community members, manage the project expectations, offer a reliable information source, and reach out to a broad audience. We found that websites are an effective means of communication if they include interactive components and are regularly updated.

Recommendation 1: Use the MNCEH to inspire rural communities to establish similar organizations.

Promoting the success of local energy projects can help encourage other communities to take similar actions. People are more likely to adopt new practices after seeing the achievements of other community projects.

Recommendation 2: Ensure the MNCEH is seen as a trusted source of information.

People are less likely to be influenced by information they receive from a source that they do not fully trust. We recommend that the MNCEH shows the community that their sole intention is to assist the community with their energy issues and encourage sustainable energy practices. One way to enhance community trust is through establishing a democratic voting system to allow community members to voice their opinions.

Recommendation 3: We suggest that the MNCEH develop a realistic timeline for when specific goals will be reached.

We recommend that the MNCEH manage community expectations by creating a reasonable delivery timetable of their goals. If goals are set unrealistically, the community will become frustrated with the lack of development of the project and lose interest. We recommend that any possible delays from approval processes be accounted for in advance.

Recommendation 4: The MNCEH could compile and distribute relevant information on sustainable energy technologies and practices.

One method that could be useful in helping community members make investments in energy technologies is to create a decision-making flow chart. This chart would contain

occupational and financial information that would assist individuals in selecting the appropriate technology for them. It would also contain a list of accredited installers within a 100 km radius of Mirboo North. Additional information on funding options and rebates could be made available.

Recommendation 5: We advise that the MNCEH use multiple communication strategies to reach a broader audience.

Multiple communication strategies are needed to effectively interact with people. One of the most effective strategies is through word of mouth. People are more likely to get involved if they hear about successful sustainability practices from family or friends. Along with word of mouth, local newspaper articles and advertisements appear to be effective. It is also important to direct these outreach strategies to the community's youth.

Recommendation 6: We recommend the MNCEH take actions to increase their website interactivity.

We recommend that the MNCEH website contains quizzes that test users' knowledge on energy related topics. The quizzes could provide descriptive feedback and the correct answer after each question. Videos and interactive diagrams can be included to explain renewable energy technology systems and energy storage systems. An energy efficiency rating system could be implemented on the website that enables community members to track their progress in becoming more sustainable. A testimonials page would allow community members to give feedback on experiences they have had with the MNCEH and communicate with one another to discuss energy related topics.

Recommendation 7: We recommend that the MNCEH update information on their website regularly.

Technologies are constantly advancing and it is important that the information presented on the website reflect such changes. Government policy that regulates the level and eligibility of rebates also changes periodically, so it is imperative the website contain the most recent information. A news and events page would provide community members with a schedule of upcoming events and a review of past energy hub news. The MNCEH can also post meeting minutes on the website to keep community members informed with what has been accomplished at the committee meetings.

Authorship

This Interactive Qualifying Project was written in collaboration with its authors: Colin Burns (CB), Joseph Collins (JC), Paul Johnston (PJ), and Rebecca Nichols (RN). The primary author(s) for each section are outlined below as indicated by their initials. Each section of the report was collectively edited by all group members. The compilation and formatting of this report was done by Rebecca Nichols with assistance from Colin Burns. The prototype website was developed by Colin Burns with content contributions from the entire group. The supplementary document of the prototype website was written and compiled by Colin Burns.

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 - 2.1. Comparable Projects Outside Australia – PJ
 - 2.2. Comparable Australian Projects – JC, PJ
 - 2.3. Renewable Energy Sources - CB
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 - 3.1. Explored lessons learned from community energy projects outside of Australia – PJ
 - 3.2. Explored lessons learned from community energy projects in Australia – JC
 - 3.3. Reviewed various types of sustainability practices – CB
 - 3.4. Mirboo North and district visits – RN
 - 3.5. Developed a prototype website for the MNCEH – RN
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- 4.3. Creating an Effective Website - CB, JC, PJ, RN
 - 4.3.1. Website Matrix - CB, JC, PJ, RN
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 - 4.3.3. Website Feedback - JC, RN
- 5. Conclusions and Recommendations - CB, JC, PJ, RN

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1. Introduction

Growing population, economic development, and energy-intensive lifestyles have resulted in a rise in the global consumption of energy, primarily from fossil fuels. Fossil fuel consumption causes a variety of adverse environmental effects at the local and regional levels, such as increased air pollution which can have hazardous effects on public health. On a global scale, increased carbon emissions contribute to climate change. Considering the consequences of burning fossil fuels as a primary energy source, many individuals, organizations, and governments around the world are advocating for a shift towards a more widespread use of energy efficient practices and renewable energy technologies. Solar, hydro, bio, wind and geothermal energy sources are possible solutions to aid in the reduction of fossil fuel usage. Although numerous efforts are underway to encourage rural and urban communities in Victoria to adopt energy efficient practices and renewable technologies, gaps in knowledge and the costs associated with implementing these technologies have prevented many from achieving their goals. Snowy River Innovation (SRI), a collaborative venture involving five companies that create sustainable solutions, has undertaken a strategic planning exercise in Mirboo North and district that resulted in a three year blueprint for the development of the Mirboo North Community Energy Hub (MNCEH). Our group's primary goal was to explore ways to increase community engagement in the implementation of the MNCEH, particularly in the dairy farming and agroforestry sectors. We hoped to achieve this goal by providing the MNCEH committee with recommendations on community engagement strategies. We looked at comparable projects within Australia as well as projects regarding community engagement in other countries in order to identify engagement strategies applicable to Mirboo North. We collected and analyzed data on energy efficient practices and renewable energy technologies with an emphasis on their relevance to the dairy farming and agroforestry sectors in Mirboo North. Our group visited Mirboo North and district to gain a better understanding of the goals, interests, and concerns that the dairy farmers and horticulturalists had regarding their energy consumption. We collected information from Ellinbank Dairy Research Facility, dairy farms, horticulture farms, and small-scale, sustainable home and business operations in Mirboo North and district. We also interviewed several members of current sustainable energy projects in Melbourne and regional Victoria including: the Yarra Energy Foundation (YEF), Castlemaine 500 (C500), Locals Into Victoria's Environment (LIVE), Moreland Energy Foundation Ltd. (MEFL), and Going Solar.

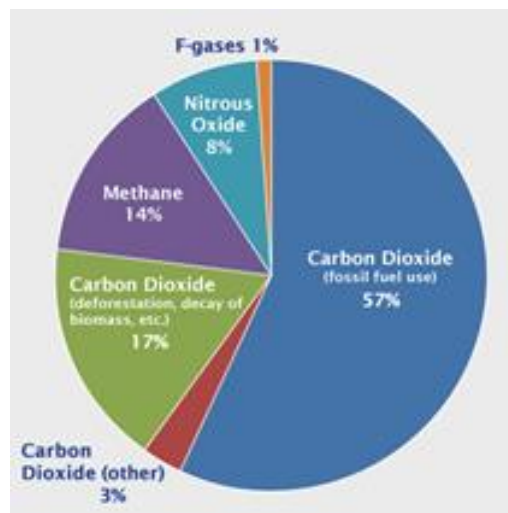
We synthesized the information from these visits and interviews to provide SRI and the MNCEH with recommendations on how to increase community engagement and proceed with their website development.

2. Background

Fossil fuels, which consist of petroleum, natural gas, and coal, are the world's most consumed energy source. All fossil fuels are considered non-renewable because they take hundreds of millions of years to form from high pressure and heat applied to dead organic matter. Fossil fuels are used to provide heat and power in the residential, commercial, industrial and transportation sectors and accounted for 78.2% of total global energy use in 2011 (Sawin, 2013). Unfortunately, fossil fuels have a number of adverse environmental impacts, the most worrying of which is the impact on the global climate.

Combustion of fossil fuels creates by-products that contribute to the greenhouse effect. This effect is caused by solar radiation that passes through the Earth's atmosphere. While some of the energy from the sun is absorbed, the rest of the heat radiates off the Earth's surface. The radiated surface heat that gets trapped in the Earth's atmosphere is due to absorption and re-emission by the greenhouse gases (Bernstein et al., 2007). These greenhouse gases consist mainly of water vapor, carbon dioxide, methane, nitrous oxides, as well as fluorinated gases and sulfur oxides. As shown in Figure 1, carbon dioxide from fossil fuel combustion accounts for 57% of all greenhouse gas emissions from anthropogenic sources.

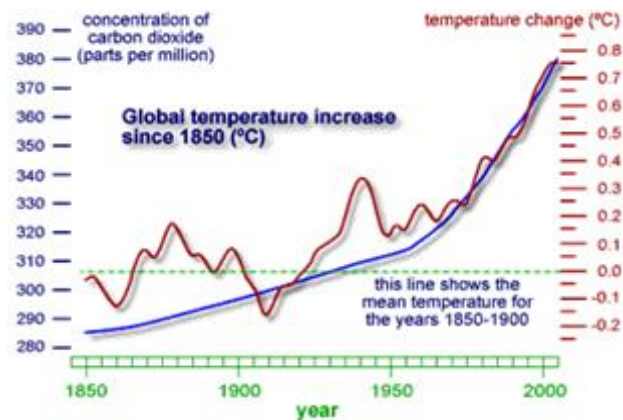
Figure 1 - World Greenhouse Gases Emissions 2004 (Pachauri, 2007)



Greenhouse gases help insulate our planet and allow the Earth's surface to maintain its temperature, but the current scientific consensus is that anthropogenic releases of carbon dioxide and other greenhouse gases are causing global climate change (Bernstein et al., 2007). Figure 2

shows the steady increase in carbon dioxide in the atmosphere which is largely attributed to human activities over the past 150 years and correlates closely with increasing global temperatures.

**Figure 2 - Climate Change and Carbon Dioxide in the Atmosphere
(Causes of Climate Change, 2007)**



The increase in greenhouse gases will affect many other aspects of the world. The patterns and amounts of precipitation are predicted to change, the global precipitation average will likely increase, and the average precipitation intensity is expected to increase. Ice and snowpack should continue to decrease, which affects the living conditions for various species in the Arctic regions and raises the sea level. Lastly, the pH of the oceans will likely increase as the carbon dioxide concentration increases which could adversely affect many marine species such as plankton, mollusks, shellfish, and corals (Bernstein et al., 2013).

Climate change will have specific effects on Australia, too. Drier areas of Australia are at a higher risk of bushfires during hotter seasons. Bushfires are caused by an ignition source, either natural or manmade, that conflagrates twigs, litter and branches in often rural areas. Climate change is predicted to increase the quantity of bushfires because of higher frequency and severity of heat waves (Milman, 2013). Bushfires have been devastating to people's lives. In Tasmania alone in 2013, these fires destroyed "25,000 hectares of land, 200 properties, and 21 businesses" (Spross, 2013). Bushfires have also ravaged the states of New South Wales and Victoria. Extreme periods of heat are also expected to increase the number of droughts (Milman, 2013).

The negative effects from the world's high fossil fuel consumption have influenced many countries to invest in renewable energy sources. Figure 3 displays the world's unbalanced energy

consumption, and 78.2% of this is due to fossil fuels. Meeting the world’s energy needs while being conscious of the environment requires renewable energy investments. Therefore, many countries are adopting and implementing renewable energy technologies as a potential solution to the problems caused by fossil fuel use. Investments in sustainable, renewable energy sources are growing around the world, as shown in Figure 4.

Figure 3 - Estimated Renewable Energy Share of Global Final Energy Consumption in 2011 (Sawin, 2013)

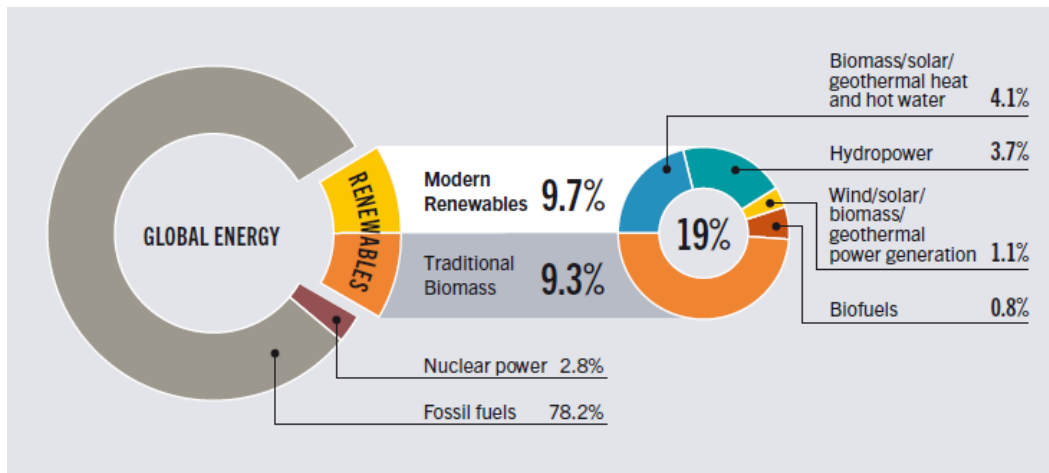
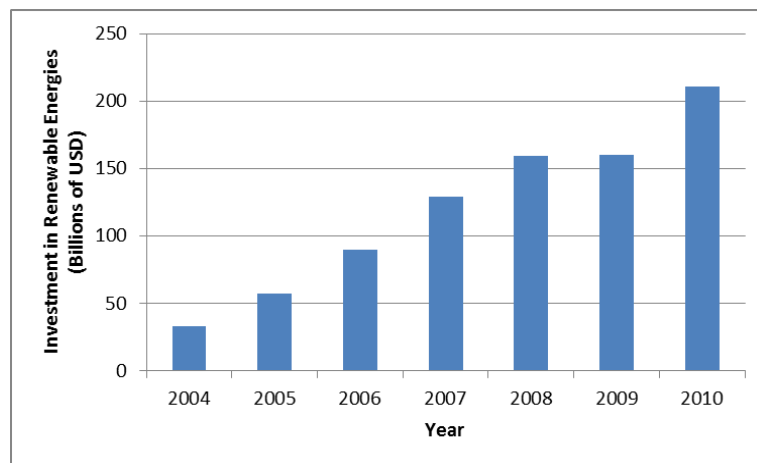


Figure 4 - Renewable Energy Data (Adapted from UNEP, 2011)



One way to address climate change at a regional level is by establishing community energy projects. These projects look to increase sustainability by promoting energy efficient practices and implementing renewable energy technologies. Community energy projects must meet three main requirements: local people have a majority of the financial stake,

noncommercial organizations execute the project, and the community and its assets are involved in energy development processes (Embark, 2013). Sustainability can be accomplished on a small or large scale. Small scale sustainability refers to individual households making efforts towards reducing their energy consumption. Large scale sustainability refers to communities as a whole taking actions to reduce their carbon footprint.

However, there are many obstacles that make it difficult to introduce these green technologies in communities. The facilities required to burn fossil fuels are well established and coal is Australia's largest energy source (Ball, 2010). People who are meeting their energy needs from fossil fuels are hesitant to change to renewable energy sources. To make this switch, societies must be aware of the detrimental effects of fossil fuel usage and the current need to take preventative measures towards climate change.

Start-up costs, power purchase agreements, and planning approvals are also hindering towns from implementing community-owned renewable energy sources. The large trade-off of switching to renewable energies is exchanging environmental and social costs of burning fossil fuels with the initial financial costs of installing renewable technologies. Lack of renewable energy education is a barrier as well because people are unwilling to invest in something that they do not understand. Governmental restrictions on certain forms of renewable energy have also presented issues for new installations. If these barriers of installing renewable energy technologies can be overcome, this could result in financial savings and environmental improvements in the long-term.

Energy sustainability is a concept that can be easily understood and should be promoted to communities before renewable energy technologies. According to the World Energy Council, energy sustainability can be divided into three categories: energy security, social equity, and environmental mitigation. Energy security refers to the proper management of primary energy supply from domestic and external sources. In a social context, sustainability means that, over time, communities will agree upon the sources of energy that are being used. In addition, social aspects of energy include accessibility and affordability of the energy supply to an entire community. Lastly, environmental mitigation means to reduce the human energy consumption habits that negatively affect the environment on a regional and global scale. Changing our regular energy consumption habits and switching to cleaner technologies will leave the environment healthier for future generations (*Energy Sustainability Index*, 2013).

While many policies have been imposed on the national and international levels to promote actions towards climate change, many efforts are being made at the local and regional level. Steps toward energy efficiency and conservation can be done immediately and require little investment. Making changes in everyday household behavior can reduce energy consumption. For example, turning off appliances and lights when they are not in use are simple ways to reduce energy. Small investments that do not alter our everyday lives, such as switching from incandescent to LED lights, are other steps that can be taken towards sustainable living. After individuals have realized the benefits of these small changes, they may be more inclined to make long-term investments, such as higher cost energy efficient practices. Once improvements have been made with energy efficiency, they can look to implement renewable energy technologies.

Many community energy projects are in the process of promoting energy efficient behaviors in hopes that residents will implement sustainable practices. Community involvement and commitment are crucial components for the success of energy projects because individual action alone is not enough to tackle the issue of climate change. In addition, “‘community’ can play a large role in sustainable energy programs because it helps define a program’s scope” (Michaels, 2011). A community hub could: aid in developing the focus and plan of a sustainable energy project, encourage residents to amend energy consumption behaviors, and provide opportunities for people to come together and learn about sustainable actions to take. With the help of local leaders, trust could be established between the MNCEH and the community. The MNCEH is more likely to be successful if it understands the culture and the concerns of the community. Executing renewable energy projects at a community level will make a positive difference towards reaching the overall goal of reducing fossil fuel consumption. Cooperative efforts provide incentives to those who share the goal of obtaining energy from environmentally-friendly and sustainable sources.

Our team reviewed renewable energy projects to familiarize ourselves with the necessary steps required for renewable technology implementation. We also wanted to learn in what activities community members are involved so we can further improve the outreach of the MNCEH. Our project team researched programs within and outside Australia that are promoting both energy efficiency and renewable energy usage that gave our team community engagement ideas to suggest to the MNCEH.

2.1. Comparable Projects Outside Australia

To gain a greater understanding of community engagement practices that could be applied in Mirboo North, it was important that we reviewed various practices from projects in other parts of the world. This allowed us to identify methods that were not currently being employed by the MNCEH committee and integrate them into their community engagement strategy. While there were many lessons to be taken from these projects, our focus was on the dairy farming and agroforestry sectors as there has been a lack of promoting sustainability within these sectors of Mirboo North and district. We needed to tailor the manner in which this information was presented so that it directly related to the corresponding sectors and increased the interest of dairy farmers and horticulturalists. We reviewed community engagement strategies that have been used in energy cooperatives and outreach programs and analyzed which aspects of these strategies contributed to the success of the project. These strategies provided us with information on how to promote energy efficiency and renewable energy technologies to the dairy farming and agroforestry sectors in Mirboo North and district.

2.1.1. Dairyland Power Cooperative

The Dairyland Power Cooperative in the United States has the goal of improving the lives of cooperative members by providing sustainable energy in rural communities. It provides wholesale electrical requirements and other services for 25 electric distribution cooperatives and 16 municipal utilities spanning Wisconsin, Minnesota, Iowa and Illinois. Approximately half a million people receive their energy from the Dairyland Power Cooperative (Korn & Berg, 2012).

Embracing renewable energy innovations has been a large part of the agenda of Dairyland. It has established several hundred consumer-owned, distributed photovoltaic and wind generation systems (Korn & Berg, 2012). Dairyland purchased power from wind facilities and, in 2012, began purchasing power from cow manure digester plants located at dairy farms (Korn & Berg, 2012). This cooperative has also provided incentives to members to use renewable energy technologies, such as solar PV, by providing rebates.

Dairyland has also stressed education of the general public to make the cooperative more successful. One learning opportunity is offered through the *Brown Bag Lunch* program. Interested employees and members can learn about regional delivery projects and pressing issues around noon-time, while enjoying their lunch. The cooperative also hosts member service

meetings, superintendent conferences, and management seminars that are available for members to attend. Dairyland also supports the education of young people. During Earth Week, a senior resource planner visited a grade school and spoke about energy efficiency and renewable generation. With a hand-propelled generator, the efficiency of different types of light bulbs was illustrated. This demonstration helped the students grasp the concept of energy efficiency through a fun, interactive activity. Dairyland's efforts towards community engagement have been integral towards member satisfaction and the overall success of the cooperative.

2.1.2. Energize Ohio

Energize Ohio is an extension program of The Ohio State University. The purpose of this program is to enhance the knowledge of community leaders and local residents on energy issues and development in Ohio. Energize Ohio provides an abundance of resources to increase awareness through free downloadable bulletins, fact sheets, blogs, and related external links. On the Energize Ohio website, users can learn about local energy efficiency programs, grants, rebates, and loans available by selecting the county from which they originate. Also, on the website, users can access webinars about energy efficiency and green building sectors. These webinars are free to access and no membership is required.

This program recognizes that many people do not know where to start when investing in renewable energy technologies. The Energize Ohio website developed a roadmap with six key steps to guide the average consumer through their initial concerns. The following steps were recommended in chronological order (The Ohio State University College of Food, Agriculture, and Environmental Science, 2011):

1. Supporting Energy Efficiency and Renewable Energy Policy;
2. Arranging an Energy Audit;
3. Beginning Simple Energy Efficiency;
4. Investing in Energy Efficiency;
5. Choosing a renewable energy system and installer; and
6. Financing for Energy Efficiency and Renewable Energy Systems.

In addition to individual engagement issues, this program recognized the difficulty of planning and implementing a renewable energy strategy within a community. The curriculum used to start a community sustainable energy strategy is entitled *Renewable Energy Development*

as a Rural Economic Development Strategy. This program advises communities on the best practices and decision making strategies (The Ohio State University..., 2011). The purpose of the curriculum is to provide a series of educational programs for local leaders who are considering renewable energy. It focuses on community actions towards utility scale wind, solar, and biomass power generation (Moss, Romich, & Bowen, 2012). Similar to the individual engagement roadmap, another roadmap was made on the steps needed to implement sustainable energy strategies. This roadmap included the following steps (The Ohio State University..., 2011):

1. Renewable energy policies and drivers;
2. Preparing your community;
3. Large-scale wind development;
4. Large-scale solar development;
5. Bio energy development; and
6. Sustainable community energy development.

Taking initial steps towards implementing renewable energies can be daunting to those who have always used traditional energy sources. Energize Ohio provides a strategy for both individuals and communities curious about using these technologies for the first time. Using the strategies given by this program could lead to well-informed decisions and sustainable energy solutions.

2.1.3. Focus on Energy

Due to the large scale of Wisconsin's dairy and food processing industries, a substantial quantity of bio-waste is generated. Thus, biodigesters in Wisconsin have been a promising solution to treat waste and harvest energy (Brown, 2011). The state of Wisconsin leads the United States in the number of farm-based anaerobic digesters, which is mainly due to the Wisconsin Biogas Digestion Program (Brown, 2011). The Wisconsin Biogas Digestion Program was developed by Focus on Energy, an organization administered by the Wisconsin Energy Conservation Corporation. In addition to biodigesters, Focus on Energy promotes solar, wind, and other biomass projects.

Focus on Energy provides various services to assist community members. It grants funds and offers technical support to farmers interested in installing digesters. The staff at Focus on

Energy also teaches farmers about renewable technologies, energy prices, and feasibility studies. Focus on Energy assisted farmers in completing required United States Department of Agriculture applications. They also host an annual biodigester conference and monthly stakeholder meetings. Efforts to remain in contact with respondents have made Focus on Energy successful (Tannenbaum, Matross, Millar, Pettit, & Pettit, 2010).

Table 1 shows data from 2010 on the energy capacity of dairy farms from several states (Tannenbaum et al., 2010). The overall energy capacity generated per farm was greater in states like Idaho and California because of the large scale of their operations. The energy capacity data was adjusted in the last column of Table 1 to account for differences in farm and herd size for each state. Due to these adjustments, Wisconsin had the highest biodigester activity because it generated the most energy per number of cows.

