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The adequacy of programs in NSW in supporting vulnerable households to transition to renewable energy

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Abstract

Rising electricity prices in Australia have caused low-income households to take drastic measures to reduce their energy consumption, cutting back on essential needs like food and heating. At the same time, prices for renewable energies like solar PV are decreasing, making renewable energy a more viable option for low-income households than grid electricity. In support of increasing the nation's supply of renewable energy, the New South Wales government is funding the Zero Net Energy Town (Z-NET) project. The Z-NET project is a new initiative to create Australia's first town that supplies all of its energy through renewable energy sources, using the town of Uralla as a model. A major concern in achieving this goal is how to ensure that Uralla's low-income residents can effectively make the transition. The purpose of this study is to determine whether existing policies and programs in New South Wales will adequately support vulnerable households in transitioning to renewable energy. If Uralla is successful, it can serve as a model for other towns and can provide policy solutions that ensure all households are able to adopt renewable energies.

In this study, I conducted an academic literature review to identify major barriers to the implementation of renewable energy and energy efficiency measures in vulnerable houses. The final categories are as follows: financial and economic constraints, lack of awareness and information, technical risks, split incentives, behavioural barriers, and infrastructure. After creating an inventory of existing policies in New South Wales, I assessed each policy based on its adequacy in addressing the identified barriers.

Policies include: energy efficiency, renewable energy, solar PV, and financial assistance. My findings indicate that the available energy efficiency policies and financial assistance programs are adequate in addressing the identified barriers. The renewable energy policies and solar PV programs are inadequate, however, because they fail to address major barriers to the implementation of renewable energy in vulnerable households. These barriers include Internet access, split incentives, habit, and environmental values and connection. My recommendation is that the Z-NET project should take advantage of the available policies and programs in New South Wales and the assistance they can provide to vulnerable households. The Z-NET project will have to take additional measures, however, to address the barriers that the available policies do not meet.

Keywords: renewable energy, energy efficiency, barriers, vulnerable, low-income, households

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1. Introduction

1.1 Rising Electricity Prices

Since 2007, Australian households have experienced a steep increase in electricity prices that far exceeds general price and wage movements, causing many to struggle in paying their power and gas bills (Chester, 2013, p.121). Out of all the states, New South Wales (NSW) experienced the highest average increase in household electricity prices at 108% between 2007 and 2013 (Chester, 2013, p.121). The increase is mainly due to upgrades in network infrastructure that were made because of a predicted rise in electricity demand (CEC, 2014b, para.5). The rising electricity prices have been met with a decline in electricity demand, which has been largely attributed to an increased national awareness of energy efficiency and the uptake of household solar (CEC, 2014b, para.5). The actions taken to reduce energy use in low-income households, however, have been much more extreme and threaten the well-being of these household members (Chester, 2013, p.124). Furthermore, the installation of solar panels, which has been a driver of lower household energy bills, may not be an option for households with limited incomes (Chester, 2013, pp.122, 124).

Several studies have found that low-income households spend a greater percentage of their income on electricity and fuel (Boyce & Riddle, 2007, p.3; Chester, 2013, p.122). In a study compromising focus groups, interviews, and an online survey of Australian households, Chester found that nearly all households had tried to reduce their energy use in response to the rising power bills. The focus groups and interview participants were representative of the poorest 20% of Australian households and about 75% of the participants said they had to cut back on food expenditure the most in order to pay their energy bills. These participants said that their diet now consisted of either no protein or less fruits and vegetables. Some parents reported that they had to either sacrifice their own nutrition or go hungry so their children could eat. Other such measures as taking shorter or no showers, avoiding cooking, rarely leaving home, and cutting off heating were used as ‘strategies’ to manage energy use. As a result of these ‘energy management techniques’, households reported to be suffering physical discomfort, reduced physical and mental well-being, loneliness, and constant stress (2013, pp.121-124).

To put downward pressure on the rising electricity prices, the Australian government decided to increase the amount of the nation’s energy supply from renewables (CEC, 2014b). In 2011, the government set the Renewable Energy Target (RET), requiring that at least 20% of Australia’s electricity comes from renewable sources by 2020 (CEC, 2014a). As part of the target, the government encouraged a diversity of energy sources to promote competition, specifically an

increase in renewable sources like wind and solar, whose prices have been falling and are continuing to do so (CEC, 2014b, para.3, 7).

Renewable energy, specifically rooftop solar PV systems, is becoming a more viable option for households than grid electricity, especially for low-income households (Frischknecht, 2013, sec.2). Solar PV systems make energy costs more predictable and save households money through reduced electricity bills (Frischknecht, 2013, sec.2). While renewable energy prices are expected to decline over the next few years, gas prices are expected to increase drastically (CEC, 2014c, sec.1). Because of this, it is estimated that switching to renewable energy will save Australian households hundreds of dollars on their electricity bills in the long run (CEC, 2014c, sec.1). The production of renewable energy can also provide economic development and employment opportunities, with already more than 24,000 Australians employed in the renewable energy sector and an estimated 18,400 more jobs to be generated by 2020 (CEC, 2014c, sec.3).