In 2010, Focus on Energy completed a study that compared the relative success of Wisconsin's biogas programs with those in other states. The study found that the funding of Wisconsin's projects was more consistent than the other states' programs. Due to the funding, the projects in Wisconsin were able to offer more than financial incentives to their customers. Technical assistance, market development, community outreach, and evaluations of their current projects were areas where many states' programs lacked development. In addition, the study found that both education and outreach in Wisconsin were higher than in other states. "Information about dairy biogas digesters is ubiquitous in Wisconsin at forums for farmers" (Tannenbaum et al., 2010). Due to the high amounts of funding and the many services that Focus on Energy provided, Wisconsin had a better informed consumer market that was prepared to install biogas technologies.

Table 1 - Dairy Farms in Several States with Biodigesters (Tannenbaum et al., 2010)

	Average Dairy Cows per Farm	Digesters per Thousand Dairy Farms	Digesters per Million Dairy Cows	Capacity per Dairy Farm (kW/farm)	Capacity per Million Dairy Cows (MW/million Cows)
Wisconsin	95	2.29	24.1	0.82	8.57
Minnesota	105	0.91	8.7	0.07	0.67
Pennsylvania	74	1.61	21.8	0.24	3.19
New York	120	2.86	23.9	0.67	5.58
California	986	8.16	8.3	1.84	1.86
Idaho	758	2.95	3.9	5.54	7.31

Successful renewable energy projects within the United States highlight some of the key factors in successful community engagement. Interaction with experts has been the most effective method of involving the community; the residents obtained useful information on renewable energy implementation from one-on-one meetings. The Dairyland Cooperative and Focus on Energy provide monthly events to learn about energy issues and current projects. Developing a plan with a feasible and foreseeable energy future also encouraged community members to invest in renewable energy technologies.

2.1.4. Biomass Energy Cooperative

The Biomass Energy Cooperative (BEC), founded in the United Kingdom, is committed to promoting green and sustainable energy solutions to businesses, farms, schools, and community groups. This cooperative was formed in 2012 and is currently the number one supplier for biomass installations in England's North West province (Biomass Energy Cooperative, 2013). This cooperative is introducing new biomass technologies to the UK, which have gained interest from farmers and the general public.

The BEC makes efforts to reach out to communities. The co-op offers a free initial site visit to discuss a client's requirements for possible implementation. Afterward, the co-op guides

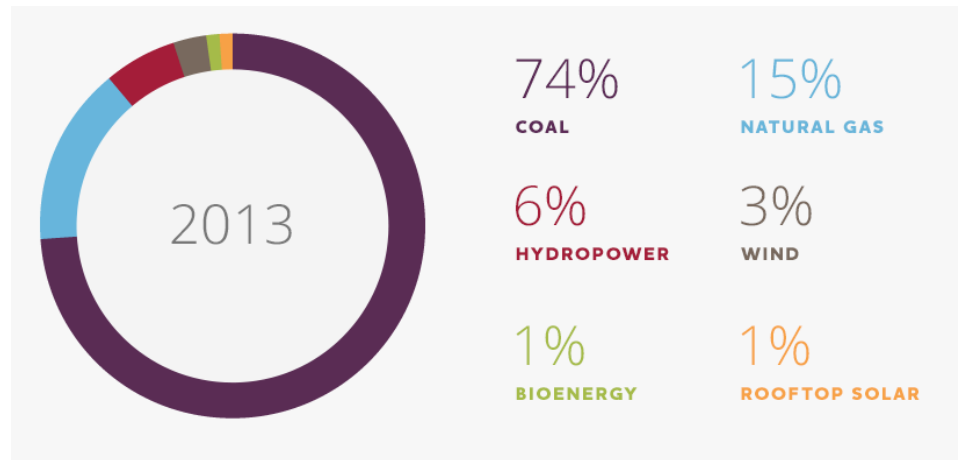
customers through funding applications and recommends experienced heating engineers and builders for the installation process (Biomass Energy Cooperative, 2013). They also provide annual servicing and maintenance contracts to monitor new installations. In addition, they invite farmers and bio-waste producers to test their own biomass mixture first-hand. The co-op also has a biomass boiler system, called MultiBio, which tests biomass fuels (Miller, 2012). From these tests, emission levels and quality of the waste as a fuel are determined. Lastly, since the co-op is owned by its members, democratic voting is used to decide important issues.

These projects outline a variety of community engagement strategies that have been employed in the US and the UK to increase community involvement in sustainability projects. We can take these strategies and compare them with ones that are implemented by renewable energy projects in Australia. This will give us a more focused vision for possible engagement practices for the MNCEH.

2.2. Comparable Australian Projects

The Australian government has been a promoter of sustainable energy in the recent past. In 2000, Australian Parliament passed the *Renewable Energy (Electricity) Act*. The goals of this act were to, “encourage the additional generation of electricity from renewable sources, reduce emissions of greenhouse gases in the electricity sector, and to ensure that renewable energy sources are ecologically sustainable” (*Renewable Energy (Electricity) Act*, 2013). Along with this act, the government has also set up organizations to aid businesses and communities that promote greater environmental sustainability. In 2005, Sustainability Victoria, which has been around for many decades under different guises, was implemented under the *Sustainability Victoria Act*. This organization is involved with several projects throughout Victoria and aims to promote renewable energy technologies and engage communities in sustainable practices (Sustainability Victoria, 2013). State and federal governments have introduced some programs to increase the usage of renewable energy; however, these have made little impact on reducing the use of fossil fuels. Australia still depends heavily on coal and natural gas for its electricity supply as 89% of its generation comes from these sources as shown in Figure 5 (Origin Energy, 2013).

Figure 5 - Australia's Current Electricity Mix (Origin Energy, 2013)



It was critical to look at community energy projects throughout Australia to determine effective engagement strategies and feasible renewable energy technologies. Projects in a similar geographic region as Mirboo North gave us a more comprehensive understanding as to what renewable energy technologies would operate most efficiently under the given climatic conditions. Also, energy cooperatives that were similar to the MNCEH presented us with valuable insight into how we could approach involving the dairy farming and agroforestry sectors in the MNCEH. These projects in Australia provided examples of community resistance and political barricades that needed to be overcome to reach a successful result.

2.2.1. Mallacoota Sustainable Energy Group

Numerous communities in Australia are engaged in energy projects. One project comparable to Mirboo North and district is the Sustainable Energy for Mallacoota project. Similar to Mirboo North and district, Mallacoota is a rural community in Victoria. As shown in Figure 6, it is located on the eastern shore of Victoria in a region called Gippsland.

Figure 6 - Location of Mallacoota (Map of Victoria Australia, 2013)



The Mallacoota Sustainable Energy Group was developed in 2012 to resolve local energy supply issues and to examine the potential for improving the reliability of the existing energy network. A consulting group of sustainability organizations, which consists of Enhar Sustainable Energy Solutions, AECOM, Diamond Energy, and the Regional Development Company, was brought in to assist the Mallacoota Sustainable Energy Group. They looked into how the region was getting its energy. They found that Mallacoota was already using renewable energy technologies to an extent; about 20% of homes had rooftop solar PV panels installed. Aside from these panels, Mallacoota is not currently utilizing other alternative energies. In addition, there are often power line disruptions, so most residents have to resort to small generators that run on petrol or diesel when a power outage occurs. The Mallacoota Sustainable Energy Group was formed to help solve these issues by providing the region with a new sustainable energy plan that is both reliable and cost effective (Jones, 2013).

The project is still in progress and the Mallacoota group is currently researching alternative energy sources and new energy technologies for residents of Mallacoota. They are also looking into setting up a mini-grid, which is a “localised group of energy sources, storage devices and loads that are interconnected by the traditional distribution network” (Jones, 2013, p. 8). With a mini-grid, Mallacoota would be able to utilize all the available renewable energy sources in the region. A mini-grid would allow the supply of energy to be localized within the

region. Therefore, Mallacoota would have independence from the larger network of energy in Australia. Power outages occur frequently so gaining independence from the grid would avoid these situations. The energy group has proposed several options for sustainable energy in Mallacoota. Some of these options include: adding more solar PV panels to homes, installing wind turbines at strategic locations, and using wastewater from a treatment plant to produce methane gas for use in a generator (Jones, 2013). Solar PV panels may be the best option for the community, as several homes have successfully installed these panels. Installation of wind turbines is not a viable option at the moment because of strict governmental planning restrictions; however, these restrictions could be lifted with a change in government. Treating wastewater to produce methane gas is also a feasible option, but may not be as cost effective as solar PV panels.

2.2.2. Hepburn Community Wind Park

Recently completed in 2011, the Hepburn Community Wind Park was the first community-owned wind park in Australia. Hepburn is a relatively small town and is located in central Victoria, as shown in Figure 7. Known as a resort town, Hepburn is located in a region that contains Australia's largest concentration of natural mineral springs and is a popular destination for vacationers (Hepburn Springs Information and Attractions, 2013).

Figure 7 - Location of Hepburn Wind (Campuses and Maps, 2013)



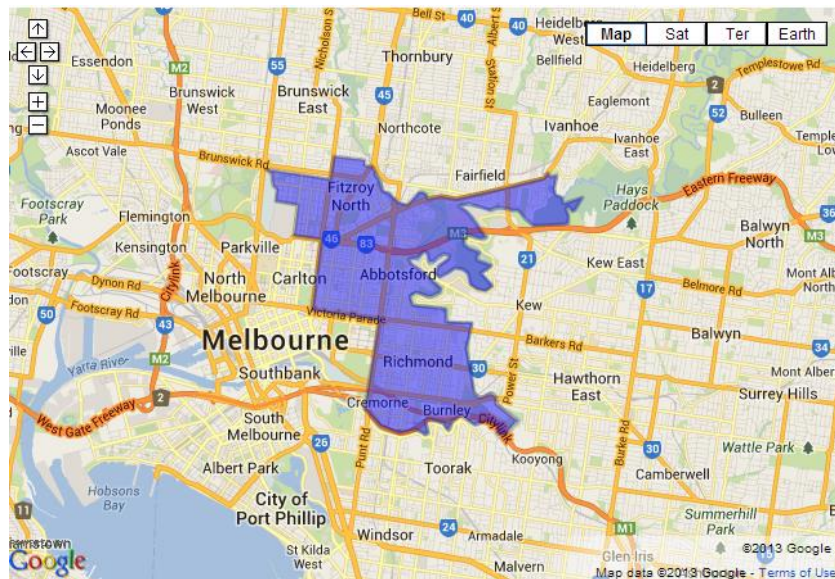
This project installed two turbines that collectively produce 4.1 MW, which is nearly enough to power the 2,300 homes in the Hepburn region. Hepburn Community Wind Park Cooperative Ltd, a trading cooperative, owns the wind park. Local residents were targeted as investors for this cooperative so they could own shares of the company (Hepburn Community Wind Park, 2013).

Community ownership was a major reason why the Hepburn project was successful, as it effectively reduced community opposition. Residents' involvement in the project was substantial because they had partial ownership in the cooperative. Due to this increased awareness, the community was better able to understand the project's environmental advantages. This increased engagement also encouraged the residents of Hepburn to learn more about the advantages of renewable energy. People wanted to be educated and have a say in the energy hub because of their share within the company. A similar community engagement model could be used in Mirboo North. If residents were able to invest in the energy hub, it would likely increase community understanding and involvement (Hepburn Community Wind Park, 2013).

2.2.3. Yarra Energy Foundation

The Yarra Energy Foundation (YEF) focuses on improving energy efficiency and hopes to make the Yarra municipality of Melbourne completely carbon neutral by 2020. Yarra is located just east of Melbourne, as shown in Figure 8.

Figure 8 - Location of Yarra (Yarra Council - Map of Yarra, 2013)



To become carbon neutral, the foundation plans to retrofit buildings and install renewable energy technologies in the city. The YEF has determined that solar PV panels are likely the best option for the community. Going forward, the YEF plans to emulate the Hepburn Wind Project by implementing a number of community-owned solar arrays. Like the Hepburn project, the YEF hopes that community ownership of the solar arrays will help to better engage the community (McNamara, 2012). The YEF has identified that the best way to involve more people in implementing their energy plan is by holding educational sessions and workshops for the residents. They have partnered with Kangan Institute and Kunexion, educational organizations, to provide the citizens with opportunities to learn about the advantages of energy efficiency and renewable energy technologies. Along with this, the partnership hopes to better inform the people on how important reducing their carbon footprint is to the environment (McNamara, 2012).

A previous WPI student project, *Sustainable Retrofit of Yarra*, assisted the YEF by identifying locations and strategies to retrofit buildings in the city (Velazquez, Simpson, Moscariello, & Selkow, 2012). Retrofitting homes in Yarra to improve energy efficiency entails more than identifying appropriate techniques and technologies. Consequently, Velazquez et al. (2012) recommended creating a retrofit display along Bridge Road, which is a popular area in Yarra with many shops and cafes. With this retrofit display, many members of the community could observe ways to improve their homes and share this information. We can use this strategy of promoting sustainability by installing renewable energy technology in a popular area when they begin to implement the energy hub.

2.2.4. Castlemaine 500

The Central Victorian Greenhouse Alliance (CVGA) gained funding from the Victorian Government for a behavior change program in Castlemaine, Victoria. The goal of the Castlemaine 500 (C500) project was to confront the global problem of climate change by making steps towards reducing carbon emissions at the local level. The goal of the program was to reduce the energy consumption of 500 households by 15 to 30% over the course of two years through the adoption of energy smart behaviors (Dingler, 2008).

Recruitment by C500 was done in many ways. The Adopt a Neighbor campaign attempted to increase involvement through house to house visits. They also tried to recruit at various community events and locations, such as film nights and grocery stores. C500 held a variety of events and workshops that were held by professional energy assessors and trained personnel to raise awareness. They also designed and implemented a Community Leadership Program over a twelve month span to embark on new community projects and train members to become household energy assessors. In addition, C500 created a Partner's Program that formed partnerships with many local groups and organizations to obtain household energy data and help reduce energy consumption. C500 used a Heat Energy Assessment Tool (HEAT) and Home Energy Action Plan (HEAP) that were completed by every workshop and home assessment participant. These were done so the participants could develop a plan and monitor their progress towards reducing energy consumption (Dingler, 2008).

One misstep taken by C500 was trying to recruit both households and leaders. This proved to be problematic because potential leaders wanted to improve wanted to improve their own homes prior to engaging as leaders. In addition, the project failed to maintain the initial level of excitement after the project's first event and did not follow up regularly with participating households to keep them involved and motivated. Lowered levels of enthusiasm could also have been due to the program's lengthy registration process and the lack of a website for information and feedback. The failure to establish a project office in the community compounded these problems further.

Although the C500 team encountered many difficulties throughout implementation, they were able to increase community knowledge and awareness of energy reduction techniques and influence behavior change for many participants in the program. The project found that smart meters encouraged people to change behaviors because they provided feedback on energy usage and allowed residents to visualize the impacts of changes in energy consumption habits. The HEAP was successful in making changes to homeowners' behavior because it allowed for people to make plans for reducing energy consumption over a period of time (Dingler, 2008).

2.2.5. Denmark Community Windfarm

The Denmark Community Windfarm, located in Western Australia, opened on February 20, 2013. The community saw a small windfarm as a way to feed power into the regional grid.

By doing this, they hoped to: reduce their carbon footprint, take a stand on the issue of climate change, and create economic and environmental benefits within the community. At the windfarm opening, over 150 residents came to show their support. Due to the project's success, our group can use it as a model as we look into community engagement strategies on how to successfully implement renewable energy technologies in Mirboo North and district (Denmark Community Windfarm, 2013).

2.2.6. Embark

Embark is a privately funded, nonprofit organization who empowers community energy projects by helping to eliminate the barriers that these projects face. The organization provides project funding, specialist advice, and education on policy settings. They believe that Australia needs to move towards a low carbon economy, and a vibrant community energy sector is an efficient way to do this. On their website, Embark provides case studies of various community projects on energy sources including: wind, solar, bioenergy, and hydro. They also provide examples of bulk buying programs, community groups, and investment models. (Embark, 2013)

Along with examples of other projects, Embark provides a roadmap for how communities can take steps towards energy efficient practices and implementing renewable energy technologies. They look to equip communities with the necessary questions to ask as they move forward with their projects. The preliminary actions of identifying the right energy source, funding the project, and communicating the project to the public are laid out on their website. Also, Embark's website is designed to allow people from various projects to post their experiences and ideas, so it includes a wide range of perspectives of how to get communities involved with energy projects. (Embark, 2013)

2.2.7. Alternative Technology Association

The Alternative Technology Association (ATA) is an organization that promotes sustainability in Australia and New Zealand. The ATA looks to overcome barriers that may be hindering people from implementing renewable technologies. They do this by advocating for access to green technologies through government and industry arenas. They also look to educate people on sustainability and steps they can take in their own homes. The ATA provides information through their website and magazine articles on conserving energy, recycling

materials, renewable technologies, and rebates that are available for energy saving products (Alternative Energy Association, 2013).

2.2.8. Heyfield Community Resource Center

Heyfield is a small town in Gippsland, Victoria with a population of approximately 2,000 people that has aimed to address climate change. The Heyfield Community Resource Center funded a ‘three flag system,’ which is helping the community reduce its carbon footprint. Participants of this program receive a flag for the level of sustainability that their household or business achieves. To achieve each flag, participants must meet requirements on a checklist that help their household become more sustainable.

The white flag is given to people who just start the program. The blue flag shows that many sustainable efforts have been made by a household. The green flag represents that a household is sustainable for the future. Sustainability takes a while to achieve, so new participants are only expected to make small changes and short term investments. After immediate energy savings are discerned from newly participating households, larger steps and investments are then encouraged.

This program seems to have gained success with the flag system; over half of the 2,000 residents of Heyfield have participated. People can visually see that other households are participating and making strides towards sustainability. The flags make it possible for non-participants to identify participants and thus learn about the program from these households. To popularize the idea of sustainability further, the city holds a Sustainable Living Festival. At this festival, community members are encouraged to learn about energy saving behaviors and exhibitors can showcase new and sustainable technologies (Green, 2012).

All of these projects illustrate two points. First, positive community engagement and involvement with energy efficient practices and renewable energy projects aid in the projects’ ease of completion. Second, there is an increasing interest to reduce the carbon footprint through greater energy efficiency and use of renewable energy. Once a community has decided to act on this desire, they can begin blueprinting a potential project. One of the main obstacles at the start of any renewable energy project is to decide exactly which types of renewable energy sources would be the best fit for the given situation. An analysis of some potential renewable energy sources for the Mirboo North project is detailed in the following section.

2.3. Renewable Energy Sources

Mirboo North, the site of our project, is a small rural community that wishes to become more environmentally sustainable. The MNCEH plans to increase sustainability and resilience in order to address the projected impact of climate change and future community and regional risks. The South Gippsland district, which includes Mirboo North, has a population of roughly 28,000; Mirboo North currently has a population of approximately 2,500 (Primaform, 2013). A map of the South Gippsland Shire and the surrounding area is shown in Figure 9. Mirboo North has only 54% of the adult population in full-time employment, compared to 57% within the South Gippsland district. Healthcare, construction, and agriculture are the leading industries in Mirboo North, and a majority of land is used for dairy farming and horticulture.

Figure 9 - Map of the South Gippsland Shire and Surrounding Areas

(South Gippsland Shire, 2013)



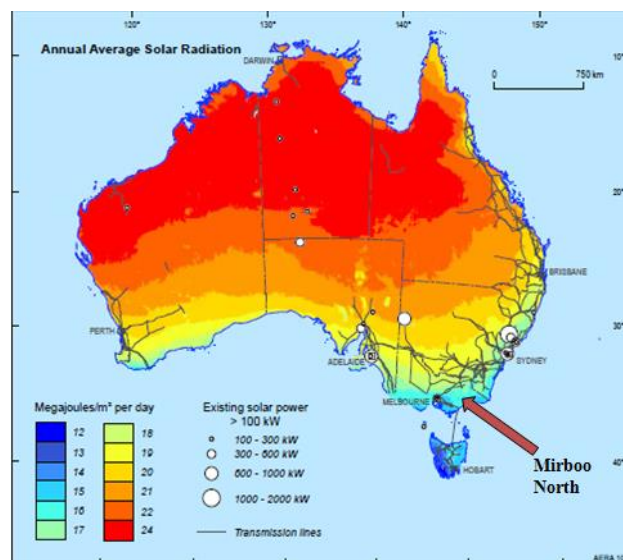
SRI has been coordinating with the MNCEH, the Mirboo North Community Shed Cooperative (MNCSC), and the Mirboo North and District Community Foundation (MNDCF). The MNCSC has been awarded a grant of \$20,000 for the project and established a 12 member project committee, the MNCEH. The goal of this hub is to enhance the social and economic strength of Mirboo North through the development of a community owned energy services provider (Primaform, 2013).

The Mirboo North and district community needs to analytically select the most appropriate energy sources to implement onto their properties. The residents' decisions on what types of renewable energies will be used are primarily based on the following factors: availability, efficiency, feasibility, scalability, and cost. We researched solar, hydro, bio, wind, and geothermal energy sources to provide the community with a general background on renewable energy technologies. This information was crucial to gather so that we could better inform and communicate with the residents of Mirboo North and district.

2.3.1. Solar Energy

Solar energy is one of the most widely recognized alternative energy sources. Due to Australia's location and community consensus, solar energy is a leading candidate for the MNCEH. Australia, which receives approximately 58 million PJ of solar radiation annually, has the most solar radiation per square mile of the seven continents (Ferguson, 2010). Mirboo North is located at latitude $38^{\circ} 24' 0''$ South in the southeastern part of the continent so it receives approximately 8 MJ/m^2 per day less solar radiation than the northern stretches of the continent. However, according to the map in Figure 10, this area still sees around 16 MJ/m^2 of solar radiation daily (Ferguson, 2010). This makes solar energy a readily available energy source for the Mirboo North community.

Figure 10 - Annual Average Solar Radiation in Australia (Ferguson, 2010)



There are two types of solar energy electricity generation that must be considered for this project: thermal and photovoltaic (PV). The method of solar thermal energy requires the conversion of solar radiation into heat before it is converted into electricity. PV is capable of directly converting the sunlight into electricity within the PV cells (Ferguson, 2010). Solar photovoltaic systems are well suited for off grid locations and also tend to provide cheaper electricity generation in rural communities when compared to fossil fuels (Ferguson, 2010). The community must decide to either install a larger scale solar farm that could meet the electricity needs of many local households, farms, and businesses or outfit each building with solar panels to provide for its own energy needs. A solar farm would require the dedicated use of a large amount of land. Solar panel units would require individual maintenance and the willingness of residents to install the units on their property.

In addition to electricity generation, solar energy can also be used for direct-use applications. The most widely commercialized solar energy technology in this category is that of solar hot water systems (Ferguson, 2010). These are commonly used with solar thermal generation, but can also be integrated into PV systems. Evacuated tube technology provides another method of utilizing the sun's energy for hot water heating.

The initial construction and system installation constitutes the largest cost component of any solar technology. Aside from this, there are no fuel costs associated with solar PV systems. The only maintenance cost with solar PV is replacing the DC/AC inverter, which has a life span of about 10 years (Ferguson, 2010). This makes the systems easy to use and have minimal long term costs.

The Australian government has been strongly supportive of the implementation of solar energy in the past; although, this could change following recent elections. In the past, the government provided consumers with rebates for the installation of solar hot water heating and PV systems (Ferguson, 2010). This allowed solar energy systems to be established in the community with minimal political or zoning barriers. It also helped alleviate the initial implementation costs of a solar system for the community.

2.3.2. Hydro Energy

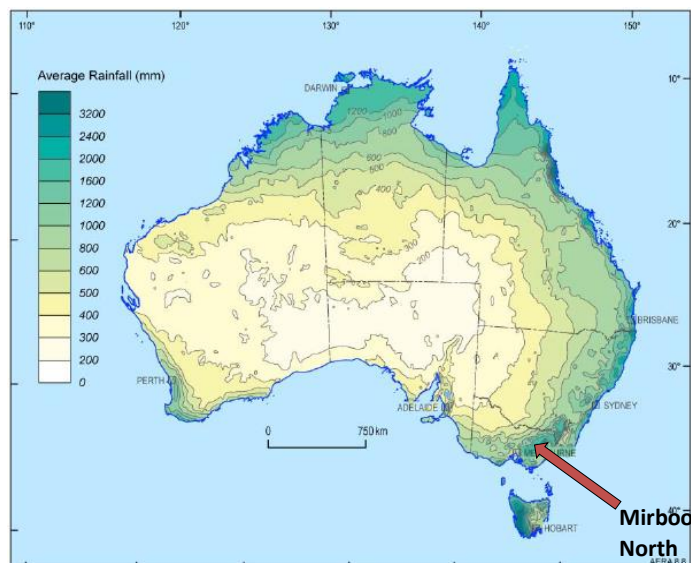
Hydro energy is one of the oldest forms of renewable energy. Water wheels have been used for centuries in moving bodies of water to generate mechanical work. Hydro energy has

since been used to generate electricity through the use of turbines. Present day hydroelectric plants consist of three main parts. The first is a reservoir that can hold excess water that will be used by the plant. The second is a dam that can regulate the water flow into the plant. The third and primary part is the electric plant where the water is used to power turbines that drive generators and produce electricity (National Geographic Society, 2013).

Hydroelectricity is currently the largest renewable source of electricity production in Australia and globally. Once the plant, dam, and reservoir have been built, clean electricity is able to be generated from the natural flow of water. The reliability of such operations is high as the flow rate of water can be adjusted to accommodate for fluctuations in electricity demand. The reservoirs in these systems can also be used for recreational activities (National Geographic Society, 2013).

There are several disadvantages to this simple and efficient technology. The dams and reservoirs built to provide water to the electricity plants can be extremely damaging to ecosystems. They reroute the natural flow of waterways, create flooding, block the migration patterns of fish, and decrease the dissolved oxygen in the water. In the southern and inner parts of Australia, the future for hydroelectricity generation is grim as these areas receive little rainfall. However, this is not of particular concern for implementing small scale, personal hydroelectricity generators in Mirboo North due to the area's high level of rainfall illustrated in Figure 11 (Ferguson, 2010).

Figure 11 - Rainfall Levels in Australia (Ferguson, 2010)

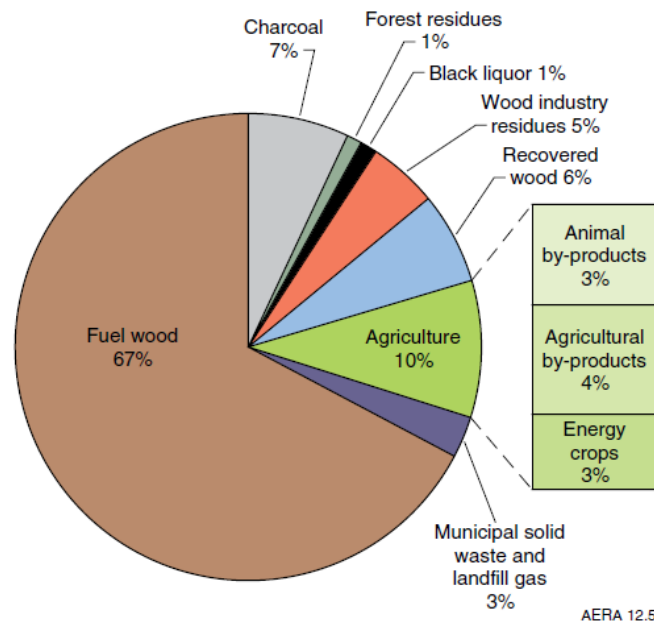


The possibility for implementation of small to medium scale pumped hydro storage in combination with hydroelectricity generation in Mirboo North is quite high as much of the required infrastructure is already in place on some farms. The natural topography of the region provides the height differential needed to efficiently generate power to drive the turbines. Most farms have a reservoir in place atop a hill to be used for feed or irrigation. This covers the first two necessary parts of a hydroelectric plant, the reservoir and the dam. Individuals would only need to invest in the turbines and a generator and incorporate these pieces into their current systems. They could then use power from other renewable sources or from the grid during off-peak hours to pump water uphill into their storage reservoirs. When they need electricity during peak hours, they could release water from the reservoir to power their turbines and generate free or discounted electricity.

2.3.3. Bioenergy

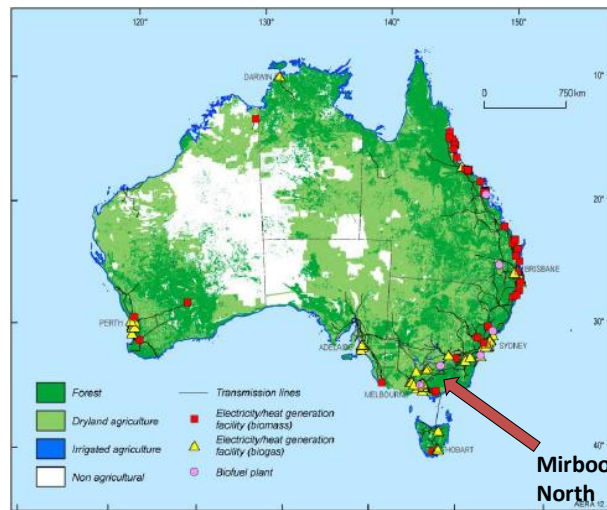
Bioenergy presents itself as a strong candidate to supply the residents in Mirboo North and district due to the abundance of potential biofuel sources in the area. The use of bioenergy is expected to increase by 60% by 2030 in providing electricity and biofuels (Ferguson, 2010). Biomass from the area's dairy and horticulture farms has the potential to provide energy for the community, although collecting sufficient material cheaply and easily may limit its feasibility. Currently, the main sources of bioenergy in Australia come from wood and agricultural waste, as shown in Figure 12 (Ferguson, 2010). There are successful, operational biodigesters that can use these sources of biomass to generate energy (Braid, 2011).

Figure 12 - Distribution of Fuel Sources for Bioenergy in Australia (Ferguson, 2010)



Bioenergy can be obtained from multiple sources. Biomass consists of vegetable and animal derived organic materials, which are produced for energy. Biomass can be used in combustion processes or chemical conversion to obtain biogas and biofuel (Ferguson, 2010). Biogas is a mixture of methane and carbon dioxide that is obtained as a byproduct of the anaerobic digestion of biomass and can be collected from landfills and sewage treatment plants. As shown in Figure 13, there are currently several biogas facilities in Victoria (Ferguson, 2010). Biofuels are formed from chemical conversions that produce ethanol and biodiesel. They are subcategorized into first, second, and third generation biofuels based on the methods used to obtain the fuel (Ferguson, 2010).

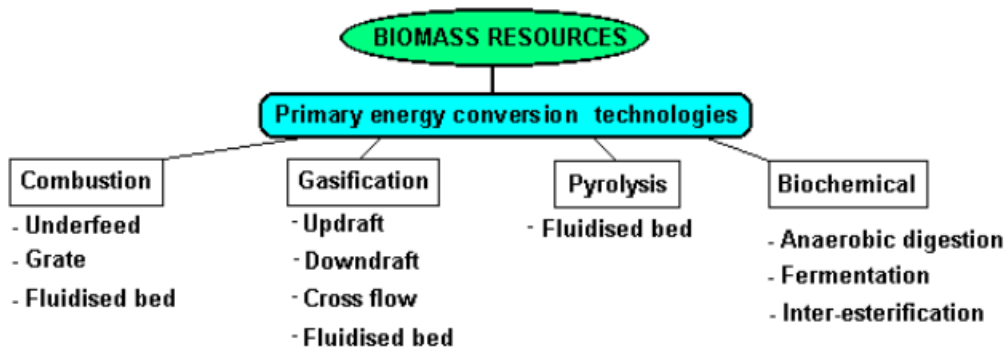
Figure 13 - Land Use in Australia (Ferguson, 2010)



Although there are many advantages to using biofuels, several factors hinder their implementation. Most engines are designed to run on petroleum, so users would be required to purchase new equipment that contained engines capable of running on biodiesel. Also, many people have the perception that biodiesels will not function at the same level as traditional petroleum fuels.

The large availability of biomass, due to the prevalence of farming in South Gippsland, makes bioenergy a potentially cost effective renewable energy choice. This will; however, largely depend on the scale of the biodigester, the amount of fuel required, and the collection methods necessary to obtain the fuel. There are several generator systems that use biofuel that could be implemented in Mirboo North and district. Figure 14 displays these possible technologies (Stucley, 2012).

Figure 14 - Biomass Conversion Technologies (Stucley, 2012)



2.3.3.1. Anaerobic Digestion

Biodigesters are a type of bioenergy generator that use biochemical conversion. They are becoming more widely used as people gain more knowledge about their benefits. Biodigesters reduce the amount of greenhouse gases released into the atmosphere, decompose organic waste, and reduce the odor from landfills, all whilst producing renewable energy (DeBruyn & Hilborn, 2007).

Anaerobic digesters function by feeding organic material into an enclosed tank, which is then decomposed by different types of bacteria. The bacteria break down the waste into a usable gas that can then be applied in a variety of ways. One way it can be used is through combustion, which would power a generator for heat and electricity. Another way is to first clean the biogas and use it in place of natural gas (DeBruyn & Hilborn, 2007).

Various digesters can be used for the different sectors within society. These systems can use the farm's manure or energy crops. The farm digesters are often more simplistic and require less management. The scale of the digesters corresponds to the size of the farm and can provide sufficient energy to power the operation. Unlike farm digesters, food-processing systems can extract organic matter from waste water (DeBruyn & Hilborn, 2007). The type of digester that is implemented depends heavily on the variety of organic material being fed into it and its percentage of solid waste. If the solid content is too high, the feed line must be made into a slurry in order for the digester to work properly.

Although biodigesters are becoming more widely used, several barriers must be overcome for successful implementation. Bioenergy projects in Australia require a feasibility examination to determine whether or not bioenergy is a suitable choice for the project. There are several areas that need to be examined, which include: community consultation, economics, and pertinent legal matters (Hamilton, 2013). The first barrier to installation is identifying a suitable source of fuel and a demand for the power. Permits must also be obtained before the building process begins. Digesters in some areas may require zoning changes, which could delay or completely terminate the project. In addition, the digester must be in a location far enough away from residential areas so that any odors do not disrupt the community (DeBruyn & Hilborn, 2007).

For farm-based systems, the primary feed into the digester is manure; however, with this follow many complications. Biodigesters perform best in a specific temperature range, usually

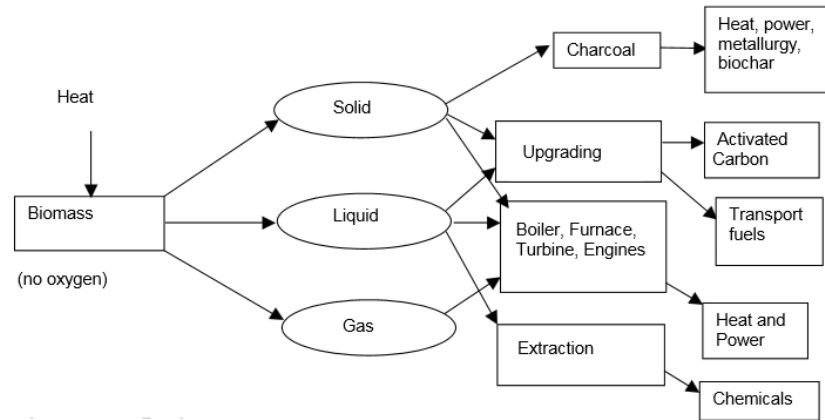
around 35° C, so when cooled manure is added to the system, compensations must be made for heat loss within the system to ensure that it operates properly (Igoni, 2008). The waste must also be less than a week old in order to guarantee the best digestion. If the manure is older than this, some of the methane could have already been released. Another difficult aspect is figuring out the optimum feed composition and feed rate so that the production of biogas remains constant. The mechanics of the system are also very complex; they contain a large number of control systems to prevent technical hitches during the production of the biogas (DeBruyn & Hilborn, 2007).

The cost of implementing a biodigester varies heavily on the size of the digester that is needed. One of the initial costs is the planning and construction of the digester itself. Another cost that needs to be taken into consideration is obtaining the feedstock and deciding how often it needs to be supplied to the digester. The waste must also be appropriately decomposed so it does not clog the digester, which could create serious pressure problems within the system. The digester would then require expensive maintenance. However, if it were maintained and operated correctly, these costs would remain low (Igoni, 2008).

2.3.3.2. Pyrolysis

Pyrolysis is a type of biomass conversion process in which the biomass supply is indirectly heated in the absence of air (Stucley, 2012). The process can be performed in two ways: flash pyrolysis or slow pyrolysis. The type of process is determined by controlling the exposure time, heating rate and temperature. Depending on the type of fuel source desired, a process with appropriate product proportions can be chosen. Figure 15 depicts the possible uses for solid, liquid, and gas products of pyrolysis processes (Stucley, 2012).

Figure 15 - Products and Uses of Pyrolysis (Stucley, 2012)



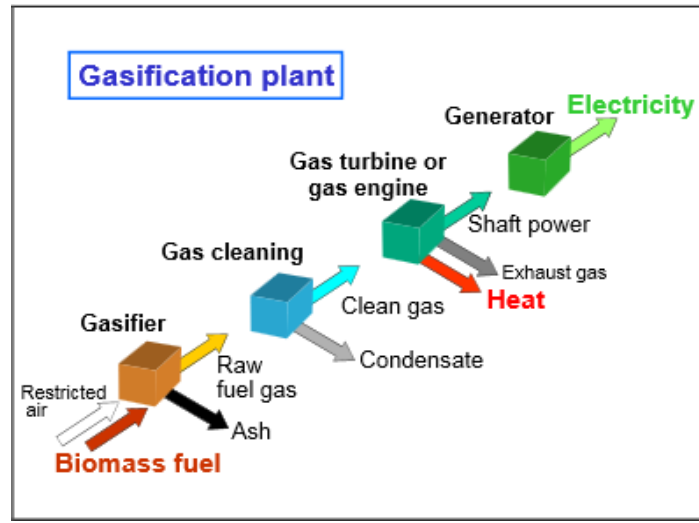
Flash pyrolysis requires temperatures between 450-500°C, high heating rates, and exposure times of under one second. This results in 60-70% liquid, 10-20% solid and 10-20% gas, making it a liquid dominated product (Stucley, 2012). Slow pyrolysis requires temperatures between 400-450°C, low heating rates, and longer exposure times. This process results in a more even product distribution than flash pyrolysis. The mixture is approximately 30-35% liquid, 20-35% solid matter, and 25-30% gas (Stucley, 2012).

2.3.3.3. Gasification

Gasification is a type of biomass conversion process that is performed under a restricted supply of oxygen. At 1200-1300°C, it requires higher heating than pyrolysis. The basic process consists of three distinct stages: devolatilization, combustion, and reduction (Stucley, 2012).

The first stage, devolatilization, heats the biomass until methane and larger hydrocarbons are separated from the reactive char as volatile gases. In the second stage of combustion, these volatile gases are partially burnt in air to produce heat and carbon dioxide. The final step, reduction, involves the carbon dioxide absorbing heat and reacting with the char to produce carbon monoxide fuel gas. Hydrogen is a secondary component to this fuel gas due to water vapor in the gasifier (Stucley, 2012). This fuel gas may then be burnt for heat or processed to be used as fuel for gas-fired engines. A model of a gasification plant is shown in Figure 16.

Figure 16 - Model of a Gasification Plant (Stucley, 2012)

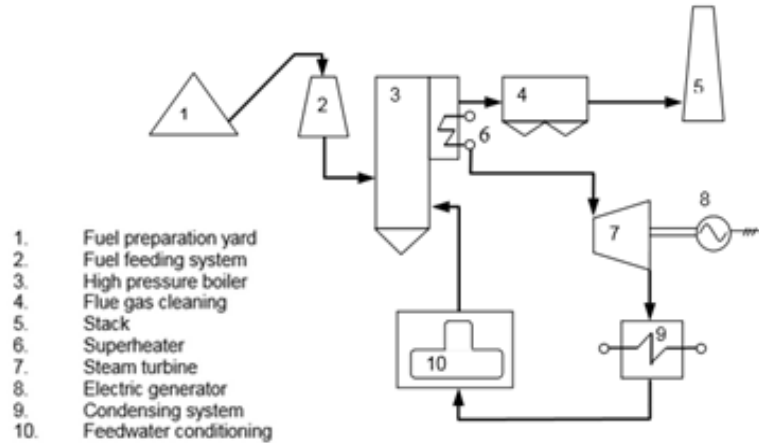


There are several designs of gasifiers that vary depending on their fuel and air mixture, scalability, and electricity efficiency. Fixed bed updraft gasifiers, referred to as countercurrent moving beds, consist of a reaction chamber that is fuel fed from the top and combustion fired from below (Stucley, 2012). An advantage to using this technology in Mirboo North is that it is capable of using a fuel of various moisture contents and particle sizes. Fixed bed downdraft gasifiers, referred to as co-current moving beds, have top fed fuel that undergoes combustion processes as it moves downward due to gravity (Stucley, 2012). This design is suitable for Mirboo North since they are popular for small-scale generation. However, these downdraft gasifiers require very specific fuel moisture contents and sizes. Fixed bed cross flow gasifiers operate at temperatures up to 1500°C and are suitable for very small applications (Stucley, 2012). Fluidized bed gasifiers are newer and have been developed to increase the efficiency of larger scale units that use biomass as a main fuel source (Stucley, 2012).

2.3.3.4. Combustion

Combustion is the most common type of biomass conversion process as 90% of the world's bioenergy plants use this process (Stucley, 2012). Combustion consists of biomass fuel being oxidized in air to produce heat. Carbon dioxide and water vapor are the primary products of combustion; smoke and ash are also produced. Combustion processes are highly efficient as they can recover 65-95% of the energy contained in the biomass fuel (Stucley, 2012). A schematic of the main components of a biomass power plant is shown in Figure 17.

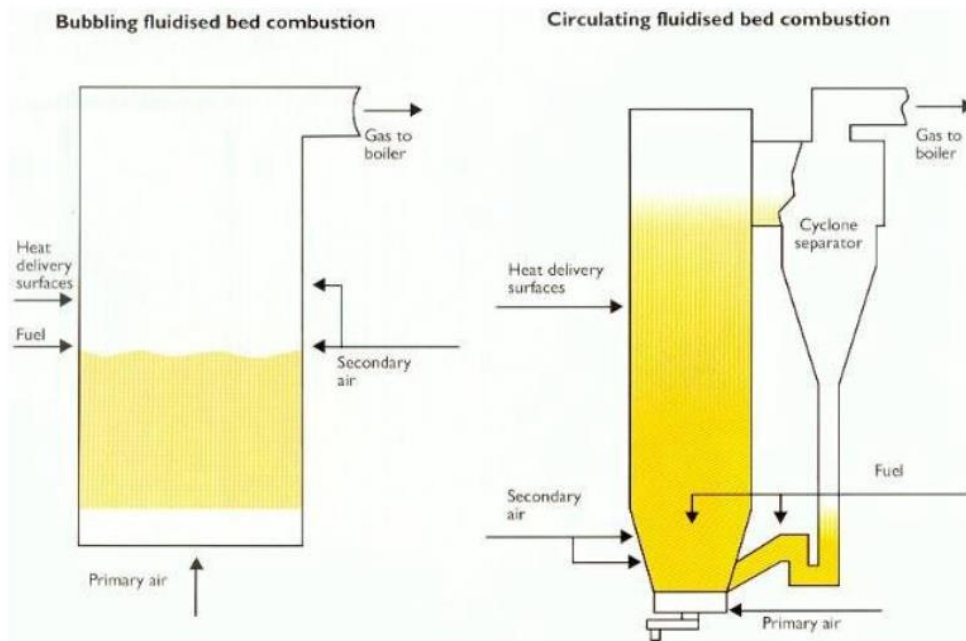
Figure 17 - Main Components of a Biogas Power Plant (Stucley, 2012)



Grate combustors, fluidized bed combustors, and biomass co-firing are three possible combustion processes that could be implemented in Mirboo North and district. A grate firing system places biomass fuel on an air or water cooled grate and travels through a drying zone, ignition zone, and burnout zone (Stucley, 2012). Grate stoker systems can be installed as fixed grates for smaller scale systems or reciprocating grates for larger scale use. These systems have low initial and operating costs and are able to operate at partial loads. However, these systems have disadvantages; excess oxygen in the system can decrease the systems efficiency, and these types of systems produce nitrous oxide emissions (Stucley, 2012).

Fluidized bed combustors burn biomass fuel in a bed of inert material that is heated from underneath by combustion air so that the bed fluidizes and acts as a boiling liquid (Stucley, 2012). It is only necessary to have up to five percent of the overall bed contain fuel and can be mixed by gravity, screw feeder, or pneumatically. These beds are able to burn low grade fuels, use fuels of variable properties, and minimize gas emissions. The two main types of fluidized beds are bubbling (BFB) and circulating (CFB). Diagrams discerning the differences in these two systems are shown in Figure 18 (Stucley, 2012). Generally, CFB have higher gas fluidization velocities, higher fuel flexibility, higher efficiency, and greater support for larger scale plants compared to BFB.

Figure 18 - Diagrams of BFB and CFB Combustion Processes (Stucley, 2012)



Biomass co-firing is a type of combustion that combines biofuel into the fossil fuels of existing power plants to offer reduced greenhouse gas emissions at lower costs (Stucley, 2012). For direct co-firing, coal and biofuel are mixed before they enter the combustion process. This method offers simplicity and low costs. For indirect co-firing, the biofuel of agricultural residues and contaminated wood is first gasified and then fed into the coal combustion chamber. Due to the separate conversion plant, the costs of this method are much higher, but allow for a larger range of fuel types to be used (Stucley, 2012).

2.3.4. Wind Energy

Wind energy generation farms are already common in Australia, and they provide a near zero emission renewable energy source (Ferguson, 2010). Wind turbines produce no operational greenhouse gas emissions and have relatively low operating costs compared to other renewable energy sources (Ferguson, 2010). This makes wind energy the fastest growing alternative energy in Australia; it is projected to increase to 12.1% of total electricity generation in 2030 from only 1.5% in 2008 (Ferguson, 2010).

Unfortunately, wind energy poses the most variables and obstacles of the potential renewable energy sources for Mirboo North and district. As shown in Figure 19, the community

is located in an area that receives a moderately high average wind speed, of approximately six m/sec (Ferguson, 2010). The average wind speed of South Gippsland, including Mirboo North and district is shown in Figure 20. However, the availability of wind is extremely site specific and, even in areas of high wind speed, can see drastic fluctuations. Therefore, a sole reliance on wind energy poses a potential hazard for Mirboo North and district so it would work best when combined with another renewable energy technology.