1.2 The Z-NET Project

The NSW government has recognized renewable energy as "a pathway to lasting economic prosperity that does not take resources away from future generations and reduces the impact of our activities on the natural environment" (DTI, 2013, p.ii). In support of an increase in the nation's renewable energy sources, the government is funding the Zero Net Energy Town (Z-NET) project, which is an initiative to "create Australia's first town which satisfies all of its own energy needs from renewable energy sources" (Z-NET, 2015a). Besides generating all of its energy from renewables, the project also aims to make the town more energy efficient (Z-NET, 2015c). Through increasing energy efficiency measures, the Z-NET project will reduce the total amount of renewable energy required to power the town, making the goal of 100% renewable energy easier to reach (Z-NET, 2015c). The chosen model for the project is Uralla, a small town in the New England Region of New South Wales with a population of roughly 2,754 people (ABS, 2012d).

The Z-NET project has indicated that solar PV panels are the best option for Uralla to generate electricity on-site (Z-NET, 2015d. p.10). Uralla has excellent climatic conditions for solar power and it is estimated that if all the rooftop solar capacity in Uralla were utilized, then solar PV panels could meet about 40% of Uralla's total annual electricity demand (Z-NET, 2015d, p.10).

Several other towns have already become energy self-sufficient and serve as models for the project. One of them is the town of Feldheim in Germany, which built its own energy grid and is powered and heated entirely by local renewable sources, primarily wind and biogas (Rayasam, 2012, para.1). This example is particularly impressive because residents pay 31% less for electricity and

10% less for heating than before, lowering their electricity bills to around half the national average (Rayasam, 2012, para.3). The introduction of renewable energy has created jobs and erased unemployment in the town (Rayasam, 2012, para.3). There are several other success stories, such as that of the small agricultural village of Wildpoldsried in Germany. Wildpoldsried produces 321% more energy than it needs and generates $5.7 million in annual revenue from renewable energy by selling it back to the national grid (Singh, 2011, para.1).

1.3 The Blueprint

The Z-NET project is currently working on preparing a blueprint for Uralla, due June 2015, which must consider and balance three different criteria: the community's desires, technical and practical feasibility, and financial viability (Z-NET, 2015a, para.5). The blueprint is crucial to the initiative's success, as a large part of it will be identifying the potential issues that Uralla could face in becoming a zero net energy town. In developing the blueprint, an issue that has repeatedly come up with the Z-NET Community Reference Group is how to ensure that Uralla's low-income residents can effectively transition to renewable energy sources (Eady, 2015, pers.comm.).

One major concern with the switch to renewable sources is the impact on vulnerable households. While prices may be falling, current prices of renewable energy still tend to be higher than conventional forms of energy, meaning that low-income households will struggle the most in adopting renewable energy (Boyce & Riddle, 2007, p.3). In Australia in 2009-10, the average weekly disposable household income of people in low economic resource households was $465 (ABS, 2012a, sec.3). 16% of households in Uralla receive less than $400 a week, suggesting that there will be a decent sector of the population in need of policy assistance if Uralla is to make the transition to 100% renewable energy (ABS, 2012d).

The high costs of installing small-scale renewable energy systems are just one of many barriers facing vulnerable households. Without government policies and programs to help support these households in adopting renewable energy, they may be negatively impacted from the transition. This report focuses on addressing that concern, specifically aiming to answer the question, "*Do policies and programs in NSW adequately support vulnerable households in transitioning to renewable energy?"*

1.4 Sustainable Outcomes

In making Uralla a zero net energy town, one of the primary goals should be to ensure that the outcome is sustainable. The United Nations' World Commission on Environment and Development (1987) defined sustainability as "meet[ing] the needs of the present generation without

compromising the ability of future generations to meet their own needs." Renewable energy is a clean source of energy and its use does not produce carbon dioxide or other greenhouse gas emissions that contribute to climate change (Johansson et al., 1993, p.4). It is an inexhaustible source, meaning that it can be used for generations to come, and will be constantly and naturally replenished (ARENA, n.d.). Sustainability is not only about the environment, however, and in order to implement the project in a sustainable way, Z-NET needs to ensure that all of Uralla's residents will benefit from the transition to renewable energy. This research is important in ensuring that vulnerable households can effectively adopt renewable energy, experience an improved standard of living because of it, and continue to share its benefits with future generations.

1.5 A Model Town

This research will provide valuable information for the blueprint that can help provide guidance in deciding which policies and programs to implement in Uralla. Specifically, it will shed light on the barriers vulnerable households in Uralla may face in transitioning to renewable energy, which existing policies in NSW can help in that transition, and what additional programs or measures must be taken to adequately support vulnerable households.

If the initiative is successful, Uralla will serve as an example and model for other towns and cities in Australia. Research on policies and programs supporting vulnerable households is particularly important because they are the group with the highest risk of being negatively impacted from the nation-wide movement towards renewables. In order to effectively implement renewable energy, local and state governments working to move communities towards renewables will have to be aware of the policies needed to ensure all residents benefit from the transition.

1.6 What is a Vulnerable Household?

Rather than using low-income as a determinant of a 'vulnerable' household, the Australian Bureau of Statistics (ABS) uses low economic resource, which it defines as households who are in the lowest two quintiles of both equivalised adjusted disposable household income and equivalised household net worth. It takes into account both wealth and income in order to exclude households who have high levels of wealth and normal levels of consumption, despite having low income levels. (2012a, sec 1-2). An example of this would be people who are retired; people who are retired may have high levels of net worth from saving up their money all their working life, but currently have low income levels since they are no longer employed. A 2011-12 study by the ABS on Household Income and Income Distribution found that people with low income levels but high levels of net worth are unlikely to be at risk of experiencing economic hardship. On the other hand, people with low reserves of wealth are likely to face financial difficulty in times of need, such as during any

period of reduced income or substantial unexpected expenses (2013, sec.3).