Figure 19 - Average Wind Speed in Australia (Ferguson, 2010)

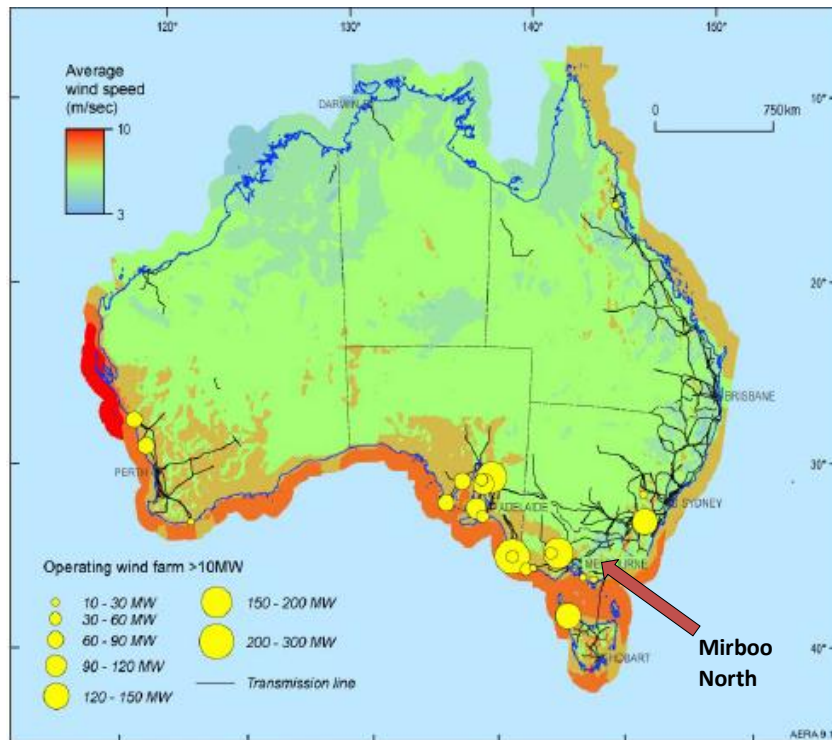
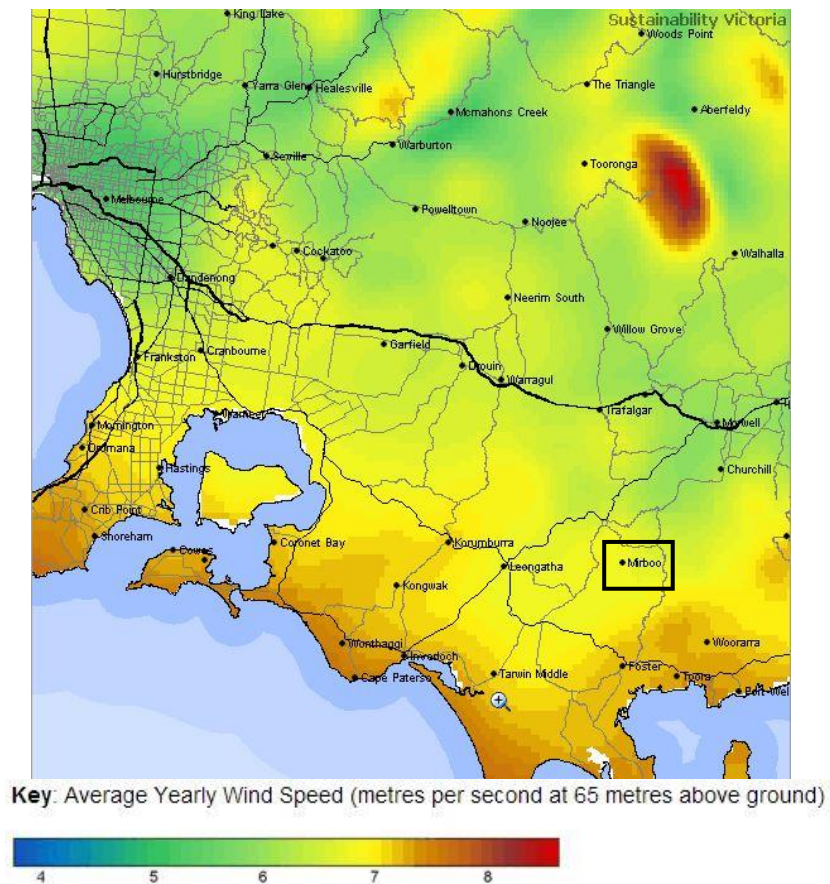


Figure 20 - Gippsland and Eastern Melbourne Wind Map
(Wind - Sustainability Victoria, 2013)



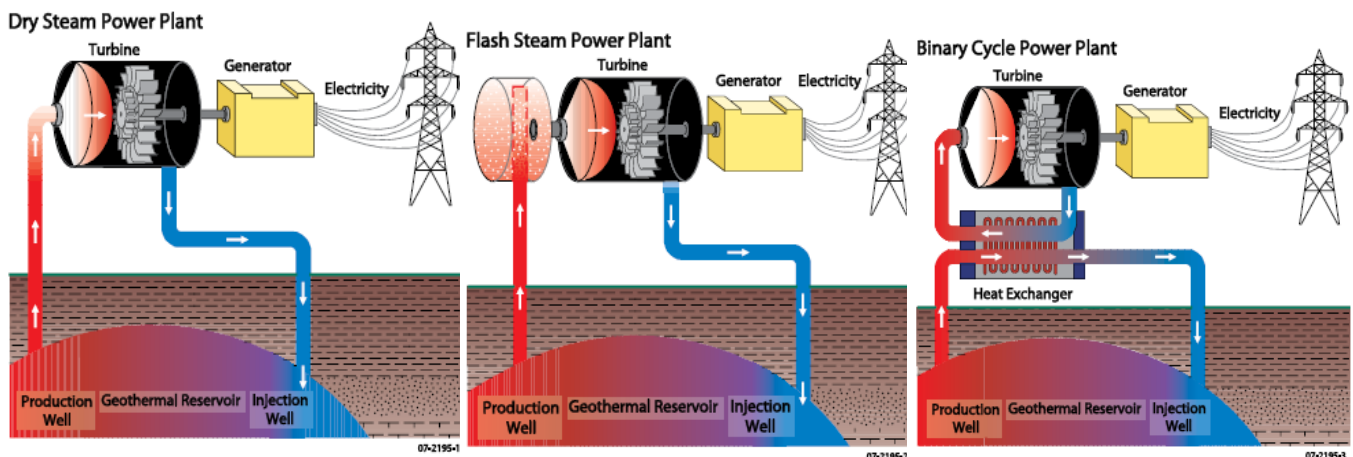
Currently, the political restrictions on wind energy are even greater than the geographic challenges. Victoria allows any resident living within two kilometers of a new turbine site to veto its implementation (Lauder, 2013). While government policies on the Renewable Energy Target may support wind energy generation, current government restrictions in Victoria make the implementation of a wind farm almost impossible (Ferguson, 2010). The noise emitted from wind farms, in addition to being an annoyance, has been a concern for public health; although, these claims have not been validated by the Victorian Health Department (Lauder, 2013). The turbines can also be aesthetically unappealing and can result in substantial impacts on bird and bat populations depending on size and location. Unless these issues are resolved with a change of government in the coming year, the possibility of using wind power in Mirboo North and district is lessened.

2.3.5. Geothermal Energy

Geothermal electricity generation is in its infancy in Australia. There is only one generator in use, located in Birdsville, Queensland, and most other projects are in conceptual stages (Australian Government, 2010; Ferguson, 2010). Although Australia lacks the seismic activity of New Zealand and other places associated with well-developed geothermal energy, the potential for expanded use of geothermal energy remains high due to the high heat producing granites and naturally circulating waters in sedimentary basins (Ferguson, 2010). It has been estimated that by 2030, geothermal energy will produce six TWh of power in Australia (Ferguson, 2010).

There are two types of geothermal power generation that can potentially be implemented for the MNCEH, hydrothermal systems and hot rock systems. Hydrothermal systems utilize naturally circulating water through areas with high heat pores (Australian Government, 2010). Hot rock systems require the fracturing of rock structures in order to create channels to artificially circulate enough water to induce heat transfer (Australian Government, 2010). Geothermal generation can take advantage of the natural high heat producing basement rocks present on the Australian continent while remaining unaffected by climatic variables that can cause fluctuations in other renewable energy electricity generation (Australian Government, 2010). This is largely due to the heat produced by natural radioactive decay of elements in the granite (Ferguson, 2010). Figure 21 illustrates three different types of potential geothermal power plants for the Mirboo North and district community (Australian Government, 2010).

Figure 21 - Diagrams of Geothermal Power Plants (Australian Government, 2010)



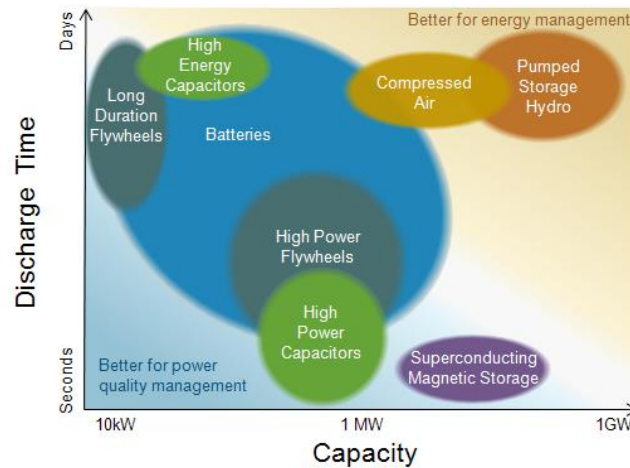
The Australian government has been supportive of expanding the use of geothermal power plants for energy generation. The Department of Resources administered a \$50 million Geothermal Drilling Program and has provided seven million dollars in grants for seven conceptual geothermal projects (Ferguson, 2010). The Australian government has also used \$153 million of its total \$435 million Renewable Energy Demonstration Program budget to take geothermal projects from a conceptual stage to a commercial demonstration stage (Ferguson, 2010). The government assistance behind geothermal energy projects bodes well for a potential plant being constructed in Mirboo North and district. However, the recent change in government could cause a decline in geothermal support. Also, it would be difficult to gain community support to install geothermal generators in a rural community that is very much against fracking operations.

2.3.6. Storage Systems

Renewable energy technologies provide a sustainable and clean source of energy. However, due to their intermittent production of power, storage options for this generated energy act as a barrier to a more widespread implementation of renewable energy technologies. This is particularly a problem with off-grid systems because they lack the backup supply that would normally be provided by the grid. In order to use the energy generated from renewable systems more efficiently, it is necessary to have a method to store this energy so it can be used at times when the system is not generating energy.

There are five main categories of energy storage; chemical, electrochemical, electrical, mechanical, and thermal. Specific methods of energy storage are grouped into these categories based on how they store energy. As shown in Figure 22, different energy storage methods are capable of storing different amounts of energy and discharging this energy over various time periods (Brown & Mobilia, 2011).

Figure 22 - Electricity Storage Technologies (Brown & Mobilia, 2011)



Chemical energy storage involves storing energy in chemical fuels that can later be burned to perform mechanical and electrical work. Gasoline, diesel, natural gas, propane, biodiesel, and hydrogen are some common chemical fuels. Unfortunately, most of these produce greenhouse gases when burned. Hydrogen is the only chemical energy carrier that is carbon-free and zero-emission. However, it has high production costs that prevent hydrogen fuel from replacing hydrocarbon fuels on a commercial level. Biofuels, while not as clean as hydrogen, may be a commercially viable replacement for hydrocarbon fuels. Through chemical processes, the carbon and hydrogen in plant and animal biomass and organic waste can be converted into hydrocarbon fuels (Wagner, 2007).

Electrochemical energy storage involves storing energy for electrical use. The most common electrochemical storage device is the battery. Batteries convert chemical energy into electrical energy and are divided into primary and secondary types. Primary batteries are single use devices that have long-life energy storage, but small capacity. Secondary batteries are similar to primary batteries, but they can be recharged for up to 1,000 uses. Fuel cells are another electrochemical storage device that feature a separated storage system and power generator. The ability to produce electricity from an external chemical fuel supply prevents fuel cells from being limited to the small capacity of batteries (Wagner, 2007).

Electrical energy storage uses capacitors to store electricity by means of static charge. Capacitors store energy on the surface of metal electrodes and are able to work with high currents, but only for very short time periods. Supercapacitors use a molecule-thin layer of

electrolytes to store charge. This enables them to carry a high capacitance, but they must work with lower currents than capacitors. They also have virtually indefinite lifetimes and a total efficiency that is typically above 90%. Superconducting magnetic energy storage (SMES) systems store energy in the magnetic field created by sending direct current through a superconducting coil that has been cryogenically cooled. SMES systems are capable of releasing megawatts of power and have efficiencies over 95%. However, they are high cost and currently only used to stabilize power plants (Wagner, 2007).

Mechanical energy storage systems use kinetic and potential energy to generate electricity as needed. Flywheels store energy under the principles of the conservation of energy and momentum. A rotor is accelerated to maintain rotational energy; the flywheel then slows down when energy is extracted from the system and sped up when energy is added to the system. Flywheels are capable of delivering energy in very short periods of time, but they are much less efficient than other storage methods. They can be used in association with wind turbines to store energy for when the turbine is not producing electricity. Another method that uses wind power is compressed air energy storage (CAES). CAES systems use wind turbines to push compressed air into underground aquifers. This allows the compressed air to be released to power generators when there is a lack of natural wind. These systems are inefficient and, thus, only commercially viable in regions with highly fluctuating electricity prices. Pumped storage hydro power uses excess electricity generated from renewable sources or electricity from the grid during off-peak hours to pump water to elevated reservoirs. The water can then be released from the reservoir to power turbine generators to produce electricity during peak hours. These systems can be implemented at any scale, have discharge times that range from a few hours to a few days, and a combined efficiency between 70-85% (Wagner, 2007). Due to Mirboo North's geographic makeup, pumped storage hydro power is a realistic storage option.

Thermal energy storage allows excess thermal energy to be collected and used when needed. Solar pond systems are comprised of a pool of water with various layers of salt solutions. The concentration of salt increases in each layer down from the surface to prevent absorbed heat from being lost by convection. This allows the lowest level of the pond to reach near-boiling temperatures. This water can then be used directly for hot water and heating in a building or to drive a turbine to produce electricity. Rock heat storage can also be used for heating purposes. While the heat capacity of rock is not as high as water, it is capable of being

heated to much higher temperatures. This allows the electrically heated rock to carry a higher volumetric capacity, so only a small brick of this material would be needed to provide heat for a single house. These systems can also use the excess heat of PV panels to store heat (Wagner, 2007).

2.4. Mirboo North and District

Mirboo North and district looked to Snowy River Innovation for advice on how to become more energy efficient and implement renewable energy technologies. Snowy River Innovation was developed to help clients, like the Mirboo North community, with sustainability and innovation projects. It is a collaboration of five partners within five key industries needed to successfully implement their broad range of projects. More details of the individual entities involved under Snowy River can be found in Appendix A. By 2015 Snowy River hopes to expand its client base from Australia to Asia and the Pacific.

The Mirboo North community looked to SRI for consultation on the proposed community owned energy hub. For this proposal, SRI prepared a business case for the Mirboo North and district community foundation to lay out the different options for the energy hub and the various stages that this project will entail. The MNCEH is intended to be a source of information for community owned energy, with the aim of reducing energy bills. To get the community's opinion on the establishment of a community energy hub, Mirboo North and district conducted a public survey of its residents. The results from the survey in the business case showed that an overwhelming majority, over 95%, of the community supported the development of the MNCEH. A major reason for this is that approximately 80% of the citizens felt a high level of concern for their current and future energy prices. In addition, there was a great deal of support for sustainability projects. Additional information obtained from the survey included barriers people realized that prevented them from becoming more sustainable. The main obstacles brought forth were limited access to government funding to help with upfront costs, competing priorities for investment with other energy companies, a long payback period, and a lack of knowledge of the current renewable energy options. The survey also showed that over five percent of the population has already taken steps to become more energy efficient (Primaform, 2013). This data proves that several residents of the community are already proactive in the green energy movement.

After conducting the survey, the town has taken several paths to further community involvement. One of the major steps taken by the MNCEH was to establish a workshop for its residents. The workshop discussed different aspects of the MNCEH to give the citizens a broader understanding of how it would work. Case studies of previous energy projects were explained to help visualize the future potential of the MNCEH. By reviewing past projects, the MNCEH was able to understand the importance of community support for the development of the project. The need for baseload power, and how it could be used along with smart grids and smart meters, was discussed (Primaform, 2013). Baseload power is the minimum amount of electricity constantly needed within a grid system. This amount must take into account the reliability of sources so that if one of the sources were to fail, the energy level would not fall below the minimum point (Needham, 2011).

A smart grid is an electric grid in which the consumers and the power plants are continuously communicating in order to optimize operation. A traditional electric grid only allows communication from the plant to the consumer. This means that the consumer has no say in what occurs (Environmental Defense Fund, 2013). If excess power is produced during the day, the community will be able to sell back this electricity to the grid. A smart meter is a device that measures the energy usage of a building in 30 minute intervals and charges various prices per kilowatt hour based on if the energy was used during peak, off-peak, or shoulder hours.

In addition to the energy workshop, the MNCEH holds information days at the community shed that people can attend to obtain updates on the current projects. They have also distributed several newsletters and set up a forum on which people can ask energy related questions. Another key aspect of getting the community involved in making their homes more energy efficient was implementing an energy assessment training program. This program taught the community about what they can do to begin living a more ecofriendly lifestyle.

For our project we helped to further the development of the MNCEH. Our main goal was to explore ways to increase community engagement in the MNCEH. We determined the most effective methods to publicize the MNCEH and its benefits to Mirboo North and district. There are four major sectors within the Mirboo North and district community: residential, small business, dairy farming and agroforestry. We focused on dairy farming and agroforestry because there were prevalent informational gaps regarding energy.

3. Methodology

The goal of this project was to explore ways to increase community engagement in the MNCEH, particularly in the dairy farming and agroforestry sectors. To accomplish this goal, our team developed five objectives. We: (1) explored lessons learned from community energy projects outside of Australia; (2) explored lessons learned from community energy projects in Australia; (3) reviewed various types of energy efficient practices and renewable energy technologies to identify information that may be useful to the dairy farming and agroforestry sectors; (4) investigated the goals and interests, with respect to sustainable practices, of the dairy farming and agroforestry sectors through our visits to Mirboo North; and (5) developed a prototype website for the MNCEH to increase community engagement and knowledge. Our project entailed a variety of methods which included: reviewing pertinent literature, conducting interviews with knowledgeable persons in the sustainable energy field, holding discussions with dairy farmers and horticulturalists in Mirboo North and district, creating a prototype website for the MNCEH, and surveying individuals on their experience with our prototype website.

3.1. Explored Lessons Learned from Community Energy Projects Outside of Australia

Our team reviewed literature on four current projects focused on community engagement efforts towards sustainable energy practices within rural communities outside Australia. Three of these projects were located within the United States and one project was located in the United Kingdom. These projects were chosen because they focused on educating communities on sustainable energy practices and used community engagement as a vehicle for success. From these projects, we learned about successful methods on how to engage the community. We investigated projects outside of Australia to gather new outreach ideas and engagement methods that could be used in Mirboo North and district. We incorporated the lessons learned from these projects into the construction of the prototype website and our recommendations to SRI and the MNCEH for the future development of its website and other outreach efforts.

3.2. Explored Lessons Learned from Community Energy Projects in Australia

Our group reviewed renewable energy and community engagement projects in Australia to gain a better sense of effective methods in a geographically, climatically, and culturally similar region. While in Australia, we built on our initial review of selected projects by

conducting a more in-depth review of past and ongoing community energy projects. Our team accomplished this by interviewing key members of projects for insight into what practices were successful in increasing community engagement and what barriers they faced. This allowed our team to gain a better sense of what technologies would be most feasible in Mirboo North and district. Our team conducted interviews with members of the YEF, MEFL, C500 and LIVE who were involved in community energy projects. A matrix showing the people with whom we talked and the nature of the interviews is shown below in Table 2. A list of interview questions can be seen in Appendix B.

Table 2 - Community Energy Project Interviews

Interviewee	Organization	Geographic Focus	Method of Interview	Date
Jim Castles	Yarra Energy Foundation (YEF)	Municipality of Yarra	Group Discussion	Nov 13, 2013
Bruce Thompson	Moreland Energy Foundation (MEFL)	Moreland	Group Discussion	Nov 14, 2013
Russell Fisher	Castlemaine 500 (C500)	Castlemaine	Group Discussion	Nov 18, 2013
Dave Robinson	Locals in Victoria's Environment (LIVE)	South Melbourne	Group Discussion	Nov 20, 2013

The YEF is a nonprofit organization that is working to make the municipality of Yarra carbon neutral by 2020 by promoting building retrofits. We talked to the YEF because they ran a similar community energy project and we were looking to gain information on their website and community engagement strategies. We were able to talk with Jim Castles, a project officer for the YEF, about his current project of reducing the greenhouse gas emissions of the municipality of Yarra. He gave us background information of how the foundation was erected by the Yarra

City Council and then described different strategies for community engagement. The YEF website and its effectiveness was also a point of discussion.

MEFL is a nonprofit organization, based in Brunswick, Victoria, that focuses on sustainability by promoting energy efficient practices and renewable energy technologies to communities. We talked to MEFL because they are involved with community energy projects and deal directly with renewable technology installations. We were looking to get information about their successful website design and obstacles they encountered when dealing with potential clients. Our team visited their office and interviewed Bruce Thompson, the director of major projects, as well as the WPI Interactive Qualifying Project group working at MEFL. The main topics of discussion were their websites, advertising options, and the Community Power Program.

C500, based in Castlemaine, Victoria and completed in 2009, was a community energy project that was executed by the Central Victorian Greenhouse Alliance that focused on behavioral change. We held a discussion with Russell Fisher, who was a leader in the communication aspect of the project. In addition to reviewing his experiences with C500, Fisher also shared his work with the Trentham Food and Energy Hub. Trentham is a small rural town similar to Mirboo North. The Hub is trying to enable consumers to make informed food choices. The topics of discussion were community education and barriers with communication. From discussing these topics we hoped to take the lessons learned from different aspects of the community project. With the Food and Energy Hub in a similar rural community to Mirboo North and district, we hoped to gain further insight about this project.

LIVE, a nonprofit community organization based in the City Port Phillip, Victoria, is taking action to reduce the human contribution to climate change by educating the community and working with local councils to develop ecofriendly policies. We spoke with David Robinson at the South Melbourne Market, where LIVE hopes to install more solar PV panels onto the roof of the market. We discussed the barriers that he is facing on his current project specifically in terms of interaction with the community. Since Mirboo North and district is at an earlier stage of its project, we hoped to relay successful means of communication from LIVE to the MNCEH.

Discussions with individuals from these organizations entailed a brief description of their background and project experience followed by a questioning session. Obstacles with engaging the community, website effectiveness, and sustainable practices were some of the topics of

discussion. We gained the interviewees' permission to be quoted in our report and allowed them to review any information that was written by us to make sure they agreed with the statements. By conducting these interviews with members of Australian sustainability projects, our team identified successful engagement methods. We also discovered aspects of these methods upon which could be improved. Based on this information, we made recommendations on community engagement strategies to the MNCEH. Along with these interviews, we visited the websites of several other community energy projects in Australia to gain a better understanding of what the current projects were as well as how effectively their websites were working. A matrix of the websites we reviewed can be found in Appendix K.

3.3. Reviewed Various Types of Sustainability Practices

A quintessential element in the establishment of the MNCEH was to educate the community on energy efficient practices and viable renewable energy. Potential options of renewable energy sources included: solar, hydro, biofuel, wind, and geothermal. These energy sources were generally analyzed to determine their technical, economic, and social feasibilities upon implementation into the Mirboo North community.

Initially, we discussed general issues such as potential communication barriers and community resistance to the MNCEH in respect to the implementation of renewable technologies. Suggestions for community involvement within the MNCEH were developed through discussions with ClimateWorks, Genesis Now, Going Solar, MEFL, Gippsland Solar, and Trentleck. We obtained information from these groups on experiences they had overcoming the barrier of customer hesitancy in implementing renewable energy technologies. They also gave us feedback on the effectiveness of their respective websites at maintaining high levels of community interest and involvement. A matrix showing the people with whom we spoke and the nature of the interviews is shown below in Table 3. Interview questions for ClimateWorks and Genesis Now can be found in Appendices C and D respectively. Interview questions for Going Solar, MEFL, Gippsland Solar, and Trentleck can be found in Appendix E.

Table 3 - Sustainability Organization Interviews

Interviewee	Organization	Location	Method of Interview	Date
Scott Ferraro	ClimateWorks	Melbourne	Group Discussion	Oct 30, 2013
Geoff Andrews	Genesis Now	Melbourne	Group Discussion	Oct 29, 2013
Stephen Ingrouille	Going Solar	Melbourne	Group Discussion	Nov 18, 2013
Bruce Thompson	Moreland Energy Foundation	Brunswick	Group Discussion	Nov 14, 2013
Andrew McCarthy	Gippsland Solar	Mirboo North	Group Discussion	Nov 8, 2013
Trent Nair	Trentleek: Solar, Wind, Hydro	Naraccan	Group Discussion	Nov 9, 2013

ClimateWorks is a nonprofit organization committed to reducing greenhouse gas emissions in Australia. They partner with leaders from the private, public, and nonprofit sectors to give advice on how companies can reduce their carbon footprint. We visited their office in Melbourne and talked with Scott Ferraro to discover ways of communicating sustainable energy.