Since the policies and barriers in this report do not strictly target and refer to low economic resource households by the definition that ABS has given them, the name used in this report will be 'vulnerable households.' A vulnerable household will be one that would suffer under financial hardship or stress, such a sudden increase in expenses (i.e. implementing a renewable energy system), without assistance. This definition would still incorporate low economic resource households; the 2009-10 ABS Survey of Income and Housing determined that in Australia, 43.3% low economic resource households were unable to raise $2,000 for something important in a week and 31% couldn't pay their gas, electricity, or telephone bill on time (2012a, sec.5).

2. Methods

No ethical issues were presented in this research study, as no human subjects were involved.

2.1 Identifying the Main Barriers

To identify the main barriers facing vulnerable households in transitioning to renewable energy and implementing energy efficiency measures, I conducted an academic literature review using online databases and other online sources. Access to certain databases like Science Direct was granted through the CSIRO system (Note: CSIRO is Australia's national science agency). Research was done on barriers to the uptake of renewable energy and energy efficiency, specifically searching for information on 'vulnerable,' 'low-income,' or 'low economic resource' households.

2.2 Categorizing the Barriers

After identifying the major barriers, they were categorized and put into distinct sections. The main categories chosen for the barriers to the uptake of renewable energy and energy efficiency measures in vulnerable households were largely based off of Reddy and Painuly's (2004) six categories of barriers to the implementation of renewable energy technologies.

When deciding on the final categories, however, I only chose barriers relevant to the residential sector in order to narrow it down to only those barriers that would directly impact vulnerable households. Thus, market barriers and failures and institutional and regulatory barriers were not included. Since those two barriers are generally the causes of many of the other barriers listed, they would need to be addressed on a larger-scale and so would not be effectively addressed by programs targeted at the residential sector. In other words, they impact vulnerable households indirectly. The specific market failure of split incentives, however, was included as a category since it is directly relevant to vulnerable households. As a subset of 'lack of awareness and information,' Internet access was included as an additional barrier.

The final categories are as follows: financial and economic constraints, lack of awareness and information, technical risks, split incentives, behavioural barriers, and infrastructure.

2.3 Determining Policy Characteristics

From the information found on each barrier in Section 2.1, I created a list of essential criteria for each barrier that a policy must meet in order to be determined as addressing that barrier. This criteria is my own interpretation of the academic literature and I acknowledge that additional ways of addressing each barrier are possible. The criteria served as a framework for assessing each policy's adequacy in addressing the main barriers.

2.4 Creating an Inventory of Available Policies

Through online sources (i.e. government websites and documents, and newspaper articles), I created an inventory of available NSW government policies and other programs in NSW of interest to the Z-NET Community Reference Group that support households in transitioning to renewable energy and implementing energy efficiency measures. Some federal government policies were included if they were a part of the other policies (e.g. the NSW Renewable Energy Action Plan supports and builds off of the Commonwealth Government's Renewable Energy Target).

The descriptions of the policies are not all inclusive, as I only took out elements of each policy that were relevant to or targeted at the residential sector and/or vulnerable households. NSW government programs like the NSW Renewable Energy Action Plan and the NSW Energy Efficiency Action Plan have many components and the parts represented in this report are only a small selection of all the programs they offer and goals they aim to achieve.

I provided a brief description of each policy and program, conducting a small literature review, in order to give the reader a clear image of what each program does and how it could be helpful (or not helpful) to vulnerable households in transitioning to renewable energy. The four categories of types of policies in the inventory are: Energy Efficiency, Renewable Energy, Solar PV, and Financial Assistance.

2.5 Assessing the Framework

To determine whether a policy was adequate in supporting vulnerable households to transition to renewable energy, I looked at the amount of barriers each policy addressed. To do this, I created a table to display the data and conduct the assessment (*See Table 1).* By using the policy framework created in section 2.3, each policy chosen from the inventory was assessed based on its ability to meet the criteria for each barrier. If a policy successfully met the criteria, it received a check mark and if it did not then the box was left blank. The percentages were calculated for both the amount of barriers each policy addressed and the amount of policies that addressed each barrier. These percentages presented the option of two different types of analysis, but the focus of the report was on the adequacy of the existing policies, and so the analysis focused on the amount of barriers each policy addressed. I added an additional section on barriers that still need to be addressed, utilizing some data from the percentages of policies that addressed each barrier.

3. Barriers to Renewables

Any policy that will effectively support vulnerable households in transitioning to renewable energy (and as part of that transition, the uptake of energy efficiency measures) needs to address the potential barriers involved. To identify barriers in implementing renewable energy technologies (RETs), Reddy and Painuly conducted a survey in Maharashtra, India, the developing country with the largest and most extensive renewable energy program. They surveyed a variety of stakeholders including households, industrial firms, wind energy developers, and policy experts to determine their perspective on what the most significant barriers were (2004, p.1433). Reddy and Painuly (2004, pp. 1435-7), grouped the barriers to the implementation of RETs into six different categories: financial and economic constraints, lack of awareness and information, technical risks, market barriers, institutional and regulatory barriers, and behavioural.

3.1 Financial and Economic Constraints

Currently, few RETs can compete with conventional fuels strictly based on initial prices (Reddy & Painuly, 2004, p.1446). As mentioned in the *Introduction*, because low-income households spend a larger proportion of their income on electricity (some as much as 20%), policies need to be implemented that protect them from the higher energy prices that could result from switching to renewable energy (Sovacool, 2009, p.1536).

3.1.1 High Upfront Costs

Although RETs are cost-competitive on a life-cycle basis, their initial costs tend to be uncompetitively high compared to other forms of conventional energy (Beck & Martinot, 2004, p.366; Reddy & Painuly, 2004, p.1436; Painuly, 2001, pp.79-80; Cabraal, Cosgrove-Davies, & Schaeffer, 1996, p.xi; Dillahunt, Mankoff, Paulos, & Fussell, 2009, p.6). For example, solar home systems have low operating and maintenance costs in comparison to fossil fuel alternatives, but because of this, the system's initial capital cost is very high in proportion to its total life-cycle costs, typically more than 75 percent (Cabraal et al., 1996, p.25). This proportion is an issue because instead of minimizing their operating costs, which run over a longer period of time, many consumers prefer to keep their initial costs low, particularly in households where there is a lack of access to cash and/or credit (Reddy & Painuly, 2004, p.1436). In the context of solar home systems, Cabraal et al. mention that consumer willingness and capacity to pay is influenced more by the size of the down payment than by the number or size of the monthly payments (1996, p.25). This would be particularly relevant to vulnerable households who do not have enough disposable income to afford the down payment.

In fact, from a survey given to households currently using or considering purchasing a solar water heater, Reddy and Painuly found that the majority of households (24%) voted financial cost as the leading barrier in the diffusion of solar water heaters. At the current prices of solar water heaters, only 17% of households were willing to buy one and of those who did 57% had to take out a loan to purchase it (2004, p.1438). Likewise, the policymakers and energy experts surveyed ranked economic and financial barriers as the most significant barrier to implementing RETs, partly because RETs are more expensive to implement than competing fuels like grid electricity (Reddy & Painuly, 2004, p.1442).

High-efficiency products and services can also have high upfront costs that reduce their appeal and accessibility, even though they would be cost-effective in the long run (OEH, 2013, p.4). For example, technical energy-saving measures are generally seen as an expensive way to reduce energy use because they often require an initial investment, although in the long term they can be cost-effective (Poortinga et al., 2003, p.51). An example of a technical energy-saving measure would be to improve the energy-efficiency of products or replace less energy-efficient products with new ones (Poortinga et al., 2003, p.52). These measures would be of particular use to people in low-income households, as they tend to have inefficient and old appliances with low upfront costs, but high running costs (ACOSS, 2013, p.6).

In a study by Poortinga et al., people with higher incomes found technical measures relatively more acceptable than people with low or average incomes, likely due to the fact that technical measures require an initial investment (2003, p.60). Low-cost practices like the installation of low-energy light bulbs have been widespread in Australia, but more expensive measures such as roof insulation, the installation of solar panels, or the purchase of new energy-efficient equipment have not been options for households with limited incomes (Chester, 2013, p.124). Without government assistance, it seems that purchasing RETs and energy-efficient products may be unrealistic for vulnerable households who do not have enough money to afford the upfront cost.

3.1.2 Lack of access to affordable credit

Another issue facing vulnerable households in transitioning to renewables is the lack of access to affordable credit (Painuly, 2001, pp.79-80; Oliver & Jackson, 1999, p.381; Beck & Martinot, 2004, p.1438). Vulnerable households may not have access to credit because they do not have adequate security or collateral for a loan, and/or because they have poor credit (Beck & Martinot, 2004, p.366; Cabraal et al., 1996, p.xi). For example, many low-income families have low credit scores and most solar leasing companies require a credit score of at least 700 (Guevara-Stone, 2014).

Financial institutions tend to have a perceived risk around renewables and may be unwilling to loan money or will only lend at a high interest rate (Painuly, 2001, p.80). Additionally, available loan terms might be too short relative to the necessary investment period (Beck & Martinot, 2004, p.369). For example, Cabraal et al. point out that term credit for the purchase of solar PV systems is unavailable in most countries. Where commercial financing or leasing schemes are available, a down payment of 25-30 percent is often required in addition to high interest rates. Furthermore, the loan repayment periods tend to be on the shorter side at around 2-3 years. This combination of high interest rates and short repayment periods increases the size of monthly payments, reducing the number of households that can buy solar PV systems on credit (1996, p.26).

Since more capital is being risked up front, capital markets may demand a premium in lending rates for financing renewable energy projects, further raising the costs of loans for households (Beck & Martinot, p.366). Lastly, for households that have irregular income streams such as those where the household head is seasonally employed or consistently in and out of employment, flexible payment schemes on loans are necessary (Cabraal et al., 1996, p.xii). Without credit, it may be virtually impossible for vulnerable households to afford to purchase or invest in a renewable energy system.