Genesis Now is the energy efficiency branch of SRI that is run by Geoff Andrews. We were able to talk to Andrews about the software he has created, called *Eco-tracker*, which allows people to view their electricity usage at a specific time and see whether energy is being used efficiently. This helped us to better communicate energy saving tips regarding everyday practices. Another topic of discussion was how to promote energy efficient practices to hesitant people, and how to go about overcoming this.

Going Solar is the renewable energy branch of SRI that is headed by Stephen Ingrouille. This company is a solar PV and solar hot water installer that also performs home energy

assessments. We interviewed Ingrouille to gain more information on the process of solar power installation and any potential problems the installers have encountered.

Gippsland Solar is a solar installer located in Mirboo North. We visited their solar showroom to view the different types of solar energy systems that they install. We also talked with Andrew McCarthy, a solar installer, to gain feedback on his experiences with installing solar energy systems and communicating technical information to potential customers. Topics of discussion included barriers that were faced when communicating with dairy farmers, problems regarding the electricity distribution network, and backup energy storage.

Trentleck is a solar, wind, and hydro installation company in the South Gippsland region. Our group met with Trent Nair at the site of a recently installed hydroelectric system. Through a discussion with Nair, we hoped to gain a better understanding of the viability of hydropower in Mirboo North and district. We also talked with Nair about some of the barriers with implementing different technologies, as he had a range of experiences with installing home renewable energy systems. By learning about these barriers, we made recommendations to the MNCEH so that they could help people overcome these barriers and progress with the implementation process.

3.4. Mirboo North and District Visits

Key perspectives from stakeholders and other interested parties were obtained from our visit to Mirboo North and district during the second week of our stay in Australia, November 8-10, 2013. This trip allowed us to talk with members of the MNCEH committee and build a more personal and trusted relationship with them. Upon arrival in Mirboo North, we gave a brief introduction to members of the district so they could understand the reason for our visit and what we hoped to accomplish through our project. We met with community members who held critical roles in the development of the MNCEH to get a better sense of the project's current direction and what results the committee would like to see from our work. Ian Southall, coordinator of the MNCEH, created the schedule of meetings and interviews for our visit. These included conversations with a dairy research facility, dairy farmers, horticulturists, and small-scale sustainable operations within the Mirboo North district. This trip helped us gain a better understanding of the interests and goals of the dairy farmers and horticulturists in terms of

sustainability. A matrix showing the people with whom we spoke and the nature of the interviews is shown below in Table 4.

Table 4 - Mirboo North Interviews

Interviewee	Organization	Operation Type	Method of Interview	Date
Bill Wales	Ellinbank Dairy Research Facility	Dairy Research Facility	Group Discussion	Nov 8, 2013
Carol Rowley	Rose and Fuchsia Farm	Flower Farm	Group Discussion	Nov 8, 2013
Graeme Wilson	Wilson Residence	Owner Managed Farm	Group Discussion	Nov 8, 2013
Ivor Auty	Auty Residence	Hydro Electric Generator	Group Discussion	Nov 8, 2013
Mike Durkin	Durkin's Produce	Potato Farm	Group Discussion	Nov 8, 2013
Emma Germano	Germano Farm	Cauliflower and Cabbage Farm	Group Discussion	Nov 8, 2013
Lez, Owen, and Claire Hutchinson	Hutchinson Farm	Dairy Farm	Group Discussion	Nov 8, 2013
Tony Cummaudo	Cummaudo Farm	Potato Farm	Group Discussion	Nov 9, 2013
Scott and Suzanne Wightman	Wightman's Organic Dairy Farm	Organic Dairy Farm	Group Discussion	Nov 9, 2013
Steven and Lisa Dumbalk	Dumbalk Dairy Farm	Dairy Farm	Group Discussion	Nov 9, 2013

The first location we visited on the way to Mirboo North and district was the Ellinbank Dairy Research Facility. Ellinbank is one of the world's largest dairy research facilities and is linked to the Department of Environment and Primary Industries. Our team met with research

manager and project leader Dr. Bill Wales, who has published research on reducing of methane emissions of cows while increasing milk production. We were able to obtain information regarding their development, barriers within their research, and current research projects. Other topics that were discussed included: dairy product efficiency, opportunities in the bioenergy field, and the influences the dairy industry on climate change. A list of questions can be seen in Appendix F.

We visited three dairy farms to learn about the farmers' current energy consumption, concerns about their current energy usage, energy goals, and gaps in their knowledge on the topic of sustainable energy. The first farm we visited was Wightman's Organic Dairy Farm, operated by Scott and Suzanne Wightman. They do not use any pesticides, herbicides, or insecticides, and instead focus on maintaining a high soil quality. The second farm we visited was Hutchinson's Dairy Farm. The farm is owned by Les Hutchinson and is family operated. Lastly, our team visited the Dumbalk Dairy Farm, a small-scale milking operation owned by Steven Dumbalk. We created a list of questions that we asked during our visits to these dairy farms, which can be seen in Appendix G.

Our team visited three horticulture farms to learn about the horticulturists' current energy use, concerns about their energy use, future energy objectives, and information needs on sustainable energy. We held a discussion with Michael Durkin at Durkin Produce. Durkin Produce is a large scale potato farm that supplies most of its sales to Woolworths supermarkets. We also spoke with Emma Germano, who is taking over her parents' farm. Germano's Mixed Horticulture Farm grows mostly cabbage and cauliflower. We held an interview with Tony Cummaudo at Cummaudo's Potato Farm. Cummaudo's farm mass produces potatoes to supply Coles supermarket in Australia. Our team developed a list of questions that we asked during our trips to these horticulture farms; our questions can be found in Appendix H.

Our team visited three small-scale sustainable operations in Mirboo North and district. From these trips we learned about the various sustainable energy actions that these operations executed. We spoke with Carol Rowley at her Rose and Fuchsia Farm. Rowley expressed her concerns on climate change and incorporated several sustainability practices into her farm and property. Graeme Wilson's residence was another small-scale, energy efficient operation we visited. Wilson is a member of the MNCEH and travelled along with us during some of our various visits. We also visited Ivor Auty's property and viewed an operating hydropower system

that had been recently installed. The questions we asked during our conversations can be seen in Appendix I.

Whilst in the Mirboo North community, we had to be mindful of sensitive topics. These included: issues on planning and zoning laws, restrictions on wind power, climate change, and the currently controversial practice of fracking. It was important that we approached these issues with caution so we did not offend those we interviewed.

3.5. Developed a Prototype Website for the MNCEH

After our stay in Mirboo North, we combined our findings to determine common sustainability goals among the dairy farming and agroforestry sectors. We worked closely with SRI and members of the MNCEH committee to determine the most beneficial content on energy efficient practices and renewable technologies for the website. Our team developed a prototype website that presented relevant information from our research and various discussions. Sections on the website included: information on the electricity supply network, energy efficiency tips, renewable energy technologies, and energy storage systems. During our second trip to Mirboo North and district for their Spring and Summer Energy Expo on November 30, 2013, we showed the prototype website to two members of the MNCEH committee to receive their feedback. We developed a short survey, shown in Appendix J, and asked these two members to complete it after browsing through the website. Some of the topics on the survey included: ease of navigation, relevance of content, layout and design, and information gained from viewing the site. Once the website was shown to the MNCEH members, they gave their approval for it to be sent out via email to additional committee representatives as well as members of Mirboo North and district who showed interest in the MNCEH. Along with the link to the website, we attached a link to an online version of the survey that was created on SurveyMonkey, a survey software tool. We also sent this online survey to WPI students to gain feedback about the layout and design of the prototype.

After receiving feedback from the survey, we analyzed the responses to determine what aspects of the prototype website needed to be revised for the final product. Aspects that could be quickly updated were incorporated into the prototype website. The remaining themes from the responses were integrated into recommendations for the future MNCEH website.

4. Findings

Through our research, surveys, interviews, and discussions we have learned successful community engagement strategies and information needs that we recommend are addressed in Mirboo North and district. We have gained insight into the most effective engagement strategies from our experiences with community energy organizations. Through these discussions, we were also able to develop a stronger understanding of what layouts and features comprise an engaging and informative website. Visits with individuals in Mirboo North and district provided us with insights about the needs and expectations of the community so that we could better shape the website to meet those needs. This allowed us to gain a better understanding of what information could be put onto the prototype website to specifically relate to the Mirboo North and district residents. This chapter presents the information we obtained from our various methods.

4.1. Community Energy Projects

We learned about various engagement strategies by talking with different staff members and representatives of community energy projects within Victoria. From our conversations, we identified several elements that helped ensure successful community engagement: establish a trusted relationship with community members; use multiple communication strategies; and carefully manage community expectations from the beginning. Since the development of a community website became one of the key objectives of our project, one of the primary lessons we learned was the necessity to keep the website dynamic and relevant to the specific needs of the community.

4.1.1. Establish a Trusted Relationship with Community Members

Trust is a concept that can act as a motivator for social resilience. Generally, trust is based on shared understandings that can take a variety of different forms. According to a study done by Paul Bellaby, a social research professor at the University of Salford in the United Kingdom, trust has different meanings with respect to authority, economic relations, and personal relations. He stated an authoritative community voice must establish itself as a reliable and trustworthy information source. Economic relations focus on ‘credit’ that enable transactions to occur. Personal relations build confidence that the energy projects will perform beneficial services to the community. Bellaby also stated that people relate three attributes to trust:

benevolence, honesty, and competence. Trust can be fragile and needs to be treated delicately by those attempting to establish it. Once this trust is made, the acting party must be equally careful to sustain this trust (Bellaby, 2010).

It is understandable that community members might be dubious about an energy organization's purpose in promoting an energy hub. Demonstrating that a project's sole purpose is to help the community without ulterior motives, such as commercial gain, can influence whether people support the project. We were told by several interviewees that not-for-profit organizations are generally perceived well by communities because these project groups tend to be motivated by their project work rather than financial gain.

Residents relate better to projects that have a strong organizational presence in the community. One of our interviewees lamented that his community energy project lacked a local presence. Due to this, trust was difficult to establish and community participation fell short of expectations. Other projects that were operated from a local office were able to gain trust with less resistance. One community workshop facilitator noted that establishing close relations with well-known community leaders could help create trust with the rest of the community. By having a local presence in the community, individuals and organizations could quickly spread information throughout the community via word of mouth.

Several interviewees suggested using a testimonials page from members of the community to make the website more relevant, engaging, and interactive. The interviewees believed it was important for the community to observe what other people's experiences have been with the project. They said that people were more likely to get involved with a project if someone they trust had a positive experience with community organizations. Updating and posting testimonials by trusted members of the community illustrates the relevance of the project to the community and signals that the organizations and people involved can be trusted by others in the community.

Transparency in communication can also help to build trust. Personal interactions with community members allow for people to discuss their goals on energy consumption and efficiency, express their concerns, and ask questions. If the MNCEH is open about potential hardships and failures, a sense of security will prevail in the community. This will show that the organization is honest about their activities and is seeking to benefit the community. By expressing an interest in what the people have to say, a mutual sense of understanding can be

attained. To be successful, the MNCEH must demonstrate that it is responsive to community opinions. In addition, when new technologies arise, the benefits are greatly heralded by the people who advertise them. However, the disadvantages of the technologies are generally overlooked (Rayner, 2010). Thus, communicating the benefits and risks from new technologies is helpful for those who are trying to establish trust.

From a conversation with a solar PV salesperson, we learned that the quality of PV panels was fundamental to his company's success. After hearing complaints from customers who had negative experiences with lesser quality PV panels from other manufacturers, his company has sold only products that are durable and long lasting. Although his company's panels are more expensive than his competitors' products, people are willing to pay more for longer lasting panels. He believes his customers have been extremely satisfied with his company's products and are more likely to share their positive experiences with others. This solar salesperson believed that many people would rather invest in a company that they can trust than save money by buying a cheaper system from a less reliable company.

4.1.2. Multiple Communication Strategies are Crucial

We found one of the strategic aspects of community engagement to be deciding how to go about increasing participation in different community activities and events. From talking to several people who work with community projects, we found that it was necessary to use multiple communication strategies to broaden the audience reached. Although some means of communication may seem to be more effective than others, it was essential to incorporate multiple methods of communication and to repeat the messages regularly to reach as many community members as possible.

One of the most common communication strategies discussed was word of mouth. People tend to listen to the opinions of those they trust, such as friends, neighbors, and community leaders. Thus, it can be useful to start a chain of verbal interactions within a community. This is especially true in small towns where face to face interactions account for a large share of communication.

A community website was also an important means of communication that we discussed. A website allows information to be broadcasted to and available for all who have access to the internet. Two organizations that strongly emphasized this point were Going Solar and MEFL.

They said their website plays a key role in communicating information to community members and potential clients. It also serves as a reliable source for those reading about certain energy efficient practices and renewable energy technologies. A project leader said that although a website needs to contain detailed information, it should be kept simple as to not discourage the user. Sometimes too much extraneous information can cause people to lose interest in reading about the topic.

Print materials, such as newsletters or newspaper articles, are another method of communicating project goals to the community. These outreach methods are vital for those who do not have access to the internet or who prefer not to use a computer. Newspaper articles and newsletters can also be made available electronically which may enable them to reach a larger audience. The local newspaper is often a major source of information in smaller communities regardless of whether it is in paper or electronic form. This can encourage both word of mouth communication and refer people to community websites and other online sources of information. A member of the LIVE project committee explained how he received several follow-up phone calls after an article about the solar project at South Melbourne Market was released in the local newspaper.

4.1.3. Managing Expectations

One project we investigated had significant initial community interest and support, but the community members were brought into the project at the wrong time. Progress on the project came to a halt as paperwork was filed, and the project organizers waited for responses. People wanted to see results, and they often got frustrated and lost interest when there was a lack of progress. This project suffered these effects as the once supportive and enthusiastic community members became discouraged with waiting and dropped their support. The project leaders we interviewed emphasized that no time or money be spent on community engagement until the project was at a point where the timeline, deliverables, and the scope and purpose of engagement were clear.

Another community energy project we examined had similar difficulties. The community was initially excited and motivated to pursue the project; however, the leaders of the project were ill-experienced and, consequently, scheduling suffered. The group did not have the necessary resources at the appropriate times to allow the project to continue along its intended path. This

caused the number of followers to dwindle, and the project fell short of its goals. This highlighted the importance of proper management of expectations on community projects, especially in regards to when the project reached out for community support and involvement in the project.

4.1.4. Keep the Website Dynamic and Relevant

A recurrent theme throughout our interviews was that websites that are interactive and updated frequently are more likely to be effective. A few interviewees had static websites for their community energy projects or organizations and did not receive much communal feedback. They believed that static websites are less effective because they do not encourage people to return to the site to find new information.

One option to make websites more interactive is to include a forum where people could post their ideas, concerns, or questions and have others respond. This feature also allows those running the website to write posts that are designed to stimulate discussion amongst community members. A news and events section could help keep the community involved with what is occurring locally.

Additionally, there are several aspects of a website that require frequent updating so that information does not become obsolete. Legislation and policies regarding renewable technologies, and the rebates that could be received, periodically change. If this information is not updated, people could be misinformed and deem the site unreliable. This also applies to content on the website regarding information on energy efficiency, renewable technologies, and installers within the area. Technologies and techniques relating to sustainable practices are constantly improving. With an increased number of people switching to renewable technologies, there will be a greater demand for information about installers and providers.

4.2. Mirboo North Interviews

Our visit to Mirboo North gave us insight into the needs of the community and how they could overcome the barriers hindering the implementation of the MNCEH, particularly in the dairy and agroforestry sectors. From talking with various dairy farmers and horticulturists, we were able to identify some of the issues that many of them were facing when implementing energy efficient practices and installing renewable energy technologies. The four main barriers

that were common among several groups were: misinformation, upfront costs of renewable energy and storage systems, concerns about the local electricity distributor, SP AusNet, and technology quality.

4.2.1. Misinformation

Gaps in knowledge and misinformation on energy topics appear to be common barriers preventing the implementation of renewable energy technologies on farms in Mirboo North and district. Farmers are not likely to invest in these technologies if they do not understand if it would be feasible or financially practical to implement them into their operation. Due to the complexities of the topics, it is unlikely that the farmers would search extensively for the information themselves. Often a large part of the issue is that farmers lack time or interest in researching energy options. Due to this, it is critical to present this information in a concise and straightforward manner.

One conversation we had with the owner of a small scale dairy farm, illustrated this problem. We learned that he was extremely interested in ways to reduce his energy bills, but before he invested in renewable technologies, he wanted to gain a better understanding of how they would benefit him specifically. However, he did not use many resources to learn more about energy options. He seldom used the internet; although, his wife would use it fairly often at home. In addition, he did not communicate with other farmers to learn about updates that they have made to their farms.

Two of the potato farms that we visited produced large amounts of waste from their farms. Both produced enough waste material to make implementing a biodigester or other waste-to-energy technology on their property viable. One potato farmer was unaware the waste product could be converted into usable electricity. The other potato farmer had considered processing his waste to obtain electricity, but had not received new information on these technologies since an energy assessment he had five years ago. Thus, a lack of information and misinformation serve as barriers to the adoption of new, alternative energy technologies.

In contrast, one organic dairy farm in the community is progressing with a variety of techniques and technologies to promote environmental sustainability. An example of sustainability on the farm is the use of an effluent pond to break down animal wastes before using the water for irrigation. The owners of the farm have been reaching out to other farmers in

the community because they have noticed educational gaps regarding sustainable practices. Accordingly, he recommends that farmers research energy efficiency basics before talking with him so that they have a more productive visit. Due to these informational needs of the community, the MNCEH could serve a key role in providing farmers, and other residents, with reliable and trusted information on current technologies and energy options.

4.2.2. Upfront Costs of Renewable Energy and Storage Systems

From talking with various farmers and horticulturists, we found that many of them were hesitant to install renewable energy technologies and storage systems because they believed that the upfront costs were too high. They believed that with such high initial investment costs, the payback period would take too long. One of the potato farmers had assessed the opportunity for implementing a biodigester using the waste produced from the farm. However, the consultant he hired calculated that the payback period was too long to be beneficial for the business. With the prices on implementing a biodigester falling recently, the idea had resurfaced.

We also talked with a small scale dairy farm that had concerns about implementing new technologies. Due to the upfront costs, investing in a renewable technology would create a financial burden. The farmer mentioned that it was a struggle to update the equipment to keep the farm operating, so investing a large sum of money into renewable technologies may not be an option. Also, this particular farmer was not planning on passing the farm down to future generations, so he was more interested in low cost options for becoming more energy efficient.

4.2.3. Concerns Regarding SP AusNet

Through our conversations with members of Mirboo North and district, we discovered that several people had various complaints about the electricity distributor, SP AusNet. Many people were upset with the restrictions that SP AusNet placed on the total energy output from an individual solar panel system. Multiple residents of Mirboo North and district with whom we spoke said that residential buildings are restricted by SP AusNet to 4.5 kW systems without additional approval. A solar panel installer with whom we spoke dealt with this issue often. They complained that the restrictions put on by SP AusNet discouraged people from installing solar panels. Many people needed larger systems that required approval from SP AusNet. A smaller system was not as effective in addressing a person's energy need, so they were less likely to

install the solar panels. This posed a problem for several of the farmers as the system size was too small to be financially feasible. Many residents claimed that the current feed in tariff rate of eight cents per kWh was controlled by SP AusNet. However, this was incorrect because the Victorian government sets this rate. Such power capacity limitations and low feed in tariff rates may be preventing farmers from adopting renewable energy technologies.

Another common concern amongst the farmers was the new smart meters. One farmer was upset with the new smart meter that SP AusNet had recently installed and wanted his old electricity meter back. He was confused about how the new meter helped him, as well as how to properly read the meter. He wanted to return to the old meter because he knew how it worked.

During our conversations, it became evident that the community thought SP AusNet was in charge of the buyback rates for excess electricity generation. A couple people we spoke with were discouraged from buying solar panels because of the low rates that were offered. Several individuals indicated that they were outraged by the rates SP AusNet was charging. This was another misconception, as these rates are determined by the energy retailers not the distributor, SP AusNet.

4.2.4. Technology Quality

The quality of alternative energy technologies was a common theme in several of our discussions with local farmers. People will be hesitant to invest in renewable technologies if they have had troubles with similar technologies in the past, or if they do not fully trust the new techniques and technologies over their current methods. This is of particular concern in a rural area where interpersonal connections are strong and word of mouth communication is dominant. Most people get their product recommendations from family, friends, and neighbors, so a single person's poor experience can have a negative influence on a large portion of a community.

One farmer with whom we spoke had a poor experience with his first venture into the renewable energy market over a decade ago. At that time, solar panels were still an evolving technology. The farmer's past negative experience of owning solar panels made him wary of investing in new solar technologies. The panels that he previously installed stopped working completely after only three years, and the original installer told the farmer that there was nothing that could be done to fix the panels. The panels were assessed several times by other installers and each concluded that the system needed to be replaced. This experience discouraged the

farmer from implementing further renewable technologies and underlines the importance of providing the community with trusted sources of information and business.

Talking with one of the potato farmers, we discovered that they were interested in the idea of producing biofuels from planting canola seeds and extracting the oil from these seeds to produce biodiesel. However, he was skeptical of the quality of the fuel that could be produced. Having purchased new trucks recently, the farmer was cautious about the type of diesel he could use and worried that the quality of the biofuel produced from the potato waste might harm the engine of the new truck.

4.3. Creating an Effective Website

In order to create a website that effectively meets the needs of the community, we first reviewed the websites of similar types of organizations in Australia. These organizations specialize in community projects, energy technologies, and environmentally friendly pursuits. They have experience with community engagement strategies and in determining what features and layouts are effective in sparking and maintaining peoples' interest. We learned from the expertise of these groups to identify key features and attributes that we might emulate on the MNCEH website. Once we established a prototype website based on this information, we surveyed the MNCEH, residents of Mirboo North and district, and WPI students to gain feedback on the design, functionality, usability, and content of the website. Addressing the comments from users' personal experiences with the website plays a major role in effective website design.

4.3.1. Website Matrix

When our group arrived in Australia, we viewed numerous websites on different community energy projects as well as those for energy efficient practices and renewable energy technologies. The matrix in Appendix K summarizes the nature and purpose of each organization and their community engagement activities.

From visiting the websites of different companies and organizations, we saw a variety of different layouts and designs. This helped us to gather ideas for what could be visually appealing when we created the prototype website for the MNCEH. Another key piece of information we took from each website was the last time it was updated. This gave a sense of how well the site

was maintained. Most of the websites we viewed had been recently updated with information about current events and projects, which underlines the idea that new information has to be added to the website to maintain its effectiveness.

A particular website that we found appealing was MEFL's. Their webpage was easy to navigate, and provided extensive, high quality information on sustainability while not overwhelming the reader. The sustainability advice was divided into different areas, which allowed the viewer to select specific information easily. The website also included how-to videos on energy efficiency to make education more interactive. Other aspects we found helpful were the testimonials and case studies included on the website. The MNCEH can use some of the strategies displayed by MEFL as they develop their website.

4.3.2. Prototype Website

We started our website design with a streamlined and easily navigable layout. Organizations with whom we spoke made it clear that a website must be straightforward and easy to use for visitors. To accomplish this, we developed a header that contains the organization name and partnering organizations. This section also includes the primary menu bar which provides easy navigation to each section of the website. The tabs on the menu are displayed in a sequential order to provide users with a sense of direction as they navigate the website. Sections of the website that contain larger amounts of material also include drop-down menus from this primary menu bar so users can navigate its subsections. The pages within these subsections include previous and next page buttons at the bottom of the respective pages so users can quickly switch between comparable pages. The footer bar includes an organization copyright and direct links to the organizations interactive social media. These links bring users to the website forum and MNCEH's Facebook page. This was included to increase traffic and involvement on the organization's Facebook page.

The first tab on the menu bar in the "Home" page of the website was designed to provide a concise overview of the website. There is a scrolling picture gallery to illustrate the Mirboo North and district landscape and the importance of community. We included a short blurb about the MNCEH to provide visitors with a brief and upfront description of what the MNCEH is and what they set out to accomplish. A screenshot of this is shown below in Figure 23. Below this is a short contact information section to provide visitors with the primary means of contacting the

energy hub. The next three upcoming events and most recent news stories are also displayed here so users do not need to navigate through the website to find timely information.

Figure 23 - MNCEH Homepage (Burns, Collins, Johnston, & Nichols, 2013)

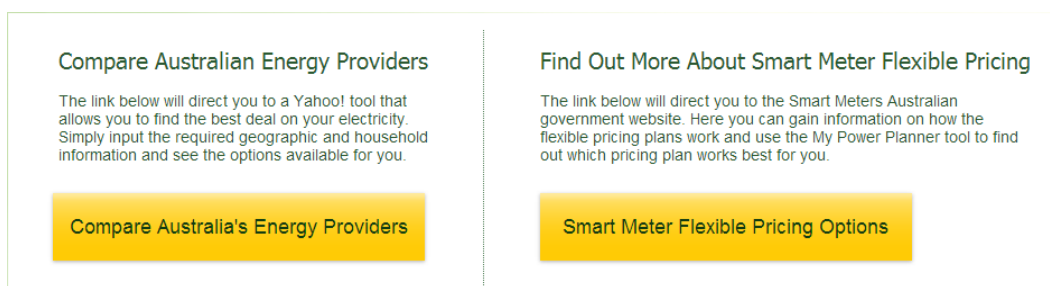


The next tab on the menu bar brings users to the “About Us” page. This section provides general information on who the MNCEH is, what they do, and why they do it. Below this, there are smaller sections on the organization’s philosophy and history. The information presented on this page is designed to give users a description of the MNCEH, build a relationship with users, and attempt to establish the transparency that a trusted source would possess.

“Energy Information” is the next main section of the website. This page provides a more detailed roadmap of how we suggest that the user navigate through the website. The roadmap was established with the mindset of learning basic energy concepts before progressing on to more complex topics. The order of these items was established so users could first build up knowledge on the electricity distribution network; then they could gain information on energy efficient practices that they could implement into their daily lives; next they could find information on renewable energy technologies that they could potentially install; users would end this energy roadmap at energy storage options to learn about methods to enable energy supply to match demand.

The first subsection of “Energy Information” is the “Electricity Supply Network” page. This page is designed to break down the electricity supply network into understandable working parts that make up the whole. At the bottom of the page, links are provided that redirect users to two different tools. This is shown below in Figure 24. The first allows users to enter their energy profile and then displays the price options from various retailers within the area. The second allows users to gain more information on smart meters and determine which flexible pricing plan is right for them.

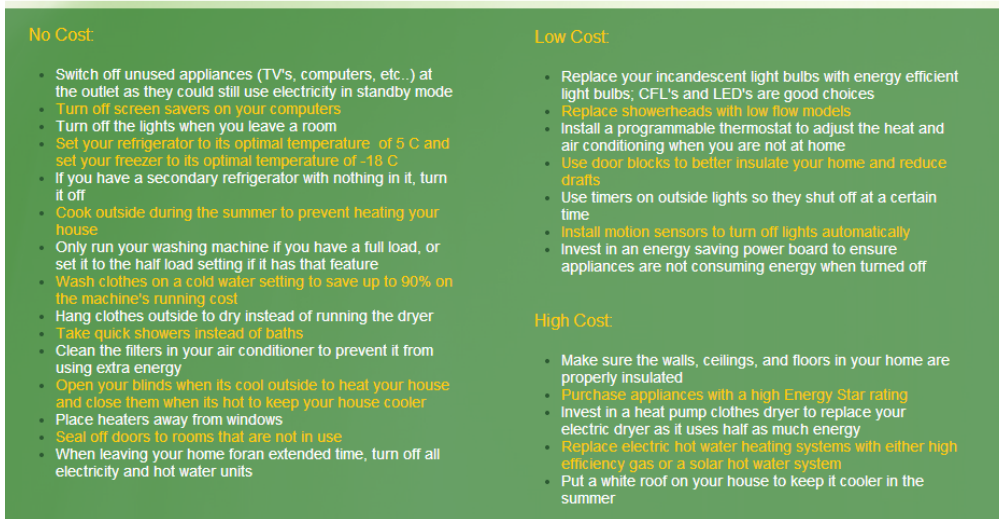
Figure 24 - Links on Energy Efficiency Page (Burns et al., 2013)



The second subsection of “Energy Information” is the “Energy Efficiency” page. The first item on this page is a quiz that allows users to test their knowledge on their energy usage and efficiency. This was included to make the learning experience more interactive and engaging to keep users entertained while they gained valuable knowledge. Below the quiz application is a list of energy efficient practices that are broken into three categories. They are divided into no cost, low cost, and high cost sections so users can more effectively find practices they can incorporate into their life. A screenshot of this is shown in Figure 25. Also included are tables that lay out the costs of different updates and their return on investment.

Figure 25 - Energy Efficiency Tips (Burns et al., 2013)

Energy Efficiency Tips

A green rectangular graphic with white text. It is divided into three sections: 'No Cost', 'Low Cost', and 'High Cost'. Each section contains a bulleted list of energy-saving tips.

No Cost:

- Switch off unused appliances (TV's, computers, etc..) at the outlet as they could still use electricity in standby mode
- Turn off screen savers on your computers
- Turn off the lights when you leave a room
- Set your refrigerator to its optimal temperature of 5 C and set your freezer to its optimal temperature of -18 C
- If you have a secondary refrigerator with nothing in it, turn it off
- Cook outside during the summer to prevent heating your house
- Only run your washing machine if you have a full load, or set it to the half load setting if it has that feature
- Wash clothes on a cold water setting to save up to 90% on the machine's running cost
- Hang clothes outside to dry instead of running the dryer
- Take quick showers instead of baths
- Clean the filters in your air conditioner to prevent it from using extra energy
- Open your blinds when its cool outside to heat your house and close them when its hot to keep your house cooler
- Place heaters away from windows
- Seal off doors to rooms that are not in use
- When leaving your home for an extended time, turn off all electricity and hot water units

Low Cost:

- Replace your incandescent light bulbs with energy efficient light bulbs; CFL's and LED's are good choices
- Replace showerheads with low flow models
- Install a programmable thermostat to adjust the heat and air conditioning when you are not at home
- Use door blocks to better insulate your home and reduce drafts
- Use timers on outside lights so they shut off at a certain time
- Install motion sensors to turn off lights automatically
- Invest in an energy saving power board to ensure appliances are not consuming energy when turned off

High Cost:

- Make sure the walls, ceilings, and floors in your home are properly insulated
- Purchase appliances with a high Energy Star rating
- Invest in a heat pump clothes dryer to replace your electric dryer as it uses half as much energy
- Replace electric hot water heating systems with either high efficiency gas or a solar hot water system
- Put a white roof on your house to keep it cooler in the summer

The next section of the menu is the “Renewable Technologies” page. This provides a general description of what renewable energy technologies are and provides a menu for users to directly navigate to a specific renewable energy technology page. There is also a photo gallery of the described technologies that give users a visual of each technology in use. The subpages of this section each include information on a specific renewable energy technology. Each subpage describes what the renewable energy source is and how the technologies that use that source work. The primary advantages and disadvantages to each technology are laid out in a bulleted list to allow users to gain key information. Each technology subpage also includes diagrams that illustrate the infrastructure of the technology and how it can be incorporated into users’ home.

The next section, “Storage Systems,” is laid out in a similar fashion to the previous section. The first page provides a description of energy storage systems and the need for them. There is also a menu to allow users to directly navigate to specific types of storage systems. The subpages of this section each describe a category of energy storage systems. They include a brief description of the storage type and then describe relevant examples of that storage type. There is also a list of the advantages and disadvantages of each described example to allow users to compare storage options. Pictures are included of the specified examples to give users a visual of the items that are being described.

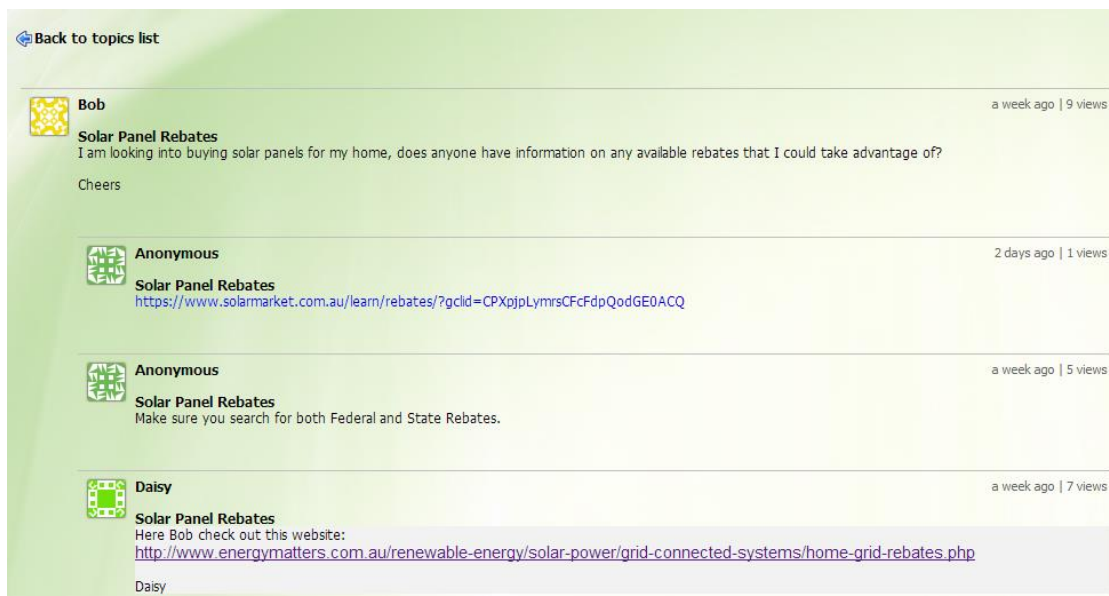
The “Community Innovators” page follows the end of the energy roadmap. This section was designed to take the general information provided in the previous sections and give users local examples of the described practices and technologies in use. This gives users a tangible

goal of what they can achieve based on the success of their peers. It is meant to encourage users and provide them with confidence as they follow the provided energy roadmap.

The “News and Events” page expands on the information presented on the “Home” page. Here, users can find detailed descriptions of past events in which the MNCEH was involved and a full list of upcoming events. This is designed to increase community involvement in MNCEH activities by making information on future events easily accessed by the community.

The next page on the primary menu bar brings users to the “Forum” page. This allows users to view posts that the MNCEH has made on the forum. Users can also comment on these posts to interact with members of the MNCEH. Users can also make their own posts to ask questions, share information, or start community discussions. An example of a post is shown in Figure 26. We included the forum feature to make the website more dynamic. Information and posts on the forum will be constantly updated by the MNCEH and community members so there will always be new information available to users when they visits the website. This also gives users the opportunity to ask that may not have been answered in the website. The forum takes the trusted word of mouth interactions of the small community and makes them readily available online.

Figure 26 - Forum Thread (Burns et al., 2013)



The final page in the primary menu bar is the “Contact Us” page. This page provides a more detailed contact list for users wishing to contact specific members of the MNCEH. There is

also an accompanying section that displays a Google map of the location of the MNCEH and general driving directions on how one could get there. The bottom of the page features a direct email form for users to seek additional information and get involved with the MNCEH. This feature allows users to email the MNCEH without having to leave the website.

All the above features on the prototype website were included due to feedback we received from community energy projects or organizations that have had experience dealing with a website. These were our initial recommendations to what could be included on the website and a suggestion of how the information be presented. We then gained feedback from the MNCEH, farmers in Mirboo North and district, and WPI students on how to further improve the website. These secondary recommendations we made to the MNCEH are discussed in the following section. We received 30 online survey responses and conducted three in-depth face to face discussions about the prototype website.

A PDF of the prototype website containing a sitemap tree diagram and screenshots of each of the pages is attached as a supplementary document.

4.3.2.1. Website Feedback

We met with two members of the MNCEH committee at the Mirboo North and district Spring and Summer Energy Expo, on November 30, 2013, that gave our group an indication about their initial reactions to the website. The purpose of the expo was to promote sustainable practices to the members of the Mirboo North and district community. Both committee members believed our prototype website was an excellent starting point, and had several ideas for improvements. Revisions that were made in response to their feedback included: navigation buttons, a search bar and index, making the website smart phone optimized, and adding another quiz for a younger age group.

We added navigation buttons on the bottom of the page to provide a direct link to previous and following pages within subsections of the website. This makes navigation of related topics on the website easier for viewers. This update can be seen in Figure 27.

Figure 27 - Navigation Buttons (Burns et al., 2013)

Advantages:

- free or reduced price electricity
- zero-emission
- built in storage system
- easy integration into farm irrigation systems

Disadvantages:

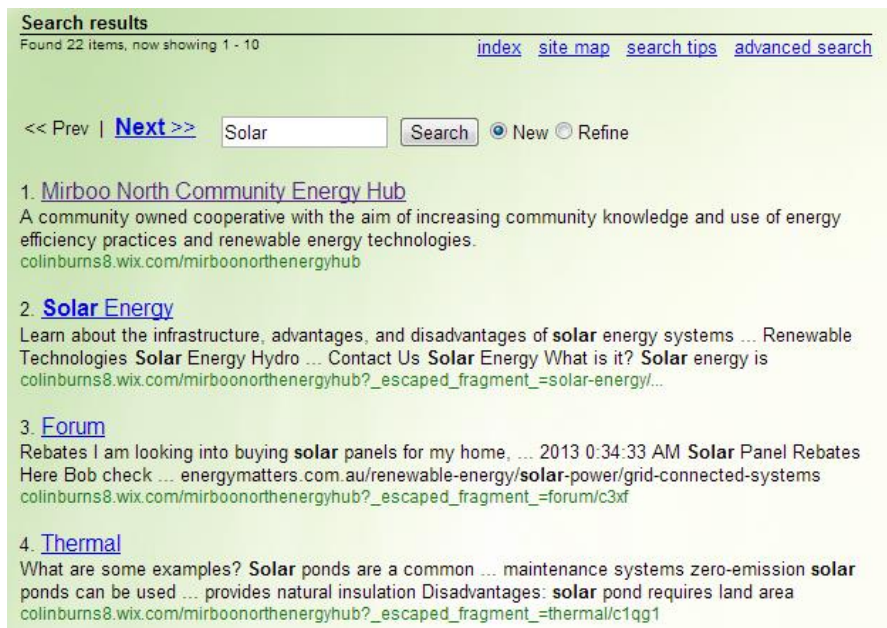
- requires nearby water supply
- need external power source to run pump

Previous - Solar

Next - Bio

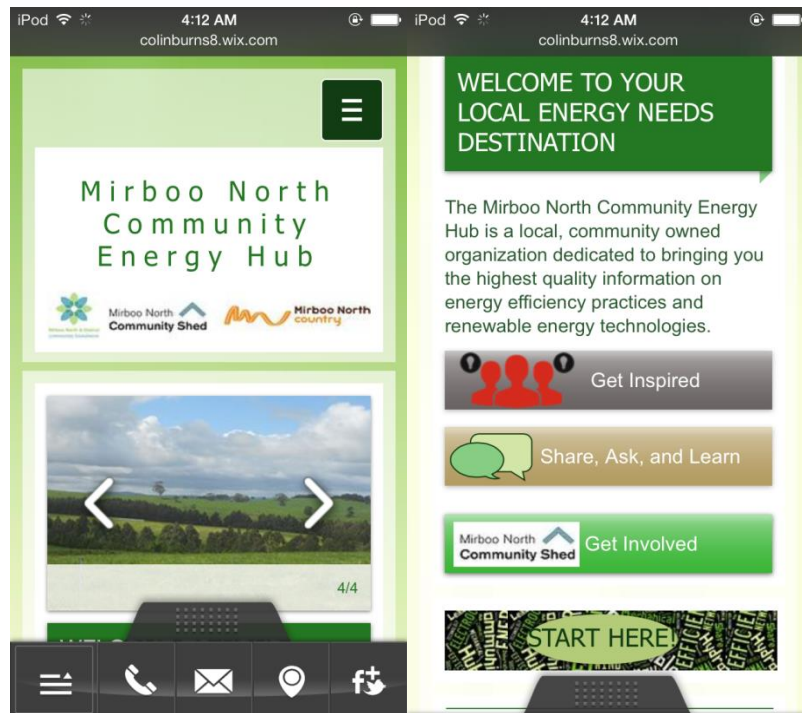
An internal search engine was embedded into the site. A button is present on the footer of each page to link the viewer to the search page, which can be seen in Figure 28. Also included on this page is an index and sitemap of the website. These additions allow users to navigate and search for specific topics they are looking for.

Figure 28 - Internal Search Engine (Burns et al., 2013)



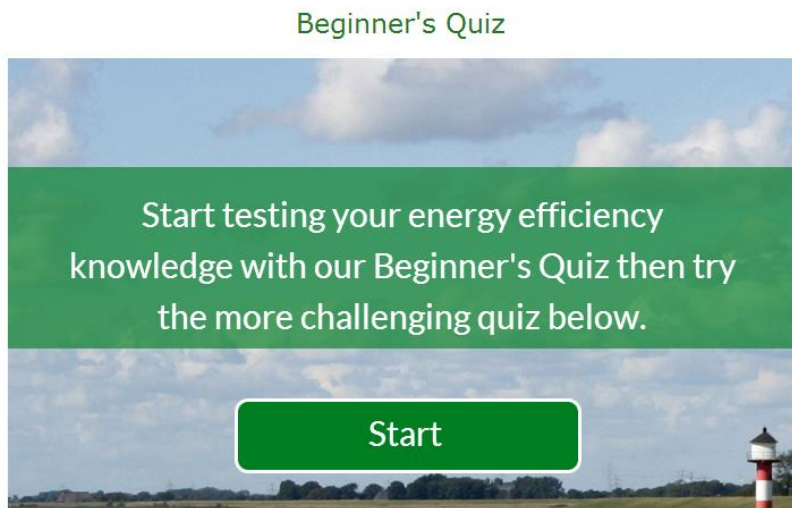
The website was smart phone optimized, allowing for a user friendly layout when viewed on a mobile device. The smart phone version of the website homepage is shown in Figure 29.

Figure 29 - Smart Phone Optimization (Burns et al., 2013)



In addition, we added another quiz that was geared towards a younger audience. The MNCEH committee felt there should be an aspect of the website that engaged the youth of the community. Parents will be more likely to research sustainable practices if their children are bringing up the topic. A screenshot of the quiz is shown in Figure 30.

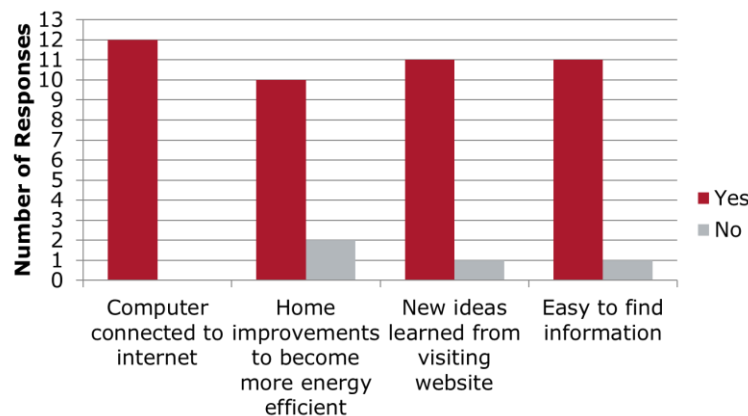
Figure 30 - Beginner's Quiz (Burns et al., 2013)



The committee members and community energy project leaders differed on whether to include links to other sites. The committee members felt that our prototype lacked links to other sites. This idea contradicted what was said in the community energy interviews, as they believed that providing links to other pages would direct users away from the site with the uncertainty that users would return.

From the online survey questions about the prototype website we were able to highlight some of the key responses as shown below in Figure 31. The responses from the online survey were filtered so that Figure 31 only displays those from Mirboo North and district.

Figure 31 - Online Survey Results (Adapted from SurveyMonkey, 2013)



The survey showed that all of the respondents had a computer with internet access. Although we were only able to get a limited number of responses from the survey, participants indicated that a website could be a useful means of communicating information. The next question we asked was if they had made improvements to their home to become more energy efficient. The feedback showed that the majority have already taken actions to become sustainable. Many of the improvements that they had implemented would be categorized as no to low cost. It seemed as though many were receptive to adopting sustainable practices, but had not proceeded with implementing higher cost solutions. When asked if they had learned new information from viewing the website, all but one answered yes. This suggests that the website was effective in communicating information about sustainability practices to members of the Mirboo North and district community. The survey also showed that the respondents found it easy to find information on the site. Along with this, many additional comments were made supporting the design and layout of the website.

5. Conclusions and Recommendations

Analysis of our findings enabled us to develop a series of conclusions and recommendations for the MNCEH. The feedback we obtained from discussions with various people and organizations in Australia, along with the information from our preliminary research, was synthesized into more prominent, succinct themes. This chapter combines all the information we have obtained from our study and provides a list of community engagement and website suggestions for the MNCEH to assist them in the next steps of their project.

Conclusion 1: Community energy projects increase awareness about energy consumption, greenhouse gas emissions, and climate change.

Climate change is a prominent issue in today's society so it is imperative for preventative actions to be taken immediately. If people are more aware of their energy consumption and its effect on climate change, they could be more likely to reduce their carbon footprint. According to Embark, individual action alone is not enough to tackle the issue of climate change. The World Energy Council believes that communities can play a large role in sustainable energy programs because cooperative efforts provide incentives to those who share the same goal of obtaining green energy. From a project study executed by Harvey Michaels, a leader in the MIT Energy Efficiency Strategy Project, it was determined that a community energy hub could help develop the focus and plan of a sustainable energy project; due to its familiarity with the culture and concerns of the community, the hub would be able to better meet the needs of its residents (Michaels, 2011).

Recommendation 1.1: Use the MNCEH to inspire rural communities to establish similar organizations.

Promoting the success of local energy projects can help encourage other communities to take similar actions. People are more likely to adopt new practices after seeing the achievements of other community projects. This can increase the confidence of community members towards implementing sustainable practices.

Conclusion 2: Establishing a trusted relationship with community members helps to promote involvement.

Development of trust between a community and those in charge of community energy projects results in a higher level of engagement. Once trust has been established between the community and leaders of a project, people will be more likely to get involved by adopting the

practices being promoted. Paul Bellaby agrees in his statement that an authoritative community voice must establish itself as a reliable and trustworthy information source (Bellaby, 2010). Trust can be established several ways, which include: presenting the project's purpose of helping the community, maintaining a local presence, communicating objectives with transparency, and striving for high quality services.

Recommendation 2.1: We suggest that the MNCEH establishes itself as a trusted source of information.

People are less likely to be influenced by information they receive from a source that they do not fully trust. The MNCEH must show the community that they are only looking to assist the community with their energy issues. Any form of communication must be transparent so people believe that information is not being withheld from them.

The MNCEH needs to provide unbiased information about renewable technologies, energy efficient practices, installers and rebates. It is important that they do not promote one technology over another nor provide recommendations to a specific installer. This must be done to ensure that the MNCEH is not held liable for an individual's poor experience with a technology or installer. Options allow people to figure out what they believe is best suited for them.

Recommendation 2.2: Incorporate democratic voting systems in the MNCEH to allow people to voice their opinions on community energy decisions.

Democratic voting systems in the MNCEH can create trust by allowing participating members of a project to express their opinions on community energy installments. A majority of the projects that we reviewed outside of Australia had a democratic voting system installed to concentrate their actions towards the people's needs and goals. Another benefit from a democratic voting system within the MNCEH is an incentive for the residents to stay updated on current events. Since each community member would have a vote on decisions being made by the MNCEH, they would be more inclined to stay educated on relevant energy issues.