3.2 Lack of awareness and information

Another barrier to implementing renewable energies in vulnerable households is the lack of awareness and information. There is inadequate information available on RETs and their costs, benefits, and potential (Painuly, 2001, p.82). Households may also have little confidence in their ability to obtain reliable information, not to mention that collecting information and processing it consumes time and resources (Reddy & Painuly, 2004, pp.1435-7). If there is available information, it may be complex, causing the problem of 'perceived information overload', when what households really need is specific and simple information (Reddy & Painuly, 2004, pp.1437). There are also the two preliminary issues of households not knowing where to find information and not having the desire to seek out information in the first place (Lorenzoni et al., 2007, p.450).

Similarly, suboptimal investments in energy efficiency often occur because of insufficient and incorrect information (Brown, 2001, p.1201). There are information gaps and asymmetry in the available information, meaning that consumers are often not aware of available opportunities or cannot evaluate different offers from tradespeople and suppliers (OEH, 2013, p.4). Information on energy efficient products and services can be expensive and difficult to obtain and the time and cost of collecting the information adds to the transaction costs for the consumer (Brown, 2001, p.1201; OEH, 2013, p.4).

Furthermore, vulnerable households may have little or no access to technology (i.e. computers, Internet) to look up information on their own (Painuly, 2001, pp.79-80). Almost 1.5 million low-income households in Australia do not have home internet access and so cannot readily access information about programs intended to assist them (Chester, 2013, p. 125). Having to find a way to gain Internet access would inevitably take away important time that could be spent otherwise, such as looking for a job. Additionally, a household's proficiency in language and literacy issues can serve as information barriers (ACOSS, 2013, p.7). Taking these information barriers into account, sticking with electricity from the grid may seem like the simpler and more reliable option to vulnerable households.

3.3 Technical risks

Technical risks relate to the technical performance of RETs and the unreliability about their performance (Reddy & Painuly, 2004, p.1436). Most RETs have been proven to be low risk, but because the RET market is relatively new, investment in RETs represents a higher technical and financial risk than conventional technologies (Reddy & Painuly, 2004, pp.1436-7). Technical risks for vulnerable households in terms of the implementation of renewable energy and energy efficiency measures are technological complexity and maintenance, and feedback.

3.3.1 Technological Complexity & Maintenance

In some RET markets, there may be a lack of skilled personnel who can install, operate, and maintain the technologies (Beck & Martinot, 2003, p.370; Painuly, 2001, p.80). This can lead to uncertainty and unreliability in the capability of project developers to successfully implement RETs in a home. There is also the issue of a wide variety of RETs to choose from and how to choose the right one (Oliver & Jackson, 1999, p.381). This is also the case with selecting and installing energy-efficient equipment, which may prevent many cost-effective investments from being made (Brown, 2001, p.1201).

For example, with solar PV systems there is a wide range of products available from a variety of manufacturers (Oliver & Jackson, 1999, p.381). Therefore, system installers must have a significant level of technology-specific knowledge to choose from all the options in order to meet the particular household's needs, taking into account a variety of variables including the household's available resources, price limitations, and time constraints (Oliver & Jackson, 1999, p.381). Standardizing solar PV systems (and other RETs) to an extent would improve their penetration and enable them to become more user-friendly (Oliver & Jackson, 1999, p.381). Adequate training for project

developers and system installers will be necessary to make RETs' implementation a lower risk investment.

In order to keep maintenance costs low, user education on maintaining RETs is essential. Education and training in simple maintenance and safe operating procedures should be given to the person in the household who will have primary responsibility for the system (Cabraal et al., 1996, p.xiv). Enabling households to maintain the system themselves rather than having to call in an expert will save money and reduce overall costs.

3.3.2 Feedback

The feedback from the technology, in other words how long until the household realizes its benefits (e.g. savings, improved services, etc.), is also a significant factor in the level of technical risk for renewables and energy efficient equipment. In Reddy and Painuly's survey, 44% of industrial firms said that technical barriers were the most significant in the diffusion of solar water heaters because of their performance, namely the high maintenance costs and claimed savings that were not as expected. Firms also wanted a shorter payback period, which can be thought of as the time it takes for the RET to "pay for itself" (2004, p.1439). Painuly (2001, pp.79-80) points out that RETs generally have a high payback period, which can be unviable, especially for vulnerable households.

One other issue vulnerable households may face related to the quality of RETs is the tendency for system providers to reduce their costs by decreasing the system's quality or support services (Cabraal et al., 1996, p.xiv). Low-quality systems can undermine the credibility of RETs as a viable energy source for vulnerable households, and so it is important that to reduce costs, low-capacity and high-quality products are offered instead (Cabraal et al., 1996, p.xiv). While this will provide a limited level of service, it will not threaten the integrity of RETs on the market.

In a study done in the U.S. by Dillahunt et al., all of the low-income households interviewed claimed they received little or no feedback about their energy use, including both those who paid for their own energy and those whose energy was subsidized. For those whose energy was subsidized, they usually did not receive a bill or feedback of any kind (2009, p.8). Those with a set quota received no information unless they exceeded the quota and those who received bills felt they were not supplied adequate information and that the information was received too late to do anything about it (Dillahunt et al., 2009, p.7). In the U.S., residential consumers get a monthly electricity bill that provides no breakdown of individual end-uses, which Brown compares to shopping in a supermarket that has no prices on the products. The consumer will get a bill at the checkout counter,

but have no idea what the individual items cost (2001, pp.1201-2). This analogy shows how hard it would be for a household to manage its energy consumption without receiving adequate feedback on its energy use, making energy efficiency a hard goal to achieve.