Conclusion 3: The expectations and timeline of the project must be properly managed to reap the most benefit from community engagement.

Leaders from community projects with whom we spoke suggested that community engagement strategies must be integrated carefully into the project timeline to avoid community disappointment and frustration. If community engagement is not carefully orchestrated in the

overall timeline and management of a project, it can lead to wasted time and resources, or even derail a project entirely. For instance, the C500 project was unable to capitalize on initial community excitement because they failed to have certain aspects, such as their website, in place at the beginning stages of the project.

Recommendation 3.1: We suggest that the MNCEH develop a realistic timeline for when specific goals will be reached.

The MNCEH needs to manage community expectations by creating a reasonable delivery timetable of their goals. If goals are set unrealistically, the community could become frustrated with the lack of development of the project and lose interest.

Recommendation 3.2: We advise that the MNCEH account for any possible delays from approval processes.

When creating the timeline for the project, the MNCEH must account for processes that need preapproval before further action can be taken. This could include government regulations or local zoning restrictions. Sometimes these processes can take an extended period of time to obtain approval, so allotting enough time for this is crucial.

Conclusion 4: The community needs a reliable information source on renewable technologies and energy efficient practices.

One of the main reasons for gaps in knowledge is the absence of a trustworthy intermediary group between community members and installers. Community members cannot trust companies to give them reliable information because they feel as though they are just trying to conduct business. Also, people do not want to scour multiple sources to find information that specifically relates to their situation. They want to be able to access personally relevant information from a single source.

Recommendation 4.1: We recommend that the MNCEH compiles and distributes relevant information on these technologies and practices.

One method that could be useful in helping community members make investments in energy technologies is to create a decision-making flow chart. This chart would contain occupational and financial information that would assist individuals in selecting the appropriate technology for them. The chart would make the selection process easier for the consumer because it would lessen the amount of background research on their behalf.

Recommendation 4.2: We suggest that MNCEH generate a list of accredited installers within a 100 km radius of Mirboo North.

Providing a list of local installers for each renewable technology would allow the consumer to quickly view all of their nearby options. Generating a list based on distance from Mirboo North instead of personal opinion removes any liability that could be associated with the MNCEH from an individual's poor experience. The MNCEH has to remember that it is ultimately up to the consumer to make the final decision when choosing an installer. Due to this, they must avoid promoting one over the other.

Recommendation 4.3: We recommend that the MNCEH provide information on available funding options and rebates.

Since upfront costs often deter potential customers from making a purchase, we suggest that the MNCEH provide information on current funding options and rebates available to the community. Due to the ever-changing nature of government rebates, this information needs to be constantly updated. In addition, several of the projects outside of Australia that we reviewed in Section 2.1 helped homeowners complete funding applications in order to encourage community action. By educating the community on potential funding options and rebates the MNCEH can encourage more people to purchase sustainable energy technologies.

Conclusion 5: The MNCEH needs to reach out to individuals of all ages and interests to maximize community involvement.

Due to the pressing environmental issues concerning fossil fuel usage, it is critical to ensure that individuals of all ages are properly educated on the need for adopting sustainable practices. Generations differ in how they obtain information, so this must be considered when developing outreach strategies. The MNCEH must also tailor their communication strategies to engage groups who have diverse interests. From speaking with community energy project leaders in Melbourne we noticed similarities to community engagement methods seen in US projects. The Wisconsin Dairyland Cooperative outreached to primary school children to spark an interest in energy conservation.

Recommendation 5.1: We suggest that the MNCEH uses multiple communication strategies to reach a broader audience.

Multiple communication strategies are needed to effectively interact with people. One of the most effective strategies is through word of mouth. People are more likely to get involved if

they hear about successful sustainability practices from family or friends. Due to the small population of Mirboo North and overlap of many community groups, promoting the energy hub through different community events can increase the quantity of participants.

Face to face contact between community members and technology experts was prevalent in successful energy projects outside of Australia. Effective methods to generate interest in a larger audience are hosting workshops or presentations for these projects. During these events, it was important for people to be able to ask questions and obtain feedback. Successful projects outside Australia showed that no or low cost energy assessments are excellent methods for homeowners to learn about the practicalities, technical aspects, and cost analyses of the different technology options. These assessments also provided homeowners with personalized advice on energy choices that they could make. Since many people are curious about installing renewable technologies for their own homes, education through personal face to face contact can be influential on households' energy decisions.

Along with word of mouth, local newspaper articles and advertisements appear to be effective. When an article is written for the newspaper, there usually ends up being an online version of the article as well, so communication would be able to be received by those who use computers frequently.

Recommendation 5.2: We suggest that the MNCEH hold outreach programs for the youth.

Much of the Mirboo North population consists of older generation farmers who are disconnected from modern social media. These individuals can be indirectly targeted by communicating with the community youth in hopes that they will relay this information to their elder kin. Interactive workshops at schools can promote sustainable practices to a younger age group. Educating energy efficiency techniques to young students could increase the likelihood for them to be conscious of these methods when they eventually become home owners.

The Wisconsin Dairyland Cooperative in the United States used outreach programs to children to increase their energy project's outreach. This cooperative presented to primary school children about energy efficiency during Earth Week. These presentations incorporated hands-on demonstrations, which helped make the concept of energy efficiency more tangible to the students. The MNCEH could provide similar interactive educational methods in regional primary schools to implant the idea of energy efficiency at a young age.

Conclusion 6: There has been substantial misinformation about the role SP AusNet plays within the electricity supply network.

One concern that kept surfacing during our interviews with the Mirboo North community was the level of understanding on the energy distribution system. Complaints about SP AusNet were prevalent; it appeared that the community felt the electricity distributor had a large influence on their energy bill. Most people we talked with were unaware that they have options in terms of their electricity retailers, particularly in terms of flexible tariff structures. It is apparent that members of Mirboo North need to be educated on this matter so they can take full advantage of the options that are available to them.

Recommendation 6.1: We recommend that the MNCEH explains how the electricity supply network functions.

Increasing the people's knowledge on the role of SP AusNet, the electricity distributor, is critical towards helping community members lower their electricity bills. Due to misconceptions on SP AusNet, it is necessary for the MNCEH to provide clearer explanations on the different players of the electricity supply network. This could be accomplished by including informational videos or interactive models on the website. Due to the fact that this is a complicated matter, we believe that an interactive visual that both captures how the system functions is crucial. Along with the website, we believe that holding a workshop to educate the community of how this system works could also be helpful. Getting people to think and analyze the system instead of simply telling them how it works will be an effective way to increase knowledge in the subject matter.

Recommendation 6.2: We suggest that the MNCEH make a list of available retailers so that people understand their options.

There are numerous retailers available with different pricing plans to fit an individual's lifestyle. However, many people are unaware of their options. Due to this, we suggest the MNCEH provide the community with an impartial list of retailers.

Conclusion 7: The most effective websites of community energy projects include interactive components.

A theme prevalent throughout our interviews was that interactive websites are the most effective at engaging their visitors. Learning tools that require users to input their responses increase their takeaway knowledge from the website. Encouraging people to think about how a

system works and how the information can be personally applicable increases the likelihood that users will adopt the presented practices. On the Energize Ohio website, viewers could click onto different segments of a strategic planning diagram to learn about each step necessary toward energy sustainability. In addition, this site gave access to webinars, which they published periodically, on sustainable practice.

Recommendation 7.1: We suggest that the MNCEH includes quizzes on their website to provide an interactive learning experience.

We recommend that the MNCEH website contains quizzes that test users' knowledge on energy related topics. The quizzes could provide descriptive feedback and the correct answer after each question. A brief blurb would also pop up that explains why the indicated choice is the correct answer. In addition, we think it would be beneficial to include various difficulty levels of the quiz for different age groups. Having a quiz geared toward younger generations will help to get the youth of the community involved. It is possible, and suggested, to include quizzes or polls on multiple pages to make each section of the website a more interactive learning experience.

Recommendation 7.2: We recommend that the MNCEH include videos and interactive diagrams on their website.

The website should include interactive diagrams and videos on how specific renewable energy technologies and storage systems work. This will help people to better understand the information being presented on these topics. The interactive diagrams can function as a Java applet that allows users to see the results of changing a specific variable of the system. For example, the flow rate, flow volume, or turbine size could be modified for a hydroelectric system to see the effect on the electricity output. The videos can be straightforward discussions presented by the MNCEH members or local farmers to give the website a more personal feel. These videos would simply explain the technology and then describe how it can specifically relate to a general resident or business owner in the Mirboo North area. Interactive media of this nature often provides beneficial educational reinforcement to static text based learning.

Recommendation 7.3: We suggest that the MNCEH implement an energy efficiency rating system within the Mirboo North and district community that will be displayed on the website.

An energy efficiency star rating system could be added to the website to display the progress community members are making in updating their homes and daily routines to become more energy efficient. Their star rating would depend on how many energy efficient practices they are employing and their use of renewable energy technologies. In order to achieve a higher star ranking, they would need to improve their current practices and usage. There could also be a running ticker on the homepage of the website that displays how many households and businesses in the community are at a certain star rating.

Recommendation 7.4: We recommend that a testimonials page be included onto the MNCEH website.

The website could include a testimonials page to allow community members to give feedback on experiences they have had with or through the MNCEH. This will take the trusted word of mouth recommendations that are a crucial part of any engagement strategy and neatly display them online for the future benefit of all community members. This tool will allow the MNCEH to interact with the community in a personal, engaging, and informative manner via their website.

Conclusion 8: In order to maintain website traffic, a website must be regularly updated with new information.

Static websites are ineffective as people will not return if there is not new information available. The MNCEH must continuously update the information on the website to maintain people's interest and draw in new visitors.

Recommendation 8.1: We advise that the MNCEH update information about technologies and rebates regularly.

Technologies are constantly advancing and the information presented on the website should reflect such changes. People may be more willing to invest in a renewable technology or storage system if sufficient advancements have been made to make it feasible for them to own. Governmental policy that regulates the level and eligibility of rebates changes periodically. The details of these rebates could greatly influence whether a renewable technology is financially

viable for an individual considering implementation. Therefore, it is crucial for the MNCEH to provide up to date information on technologies and financing options

Recommendation 8.2: We suggest that a news and events page is included on the MNCEH website.

A news and events page provides community members with a schedule of upcoming events and a review of past energy hub news. This will keep users returning to the website to see what types of events the MNCEH has been involved with and how they can get involved in future events.

Recommendation 8.3: We suggest that the meeting minutes be posted onto the MNCEH website.

The MNCEH could post meeting minutes on the website to keep community members informed with what has been accomplished at the committee meetings. This will also provide individuals with a busy schedule to stay up to date when they cannot attend meetings in person. It is also important for the MNCEH to have a record of its meetings for the purpose of tracking project progression.

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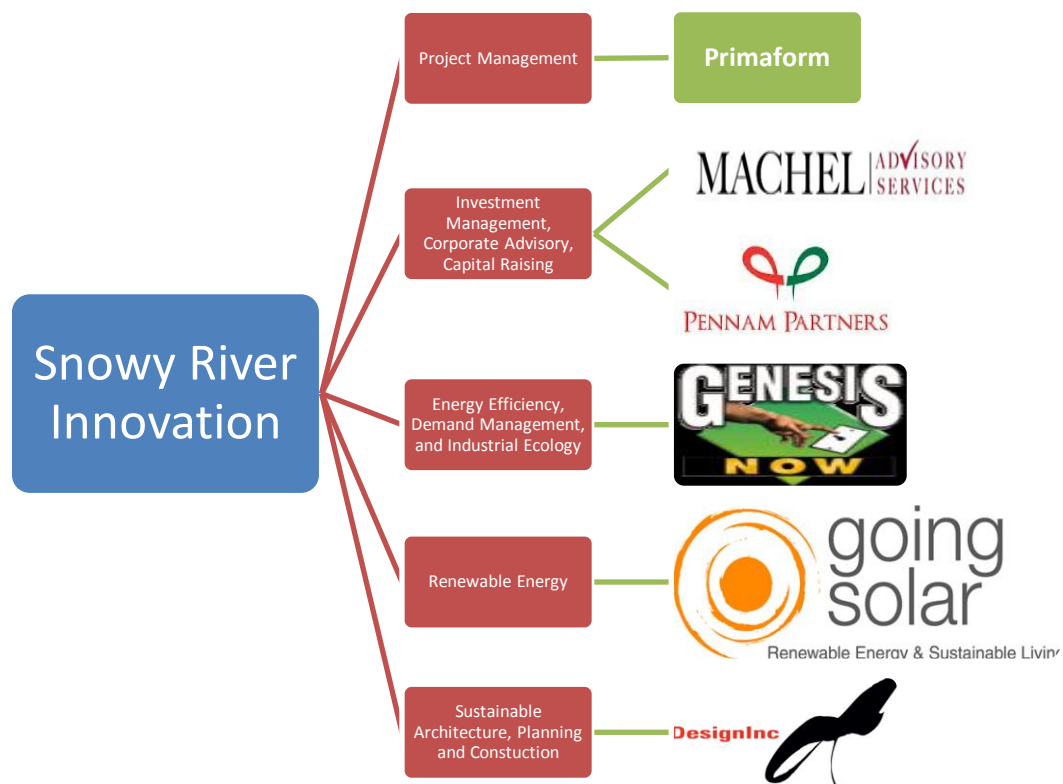
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Appendix A - Sponsor Description

Snowy River Innovation (SRI) is a newly formed private business partnership of five companies brought together under the management of Primaform, shown in Figure A1, to promote innovation in sustainable development focused on energy generation, use, and conservation. Collectively the companies bring over 150 years of experience in a variety of fields necessary to successfully develop and complete sustainability projects, including expertise in project management, funding, analysis, design and construction. Companies within Snowy River Innovation are committed to making energy more sustainable in Australia and throughout the Pacific area.

Figure A1 - Snowy River Innovation Partners and Expertise
(adapted from Snowy River Innovation, 2013)



Primaform provides project and business management services for Snowy River Innovation and business development services to a wide range of clients in Australia and South East Asia. Currently Primaform is focused on commercializing cleaner technologies in association with Snowy River Innovation. Peter Young, the leader of Primaform, is overseeing

and advising the WPI “Team Snowy River Innovation” research cohort for the Mirboo North and district community energy research (Young, 2013).

Machel Advisory Services is an advisory firm that specializes in tax consulting services. It also assists new businesses to establish, sustain and eventually exit the business market. Their tax consulting services consist of income and capital gains tax, tax modeling and forecast, management of funds, and more. Machel’s business consulting services include management of corporate transactions and development of corporate strategies. Machel helps raise capital through connections with various sources and assists with investment tactics by using cost effective solutions (Machel Advisory Services, 2013).

Pennam Partners is an investment house that provides new fund managers with fund formation and fundraising services. In conjunction with other parties, Pennam Partners makes sustainable investments, particularly related with energy efficiency, renewable energy and cleaner technologies. Within Snowy River Innovation, Pennam Partners searches for the venture capital funds that have a history of sustainable investment (Pennam Partners, 2013).

Genesis Now offers energy and materials efficiency insights to Snowy River Innovation. Their primary focus is promoting greater energy efficiency and sustainability in Australian business. They accomplish this by helping organizations to save energy and reduce demand, and seeking new opportunities to promote conservation. Recent sustainability enhancement projects include: improving production efficiency and the quality of the workplace, reducing water and resource consumption, and identifying opportunities to use sustainable products that they can then develop and manufacture. Genesis Now is headed by Geoff Andrews (Genesis Now, 2013).

Going Solar provides renewable energy insights to Snowy River Innovation. *Going Solar* has over 35 years of experience in the market as a leading retailer and wholesaler of solar and sustainable products for domestic, community, and commercial use. In addition to their energy efficient products, Going Solar has also expanded to consulting services on sustainable design in buildings and transport systems. They have won several awards that most recently include: the Clean Energy Council Award for Excellence in Solar Hot Water System Installation and Design (2012, 2011, 2009), the Award for Excellence - PV - UPS (2011), and multiple awards for grid-connected solar and PV systems (Going Solar, 2013).

DesignInc specializes in the sustainable architecture and construction. The company attempts to blend natural elements into urban design concepts that are as innovative and

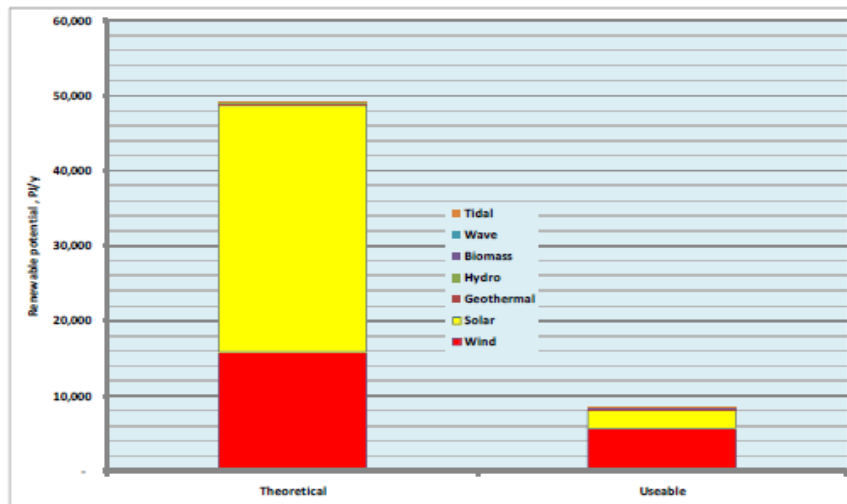
environmentally sustainable as possible while using established construction techniques to minimize costs and construction times. DesignInc has won several recent awards including: the UNAA World Environment Day Awards 2012 - Green Building Award; the Australian Timber Design Awards 2012 - Rising Star; and, the Interior Design Excellence Awards 2012 - Sustainability Award (DesignInc, 2013).

The mission at Snowy River is to be able to supply clients with sustainable solutions to problems in their everyday life. In 2013 and 2014, Snowy River is delivering their services within Australia throughout rural and regional areas. Victoria has the capability of generating extremely larger quantities of renewable energy from various sources; Table A1 and Figure A2 demonstrate the renewable energy potential in Victoria. In 2014 and 2015, they plan to expand their offerings outside of Australia to Asia and islands in the Pacific. A few of the current projects areas include community energy power, industry energy and waste solutions, and renewable energy generation in rural and remote areas (Snowy River Innovation, 2013).

**Table A1 - Renewable Resource Potential in Victoria
(Department of Primary Industries, 2010)**

	Theoretical PJ/y	Usable PJ/y	Theoretical GWh/y	Usable GWh/y
Wind	15,930	5,631	4,425,115	1,564,118
Solar	32,781	2,515	9,105,794	698,656
Geothermal	>>271	181	>>75,369	50,141
Hydro	57	3	15,000	934
Biomass	>>57	33	>>15,863	9,294
Wave	>>27	27	>>7,438	7,438
Tidal	>>0.1	0.1	>>39	39
TOTAL	>>49,121	8,390	>>13,644,618	2,330,619

**Figure A2 - Renewable Resource Potential in Victoria
(Department of Primary Industries, 2010)**



Genesis Now recently completed a project that monitored the performance of a sustainable housing development in Melbourne. They assisted the housing development by installing meters to track how efficient the building was using energy. Although the energy efficiency of the development was generally good, Genesis Now provided advice to make the building even more energy efficient (Alexander, 2013).

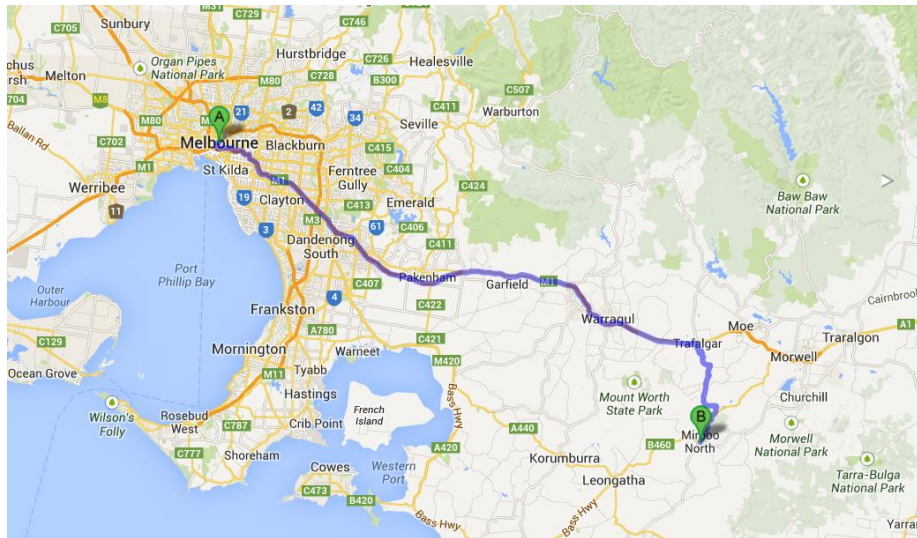
In 2012, Going Solar implemented structures that would make solar panels more efficient for homes that were limited in solar exposure due to the roof's orientation. Houses that had roofs that faced east and west have less solar exposure than those faced north and south. Traditional solar panel installation for these east and west faced homes would be less efficient for solar power. Going Solar found solutions to install solar panels onto homes to face north, therefore improving the possible solar energy efficiency of these homes. These panels, in conjunction with storage tanks, gas boosters, and circulation pumps helped power these homes. Going Solar thwarted problems for homes that were poorly oriented for solar panel efficiency and made solar power more accessible (Going Solar, 2013).

DesignInc is currently working on the construction of the new Royal Adelaide Hospital in conjunction with the South Australian government. The hospital, set to open in 2016, will feature capacity to admit over 80,000 patients a year, an automated fleet of vehicles to transport equipment within the hospital, an underground car park, a commercial precinct, a park, and a

50% targeted reduction in greenhouse gas emissions compared to equivalent hospitals (Royal Adelaide Hospital, 2013).

Snowy River Innovation is seeking to further the Mirboo North and District community energy hub to provide sustainable energy for the rural community. Mirboo North is located approximately 160 kilometers southeast of Melbourne, as seen in Figure A3.

Figure A3 - Route from Melbourne to Mirboo North (Mirboo North Community Map, 2013)



The community has a population of approximately 2,500 within 97 kilometers and consists of mostly farmland and forest. See Figures A4 and A5 below for reference.

Figure A4 - Mirboo North (Mirboo North-Victoria-Australia, 2013)

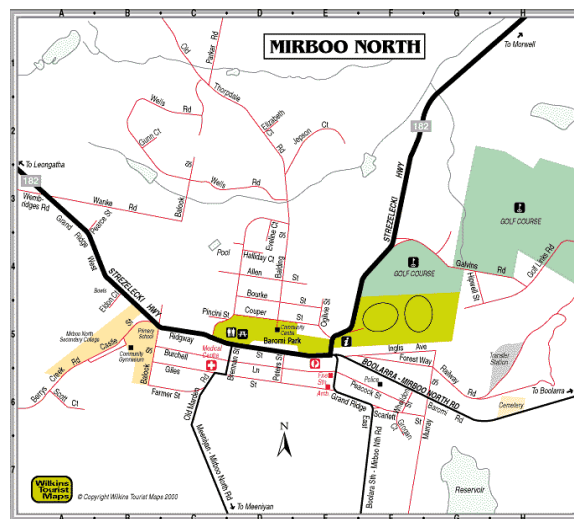
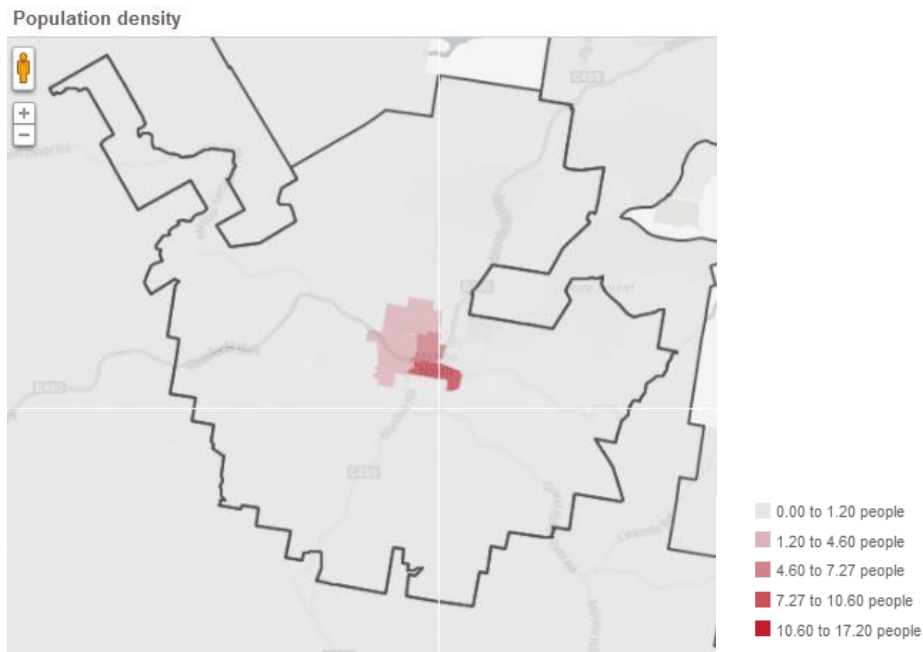


Figure A5 - Population Density of Mirboo North (Mirboo North- Baromi, 2013)



The rural land of Mirboo is used mainly used for dairy farming as well as a small portion to potato and onion farming. The region consists of 27.8% low income households (less than \$600 weekly income) and only 8.7% high income households (more than \$2500 weekly income) (Mirboo North-Baromi, 2013). The Mirboo North Community Shed is striving to develop an energy hub which is a community owned and operated energy service. This group is hopeful that this hub could provide savings in energy costs to the local community, provide local jobs, and benefit the environment (Primaform, 2013).

Appendix B - General list of questions for the Australian Community Engagement Projects

- What are you trying to achieve with your project?
- What are your motivations for becoming more sustainable?
- Why did you decide on this renewable energy source?
- How did you educate community about the renewable energy source?
- How did you keep the community involved and updated with the project?
- How did the community react to this implementation?
- What struggles did you face with community involvement?
- Was there any source of government outreach?
- What type of funding did you receive for this project?
- How long of a period before the customers started to see a return?
- Have you had an energy efficiency assessment done to find ways to reduce your energy usage?
- Has a community energy system been initiated?
- Are you doing anything in the big business sector?
- How do you measure your performance?
- What has been successful on your website?
 - Do you track what people are visiting?
- What are the critical last steps?
- What has worked for you?

Additional Questions to ask MEFL

- What are some of the main reasons for people to be hesitant about installing solar technologies?
- What were some of the difficulties of communicating with people who are hesitant about renewable energy?
- Would the map system, NearMap, be possible to use in a rural area?
- Moreland Foundation is the only of its kind in Australia that connects the Moreland community and the broader climate change action movement: How were you able to establish yourself successfully as the first connection between the community and the climate change movement?
- Have you dealt with any energy storage systems?
 - If so, what battery options are currently available?
 - If not, do you plan on picking this up as the technology advances?
- How were you able to obtain the five-year partnership agreement with Moreland City Council for funding assistance?
- Has Moreland Energy Foundation attained overall success from renewable energy cooperative systems?
- Could you explain the Community Power Program?
 - Why did you have to disband the program?
 - Would you do differently?
- How do you measure your performance?
- How do you continue to communicate with and gain feedback from those who have installed solar systems?

Additional questions to ask LIVE

- What is the current progress of the South Melbourne Market Solar PV project?
 - What barriers have you encountered with its implementation?
 - How have you dealt with the city council to progress the project?
- Have you made developments with energy storage options?
 - If so, what do you believe the best option to be?
- What outreach programs have you done to communicate renewable energy to the people?
 - If so, were they successful?
- How did you advertise/commercialize your project?
 - What has been the best mode of communication? (Website, newsletters, word of mouth, etc.)
- How do you keep people updated?
- What struggles did you face with community involvement?
- Have you seen success in the community-run cooperatives?

Appendix C - Questions from ClimateWorks Interview

- How do you go about building trust with your clients?
- How have you gone about talking about climate change with the farmers?
- Have you found that people far less interested in making change towards the long term than the short term?
- Have you raised awareness for funding opportunities for retrofitting? And if so how?
- How is funding attained at ClimateWorks as a nonprofit organization?
- Specifically within dairy farming or agroforestry sectors, how do you raise awareness of biomass technologies?
- Out of the nine solutions across the three main sectors identified on the website, the single largest opportunity to reduce emission is from planting trees to act as carbon sinks. If it is that easy to reduce 43.6 million tonnes per year, why are more trees not planted?
- Since there is such controversy with bush fires, how do you get people to trust the burning process?

Appendix D - Questions for Genesis Now

- What have you found successful on your website?
 - What hasn't been successful?
 - Do you use tracking software on your website?
 - Are the case studies on your website an effective way to communicate successful projects?
- Can you further explain the eco-tracker software?
 - How do you promote your software?
- How do you convince potential clients to adopt your reduced energy consumption practices?
- What communication barriers have you faced while working with clients?

Appendix E - Questions for Going Solar, Gippsland Solar, and Trentleck

- What have you found successful on your website?
 - What hasn't been successful?
 - Do you use tracking software on your website?
 - Do people view the case studies?
- Do you provide rebates or other incentives to those who convert to a renewable energy source?
- Have you found that the advice you give during audits helps to reduce energy consumption?
- What are some of the challenges you face when working with community-owned hubs?
- What were some of the difficulties of commercializing your services to the community?
 - How do you establish trust with clients?
- What are the barriers you face when installing solar PV panels?
- How long after installation do the customers start to see profit?
- Are people hesitant to install due to the initial costs?
 - If so, how do you present information on solar panels to these people?
- What are some examples of sustainable transport you've worked with?

Appendix F - Questions for Ellinbank Dairy Research Facility

- What are the power requirements for the local farms?
- Will the farms need generators separate from the community if they are in more rural areas?
- How much agricultural waste is produced by the area farms?
 - Is it enough to supply a biodigester?
 - Is there an efficient method to collect this waste?
- From your research with the methane capture equipment, what correlations can you draw between feed intake, milk production, and methane output?

Appendix G - General Questions for Mirboo North dairy farm visits

- How have the past few years been?
 - Struggles, concerns, successes?
 - What would you do differently?
- Have you noticed a trend in crop yield over the past few years?
 - What do you think may be the cause of this?
- How have the bush fires affected your farm/business in the past years?
- How many head of cattle do you have?
 - Are you looking to expand?
- Where do you see the farm in five years?
- Do you have children? If so, will they be taking over the farming operation?
- Would you be interested in cutting energy usage?
 - Short term savings through energy efficiency?
 - Long term investment with renewable energy technologies?
- Have you had an energy efficiency assessment done to find ways to reduce your energy usage?
 - If so, what steps have you taken to do so?
 - If not, would you be interested in learning about such opportunities?
- Are you currently using any renewable energy technologies?
- Would you be interested in attending a workshop on the different renewable energy technologies to learn how to reduce your energy costs?

- Have you considered the potential conversion of wastes into energy (i.e. biodigesters, combustion)?
 - If you have considered biodigesters, what are your strongest incentives?
- Are you hooked up into a smart meter?
- Do you know about smart grids?
- Have you heard about the Carbon Farming Initiative?
 - If you not aware of it, would you like information on it?
 - Would you be interested in attending workshops to learn more about this and find networking opportunities?
- Have you recently made any upgrades on your farming equipment? If so, what influenced to do this?
- Do you interact with other farmers to share information about how business is or discuss energy efficiency opportunities?
- Have you participated in any of the activities regarding the Mirboo North and District Energy Hub?
- Are you aware that there is a Facebook page about the community energy hub?
 - What do you believe would be helpful and useful to see on the Mirboo North and District website that will be released soon?
- By what other means would you be interested in receiving information about cutting energy usage?

Appendix H - Questions for the Mirboo North horticulture farms

- What influenced you to become an organic dairy farmer?
- How have the past few years been?
 - Struggles, concerns, successes?
 - What would you do differently?
- Have you noticed a trend in crop yield over the past few years?
 - What do you think may be the cause of this?
- How have the bush fires affected your farm/business in the past years?
- Where do you see the farm in five years?
- Do you have children? If so, will they be taking over the farming operation?
- Would you be interested in cutting energy usage?
 - Short term savings through energy efficiency?
 - Long term investment with renewable energy technologies?
- Have you had an energy efficiency assessment done to find ways to reduce your energy usage?
 - If so, what steps have you taken to do so?
 - If not, would you be interested in learning about such opportunities?
- Are you currently using any renewable energy technologies?
- Would you be interested in attending a workshop on the different renewable energy technologies to learn how to reduce your energy costs?
- Have you considered the potential conversion of wastes into energy (i.e. biodigesters, combustion)?

- If you have considered biodigesters, what are your strongest incentives?
- Are you hooked up into a smart meter?
- Do you know about smart grids?
- Have you heard about the Carbon Farming Initiative?
 - If you not aware of it, would you like information on it?
 - Would you be interested in attending workshops to learn more about this and find networking opportunities?
- Have you recently made any upgrades on your farming equipment? If so, what influenced to do this?
- Do you interact with other farmers to share information about how business is or discuss energy efficiency opportunities?
- Have you participated in any of the activities regarding the Mirboo North and District Energy Hub?
- Are you aware that there is a Facebook page about the community energy hub?
 - What do you believe would be helpful and useful to see on the Mirboo North and District website that will be released soon?
- By what other means would you be interested in receiving information about cutting energy usage?

Appendix I - Questions for small-scale sustainable operations

- What influenced you to adopt sustainable practices?
 - Financial, environmental?
- What renewable energy technologies do you have in use?
 - Why did you choose this?
 - What have been the financial results of your initial investment?
- Would you consider incorporating energy storage systems into your current renewable technology setup?
- Have you considered installing other forms of renewable energy?
 - If so, which ones and why?
 - If not, why not?
- What are some things you do to reduce your energy consumption?
- Have you had an energy assessment done?
 - If so, what have been the results of that?
 - If not, would you consider having one done to reduce your energy usage and lower your energy bill?
- Would you be interested in attending workshops that provide information on energy efficient practices and renewable energy technologies?
- What information would you like to see presented on the Mirboo North Community Energy Hub website?

Appendix J - Website Survey Questions

1. Do you have a computer connected to the internet?
2. How many hours a week do you use the internet?
3. Have you made improvements to your home/business or changed your energy use behaviors to become more energy efficient? If so, what have you done?
4. Was it easy to find information on the website?
5. What did you like about the site?
6. What did you not like about the site?
7. What would you change about the website/additional information that we should include?
8. Would you use this site to find information on renewable technologies and upcoming energy events in Mirboo North?
9. Who do you trust to get your information from?
10. After viewing the website, did you learn any new ideas to make your home/business more energy efficient?
11. Was the diagram visual enough for you to gain a better sense of the energy network?
12. Would a video or interactive model make the energy network easier to understand?

Appendix K - Website Matrix

Company or Organization	Type of Organization	Purpose	Community Engagement	Information on Technologies	Case Studies	Testimonials
<p>Moreland Energy Foundation Ltd. (MEFL): http://www.mefl.com.au/ (*last updated December 2, 2013)</p>	<ul style="list-style-type: none"> • Nonprofit organization focused on sustainable energy projects 	<ul style="list-style-type: none"> • Reduce greenhouse gas emissions in the northern inner suburbs of Melbourne 	<ul style="list-style-type: none"> • Worked with thousands of local households and community groups to help with their energy efficiency • Created resources for ways to reduce carbon emissions 	<ul style="list-style-type: none"> • Section on their website focused on renewable energy and small amount of info on solar and wind 	Yes	Yes
<p>Yarra Energy Foundation (YEF): http://yef.org.au/ (*last updated February 2013)</p>	<ul style="list-style-type: none"> • Energy foundation set up to assist the municipality of Yarra with their energy efficiency and production 	<ul style="list-style-type: none"> • To make the municipality of Yarra carbon neutral by 2020 	<ul style="list-style-type: none"> • Looking to set up community owned solar arrays throughout the city • Partnered with the Kunexion and Kangan Institute to educate people about sustainability 	<ul style="list-style-type: none"> • Briefly describes solar power in annual report • Using animal waste for production of methane (Poo Power Program) 	N/A	N/A
<p>Hepburn Wind: http://hepburnwind.com.au/ (*last updated May 2013)</p>	<ul style="list-style-type: none"> • Community owned wind farm 	<ul style="list-style-type: none"> • Provide electricity to the 2,300 Hepburn households at an affordable cost 	<ul style="list-style-type: none"> • The wind farm was a cooperative among the citizens of Hepburn, so the community owned the wind farm. 	<ul style="list-style-type: none"> • Information on wind turbines that could be implemented in Hepburn • Wind data for possible locations of setting up the turbines 	N/A	N/A

Company or Organization	Type of Organization	Purpose	Community Engagement	Information on Technologies	Case Studies	Testimonials
Renewable Newstead: http://newstead.vic.au/organisation/renewable-newstead (*last updated October 2013)	<ul style="list-style-type: none"> • Collaboration between Newstead 2021 and Central Victorian Solar City to convert the town to renewable energy 	<ul style="list-style-type: none"> • Convert Newstead to 100% renewable by 2015 	<ul style="list-style-type: none"> • Community looking into building a solar park 	N/A	N/A	N/A
Sustainability Victoria (SV): http://www.sustainability.vic.gov.au/ (*last updated October 2013)	<ul style="list-style-type: none"> • Government authority with programs in integrated waste management and energy efficiency 	<ul style="list-style-type: none"> • Maximize value from resources to support a sustainable future 	<ul style="list-style-type: none"> • Support and recognize those who contribute time to SV's programs 	<ul style="list-style-type: none"> • Information on rebates for implementing energy-saving measures 	Yes	N/A
Ellinbank Dairy Research Facility: http://www.depi.vic.gov.au/agriculture-and-food/innovation-and-research/research-centres/dpi-ellinbank (*last updated September 2013)	<ul style="list-style-type: none"> • National Center for Dairy Research and Development 	<ul style="list-style-type: none"> • Research the efficiency of dairy farming to ensure all Australian farms meet efficiency standards • Research carbon emissions with different feedstock 	N/A	N/A	Yes	N/A

Company or Organization	Type of Organization	Purpose	Community Engagement	Information on Technologies	Case Studies	Testimonials
Maryvale APM: http://www.australianpaper.com.au (*last updated 2013)	<ul style="list-style-type: none"> • Australia's largest integrated paper-making and packing papers complex 	<ul style="list-style-type: none"> • Use waste products as energy sources, and recycle large amounts of water 	<ul style="list-style-type: none"> • Contribute a positive social and economic impact in the communities of operation 	N/A	N/A	N/A
Hancock Plantation: http://www.hvp.com.au/ (*last updated July 2013)	<ul style="list-style-type: none"> • One of the largest private plantation companies in Australia 	<ul style="list-style-type: none"> • Wood supplier to manufacturing companies 	<ul style="list-style-type: none"> • Active community consultation program 	N/A	N/A	N/A
ClimateWorks: http://www.climateworksaustralia.org/who-we-are (*last updated November 26, 2013)	<ul style="list-style-type: none"> • Research based, nonprofit organization set up to assist businesses in reducing greenhouse gases 	<ul style="list-style-type: none"> • Significantly reduce greenhouse gas emissions in Australia in the next five years 	<ul style="list-style-type: none"> • Low Carbon Growth Plan for Gippsland could save the region \$100 million a year in energy costs while reducing greenhouse gas emissions • Low Carbon Lifestyles series aims to provide homeowners with information on how they can reduce their energy use 	<ul style="list-style-type: none"> • Low Carbon Growth Plan for Gippsland gave strategies on how to improve energy efficiency as well as renewable energy options for the region 	N/A	N/A

Company or Organization	Type of Organization	Purpose	Community Engagement	Information on Technologies	Case Studies	Testimonials
<p>Energy for the People: http://energyforthepeople.com.au/ (*last updated November 1, 2013)</p>	<ul style="list-style-type: none"> • An organization formed to challenge the current energy market 	<ul style="list-style-type: none"> • Develop clean energy projects for community buildings • Make renewable energy easy to understand 	<ul style="list-style-type: none"> • Community workshops for technology and ownership options 	<ul style="list-style-type: none"> • Gives links to other websites about micro-grids and off-grid technologies but no information directly on site 	Yes	N/A
<p>Locals Into Victoria's Environment: http://www.live.org.au/ (*last updated October 2013)</p>	<ul style="list-style-type: none"> • Nonprofit community organization that runs campaigns across Australia on climate change 	<ul style="list-style-type: none"> • Aims to reduce the human contribution to climate change 	<ul style="list-style-type: none"> • Setting up a community owned solar panel array on top of the South Melbourne market 	N/A	Yes	N/A
<p>Murray Goulburn Cooperative (MGC): http://www.mgc.com.au/our-story/environment/ (*last updated 2013)</p>	<ul style="list-style-type: none"> • Cooperative of dairy farmers that process a third of Australia's milk supply 	<ul style="list-style-type: none"> • Striving to deliver higher quality dairy products 	<ul style="list-style-type: none"> • Energy Blitz - identifies energy savings through a unique combination of on-site engagement, energy analysis and observations on plant operations. • Dairy rebates, offering financial support to young and new farmers 	N/A	N/A	N/A

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<p>Mallacoota Sustainable Energy Project:</p> <p>http://mallacootacommunitydirectory.info/mallacoota-sustainable-energy</p> <p>(*last updated November 19, 2013)</p>	<ul style="list-style-type: none"> Mallacoota Sustainable Energy Project is a project of SP AusNet, East Gippsland Shire Council and Mallacoota Sustainable Energy Group. 	<ul style="list-style-type: none"> Engage the Mallacoota community and address their energy needs 	<ul style="list-style-type: none"> Held information sessions and encouraged citizens to come and share ideas Gave frequent updates on their website for the progress of the project 	<ul style="list-style-type: none"> Directed citizens on their website as to where to go for information on renewable energy technologies 	N/A	N/A
<p>DEPI (Dept. of Environment and Primary Industries):</p> <p>http://www.depi.vic.gov.au/</p> <p>(*last updated November 4, 2013)</p>	<ul style="list-style-type: none"> Formed from the Dept. of Sustainability and Department of Primary industries 	<ul style="list-style-type: none"> Protecting the environment, management of natural resources 	<ul style="list-style-type: none"> Communities for Nature Grants Creates partnerships at the local level with communities 	N/A	Yes	N/A
<p>Clean Energy Council:</p> <p>http://www.cleanenergycouncil.org.au/</p> <p>(*last updated November 21, 2013)</p>	<ul style="list-style-type: none"> Industry association comprised of 600 companies within renewable energy and energy efficiency 	<ul style="list-style-type: none"> Make at least 20% of Australia's electricity to be renewable by 2020 Promoting clean energy technology 	<ul style="list-style-type: none"> Clean energy week : conventions about clean energy ATRRA: Australia's largest solar event-exhibition and clean energy debate 	<ul style="list-style-type: none"> Different page for the individual renewable technologies 	N/A	Yes

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<p>Castlemaine 500: http://www.cvga.net.au/main/index.php?option=com_docman&task=cat_view&gid=15&&Itemid=72 (*last updated 2009)</p>	<ul style="list-style-type: none"> Formed from the Victorian Government, confronts climate change through steps towards carbon emissions 	<ul style="list-style-type: none"> Raise awareness to adopt energy smart behaviors towards the issue of climate change 	<ul style="list-style-type: none"> House to house recruitment to increase participants Participants completed Home Energy Assessment Tool and Home Energy Action Plan Community Leadership Program to promote community household leaders to learn new facilitation skills, project design and communication Form partnerships with many local groups to reduce energy consumption 	N/A	Yes	N/A
<p>Beyond Renewable Energy and Zero Emissions (BREAZE): http://www.breaze.org.au/ (*last updated October 2013)</p>	<ul style="list-style-type: none"> Nonprofit organization who has gathered members of the Ballarat community who want to take action to climate change 	<ul style="list-style-type: none"> Focus on community engagement, local government action, retrofitting renewable energy, and local food 	<ul style="list-style-type: none"> Host benefits and donations and have prizes at events to encourage attendance Community Engagement Action Group Sustainability Workshops 	N/A	N/A	N/A

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<p>Trentleck: http://www.trentleck.com/about-us (*last updated March 2013)</p>	<ul style="list-style-type: none"> Company that installs photovoltaic power systems, wind turbine power systems and solar hot water systems in the Gippsland region. 	<ul style="list-style-type: none"> Sell renewable energy to the Gippsland people. 	N/A	<ul style="list-style-type: none"> Prices of renewable technologies such as solar PV Website will have information in the future on solar and wind power 	N/A	N/A
<p>Organic Dairy Farmers Co-op: http://www.organicdairyfarmers.com.au/ (*last updated July 1, 2013)</p>	<ul style="list-style-type: none"> Produce organic milk 	<ul style="list-style-type: none"> Embrace modern farming and manufacturing methods that are sustainable 	<ul style="list-style-type: none"> Small group of dairy farmers that shares ideas, resources and profits amongst each other 	N/A	N/A	Yes
<p>Consumer Utilities Advocacy Centre: http://www.energyinfohub.org.au/energy-information-fund (*last updated October 31, 2013)</p>	<ul style="list-style-type: none"> Created in 2002 to represent the Victorian energy and water consumers with the changing policies and regulations 	<ul style="list-style-type: none"> Website designed for energy information, resources about energy, and funding options 	<ul style="list-style-type: none"> Section that allows people to find resources that would be helpful within their community Examples of different projects 	<ul style="list-style-type: none"> General energy information, as well as on smart meters 	N/A	N/A

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Embark: http://embark.com.au/display/WebsiteContent/Home (*last updated 2013)	<ul style="list-style-type: none"> Privately funded, nonprofit organization working to help break through barriers that are seen with the implementation of renewable energy technologies 	<ul style="list-style-type: none"> Promote community energy 	<ul style="list-style-type: none"> Looking to take on more community energy projects Have done several case studies for different renewable energy projects 	<ul style="list-style-type: none"> Have pages on different renewable energy technologies 	Yes	N/A
Bega Cheese: http://www.begacheese.com.au/ (* last updated 2012)	<ul style="list-style-type: none"> A large producer of natural and processed cheeses in the Bega Valley of NSW and Victoria 	<ul style="list-style-type: none"> Sells various dairy products 	<ul style="list-style-type: none"> Supporter and partner of local community by sponsoring and donating to local community organizations that cover education, sports, arts, health, and community services 	N/A	N/A	N/A
Dairy Australia: http://www.dairyaustralia.com.au/ (*last updated October 28, 2013)	<ul style="list-style-type: none"> Act as investors to farmers and companies to help them become more sustainable 	<ul style="list-style-type: none"> Help farmers to adapt to the changes within operation in order to become more sustainable 	<ul style="list-style-type: none"> The Project in Dairy Program developed online resources for dairy farmers and runs various training and research projects 	N/A	Yes	N/A

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<p>Alternative Technology Association (ATA): http://www.ata.org.au</p> <p>(*last updated November 2013)</p>	<ul style="list-style-type: none"> • Australian not-for-profit organization promoting sustainable technologies and practices 	<ul style="list-style-type: none"> • Promote good building design, water conservation, and renewable energies 	<ul style="list-style-type: none"> • Provides expert advice for sustainable solutions for independent households • GreenPower Program 	N/A	N/A	N/A
<p>Denmark Wind: http://www.dcw.org.au/</p> <p>(*last updated 2013)</p>	<ul style="list-style-type: none"> • Project formed to address Denmark's energy needs and the global challenge of climate change 	<ul style="list-style-type: none"> • Build a small, community owned windfarm that feeds into the regional grid 	<ul style="list-style-type: none"> • Community owned windfarm • Gave information on community energy projects on their website, including the characteristics of these projects 	<ul style="list-style-type: none"> • Gave links to websites such as Embark for more information on these projects • Gave technical specifications on the turbines in Denmark 	N/A	N/A