3.4 Market Barriers and Failures

Market barriers and failures refer to, "any factor which explains why technologies which appear cost effective at current prices are not taken up while market failures refer to those market barriers which correspond to market imperfections" (Reddy & Painuly, 2004, p.1436-7). In order to be efficient, markets need to be competitive, and in current situations where electric utilities are able to charge prices in excess of marginal costs, the market is not efficient (Reddy & Painuly, 2004, p.1436). Relevant to vulnerable households, an example of such a barrier includes subsidies favouring conventional energy, which in turn adversely affects the competitiveness of renewable energy (Painuly, 2001, pp.79-80). Furthermore, environmental externalities, such as real costs to society in terms of human health, infrastructure decay, and declines in forests and fisheries, are not included in the costs of fossil fuel energies, making their prices lower than they should be in reality (Beck & Martinot, 2004, p.367). For all these reasons and more, the prices of renewable energies remain high, making conventional energies the more affordable option.

Another market failure is split incentives, which Reddy and Painuly discuss with the most common example of landlords and tenants in the housing market. The landlord of the building may be unwilling to install a solar PV system, for example, since the tenant would be the one to realize the resulting savings. At the same time, the tenant may be unwilling to install the system because he or she may move out before benefiting from the cost savings (2004, pp.1436-7). Similarly, landlords do not have any reason to invest in energy efficiency. In Australia, landlords cannot claim a tax deduction for energy efficiency upgrades (ACOSS, 2013, p.7). They can, however, claim a deduction for spending on 'maintenance,' including 'like for like' replacement of inefficient appliances, which is essentially replacing the same appliance with a new one (ACOSS, 2013, p.7). Split incentives are particularly important when looking at vulnerable households as the majority (68%) of low economic resource households in Australia are renters (ABS, 2013, sec.5).

3.5 Institutional and Regulatory

Painuly gives examples of a few barriers falling under this category, one being the lack of institutions and mechanisms available to support the uptake of renewable energy and disseminate information about RETs to the general public. There needs to be more research and development in renewable energies and the lack thereof makes them a higher-risk investment, therefore more costly,

and also inhibits the possibility of more efficient systems in terms of costs and increased energy production. There is also insufficient legal and regulatory framework for renewable energy, national or otherwise, which may cause renewable energy producers to face market/economic/financial barriers. Lastly, the lack of private sector participation in the RET market keeps the market small with a lack of competition, further increasing prices and retaining the market's inefficiency (2001, p.80). While the institutional and regulatory barriers are not directly related to vulnerable households, they include some barriers that are the root causes of many of the barriers to the implementation of renewable energy in vulnerable households.

3.6 Behavioural Change

Behavioural change is an underlying psychological barrier to getting households to adopt renewable energy systems and increase their home's energy efficiency. Morgan, Hine, Bhullar, and Loi (2015, pp.36-37) conducted a study to identify the primary psychological drivers and barriers associated with the adoption of low emission agricultural practices (LEAP) using a sample of 551 Australian farmers. They found that farmers were more likely to adopt LEAP if they perceived a financial benefit, possessed both knowledge and financial efficacy, were high in ecocentrism and low in environmental apathy, and were future-oriented (2015, pp.40-41).

Stern (2000, p.416) grouped the influences on environmentally-significant behaviour into four categories: 1) attitudes, values, and beliefs (relating to the environment, but also to other aspects such as comfort and quality), 2) contextual forces (including social, economic, institutional, and political factors), 3) personal capabilities in terms of knowledge, skills, and resources, and 4) habit. Stern asserted that strategies need to be employed that influence more than one of these categories in order to have a significant impact on behavioural change. For example, Stern found strong evidence that combining financial incentives with information can be much more effective than employing each separately (Stern, 1999, p.467).

Taking from both Morgan et al. and Stern, the categorizations for barriers to behaviour change relevant to vulnerable households are as follows:

3.6.1 Comfort and Sacrifice

Adopting RETs is often perceived to be accompanied by discomfort and sacrifice rather than providing equal, but cheaper services that use less energy (Reddy & Painuly, 2004, p.1437). Likewise, behavioural energy-saving measures are often associated with additional effort or decreased comfort, such as reducing one's car use and having to adjust his/her lifestyle (Poortinga et al., 2003, p.51).

Whitmarsh conducted a quantitative survey of Hampshire residents, a county in Southern England, to examine the UK public's energy conservation practices and actions taken "out of concern for climate change." Whitmarsh found that actions which are easier to perform, such as recycling and turning off lights, are more likely to be linked to environmental attitudes, while actions which are perceived to require sacrifice like avoiding driving are more dependent on conducive circumstances. For example, the study found that environmental concern more often motivates recycling and domestic conservation than transport-related conservation (2009, pp.16, 20). This suggests that households expressing environmental concern are more likely to engage in energy conservation measures that are "easier" and may not require much sacrifice than ones that are perceived to require sacrifice.

Lorenzoni, Nicholson-Cole, and Whitmarsh conducted three mixed-method studies in the United Kingdom (Norwich, Norwich and Rome, South of England) to identify perceived barriers to engaging with climate change. They found that some individuals supporting climate change mitigation are simply unwilling to adopt certain actions, rather than being unaware of what to do. They also found that different barriers often work together to exacerbate the constraints to engagement such as the perceived unavailability of efficient and accessible public transport, in addition to the convenience and habitual use of a car, as reasons for continuing to use public transport (2007, p.449).

The studies by Lorenzoni et al. also found that a reluctance to change lifestyles was a significant barrier in contributing to climate change mitigation. Respondents said that not only would doing so be an inconvenience, but it would also be a threat to their current standard of living. They perceived that personal actions to mitigate climate change would only be achieved through great discomfort and a sacrifice of current living standards and their social image (2007, p.453).

3.6.2 Environmental values and connection

Ecocentrism is an environmental worldview that sees nature as having intrinsic value and thus gives it moral consideration, while environmental apathy refers to the view that nature is not valued at all (Kortenkamp & Moore, 2001, p.262; Morgan et al., 2015, p.36). Casey and Scott found that high levels of ecocentrism and low levels of environmental apathy are correlated with higher levels of pro-environmental behaviour (2011, p.64). Similarly, Stern's (2000, p.412) value-belief-norm theory of environmental intent states that those who believe climate change threatens the non-human world, and who value it, tend to be more willing to mitigate climate change. This indicates that the environmental values one holds may affect one's decision to take pro-environmental action, such as improving the energy efficiency of their home.

The second part to address is the connection to the environment, or in other words a 'sense of place.' Rogers and Bragg define 'sense of place' as, "a psychological construct that involves attributing a geographical location with meaning, values, and a sense of 'connection.'" The purpose of their study was to examine the relationship between sustainable lifestyles and a 'sense of place' in urban environments through interviewing activists in Melbourne. The study found that it was the participants' broader feelings of connection with nature and the community that made them take pro-environmental action (2012, p.307). This research suggests that a disconnect to the environment and a lack of involvement in one's community may make people less likely to take pro-environmental action, such as installing a renewable energy system or taking energy efficiency measures.

3.6.3 Financial Benefit

There is a significant amount of evidence indicating that financial factors have a role in influencing pro-environmental behaviour (Morgan et al., 2015, p.37). In Whitmarsh's survey of UK residents, she found that less than a third of all respondents have taken measures to conserve energy explicitly out of concern for climate change, rather they tend to do so for reasons unconnected to the environment. Energy reduction is more often motivated by economic self-interest and other tangible benefits, such as saving money, than by environmental concern (2009, p.18, 21). Out of all the low-income houses interviewed, Dillahunt et al. (2009, p.5) found that 35% of participants said the primary reason they engaged in energy saving behaviours was to save money. In the study done by Morgan et al., one of the main two influencing factors that drove the farmers' decisions to adopt LEAP was anticipated financial benefits (2015, p.42). Another example is a study done in the Netherlands by Poortinga et al, which found that behavioural measures to reduce direct energy use were more acceptable to respondents with a low-income. The theory for this was that behavioural measures are more acceptable to low-income respondents because they are generally cost saving (2003, p.60-1). From these examples, financial benefit in the sense of cost-savings seems to be a motivating factor in pro-environmental behaviour.

3.6.4 Knowledge and financial efficacy

Self-efficacy, an individual's perceived ability to engage in a behaviour, has repeatedly been found to be an important predictor of pro-environmental behaviour and has been associated with several specific agricultural conservation behaviours (Morgan et al., 2015, p.37). This includes both the knowledge and skills to successfully engage in the behaviour and the financial resources required to do so (Morgan et al., 2015, p.37). In the study done by Morgan et al., one of the main influencing factors that drove the farmers' decisions to adopt LEAP was knowledge self-efficacy (having relevant knowledge and skills) for the adoption of a given farming practice (2015, p.42). In the study

by Lorenzoni et al., respondents indicated that the perceived barriers to engaging in climate change were a lack of experience and understanding of how to engage and why they should, and their inability to make an impact (Lorenzoni et al., 2007, pp.451-452). This lack of self-confidence could present itself as a significant barrier in installing a renewable energy system, as households may not believe they have sufficient knowledge and skills to maintain the system or choose the right one to implement. Furthermore, a household's ability to communicate and negotiate with energy suppliers, in addition to being uninformed about their options, can contribute to feelings of disempowerment or being coerced into an outcome more preferable to the company than the household (Chester, 2013, p.125).

3.6.5 Habit

Habit has an important role in environmentally significant behaviour (Stern, 2000, p.417). Consumers tend to resist change and may not be interested in shifting from their current technology to another one (Reddy & Painuly, 2004, p.1437). This may especially be prevalent if there are no issues with the current technology and making a switch may seem like an unnecessary inconvenience. In the survey conducted by Lorenzoni et al., many respondents identified the current social norms and expectations that required carbon-dependent lifestyles as a significant barrier to taking action in mitigating climate change. Respondents indicated that socially-acceptable behaviour such as driving to work and going to the supermarket each week had become habitual and unquestionable behaviours. It is argued that once people become used to a particular standard of living, their perceptions of needs versus wants change. For example, participants talked about "needing" a car to get to work, do the shopping, take the children to school, etc. without considering alternative options (2007, p.453).

In fact, 13% of respondents from Norwich, when asked why they had not or were not willing to change their behaviour to reduce their individual contribution to climate change, claimed there was a lack of suitable alternatives to current behaviour, while 7% claimed they "needed" to keep their present lifestyle (Lorenzoni et al., 2007, p.450). Jackson indicates that habitual behaviours often undermine even the most determined intentions to change and are an important structural feature of behavioural 'lock-in'. Habit is one of the greatest barriers facing behavioural change policy since it is such a key feature of many environmental behaviours (2005, p.ix).

3.7 Other barriers: Infrastructure

The last major category relevant to vulnerable households is infrastructure, specifically structural inefficiencies and tenure type. Interviews done in U.S. households falling below the poverty line indicated that the primary barriers facing participants were financial issues and structural

inefficiencies (Dillahunt et al., 2009, p.5). The structural inefficiencies of living spaces, such as poor insulation, can cause draughts, which present themselves as a huge barrier to saving energy in vulnerable households (Dillahunt et al., 2009, p.6). In the study, one public housing tenant had even overcompensated for the air leaks by turning up the heat (Dillahunt et al., 2009, p.6). Aggregate data provided to the Australian Council of Social Service from the NSW Home Power Savings Program showed that 77% of low-income homes that the program visited had gaps in doors and windows (HPSP 2013). Without insulation, up to 35% of the energy used for heating and cooling can 'leak' out of a home, and draughts can account for up to 25% of heat loss during winter (DRET, 2010, p.101).

Tenure type is also a barrier, specifically rental housing and group homes. In these cases, the issue presents itself because the residents do not own their dwelling structure and therefore have limited decision- making (Dillahunt et al., 2009, p.8). Dillahunt et al. point out that a major barrier to saving energy for their study's participants was the lack of control they have of services (e.g. recycling), the home itself, other household members, and members of the broader community (2009, p.6). Since the decisions to both install a renewable energy system and implement energy efficiency upgrades are up to the landlord, this can make it impossible for tenants to take either measure. Even with free energy efficiency upgrades, aggregate data released by the NSW Home Power Savings Program revealed that only 10.2% of private landlords gave consent for the program to install free efficient showerheads and draught strips for the low-income renters that were participating (HPSP 2013).

4. Policy Framework

The final categories are as follows: financial and economic constraints (incl. high upfront costs and lack of access to affordable credit), lack of awareness and information (incl. internet access), technical risks (incl. technological complexity & maintenance and feedback), spit incentives, and behavioural (incl. comfort & sacrifice, environmental values & connection, financial benefit, knowledge & financial efficacy, and habit), and infrastructure (structural inefficiencies and tenure type).

The descriptions of what criteria a policy must meet to be determined as addressing each barrier are as follows:

4.1 Financial and Economic Constraints

4.1.1 High Upfront Costs

Must do one of the following:

- Eliminate the upfront costs entirely, or
- Provide a discounted initial price for the system, product or service
- May also spread these costs out over time

4.1.2 Lack of Access to Affordable Credit

Must provide loans with one or more of the following:

- Low-interest
- No interest
- No upfront costs or down payment
- Longer repayment periods
- Flexible payment schemes
- No extra fees

4.2 Lack of Awareness and Information

Must do one or more of the following:

- Provide reliable, sufficient, and up-to-date information
- Include information on both the costs and benefits of the system, product, or service (i.e. no bias)
- Provide information that is simple and easy-to-understand
- Increase the supply of available information
- Create awareness on where to find information
- Give information on all different options for easy comparison and/or an explanation on how to compare them
- Make information free and easy to obtain
- Provide information for those who are not proficient in English and/or those who are illiterate
- Create awareness in the community about possibilities for renewable energy and/or energy efficiency and the opportunities for individual households

4.2.1 Internet Access

- Provide ways of obtaining information without the Internet.

4.3 Technical Risks

4.3.1 Technological Complexity & Maintenance

Must do one or more of the following:

- Provide households with skilled and trained installers and system providers to ensure that the equipment is reliably implemented
- Provide or mandate training for the installers and/or tradespeople that sell the services
- Ensure that households have access to trained personnel who can help them in choosing the right renewable energy system or energy efficient appliance
- Ensure low maintenance costs for RETs
- Either have installers and system providers keep up the maintenance of the technology or train the household how to do it

4.3.2 Feedback

Must do one or more of the following:

- Provide a short or shorter than average timeframe in which the household realizes the benefits from installing the system or purchasing the equipment. Examples:
    - Cash savings (e.g. reduced electricity bills)
    - Short payback period (i.e. the time it takes for the household's investment, such as paying the upfront cost of the system, to be paid off)
    - Improved services (e.g. a warmer house through energy efficient building upgrades)

4.4 Split Incentives

Must do one of the two:

- Provide incentives for landlords and property owners (home vendors) to install a renewable energy system or make an energy efficient building upgrade, or
- Provide incentives for tenants and homebuyers to do so.

If the policy provides incentives for tenants and homebuyers, then it must also address the problem of how to enable them to install a solar PV system on the roof, for example, when they are not the building owner. Potential solutions to this could be a state mandate for residential buildings to install solar PV systems, or back to the first solution of providing incentives for the landlords and home vendors.

4.5 Behavioural Change

4.5.1 Comfort and Sacrifice

Must do at least one of the following:

- Persuade households that there will not be sacrifice and/or discomfort

- Convince households that any sacrifice and discomfort will be worthwhile for ____ reason, or
- Provide a way to implement renewables or energy efficiency upgrades without resulting in discomfort and sacrifice

4.5.2 Environmental Values and Connection

Must do one or more of the following:

- Influence the household's environmental values
- Educate on climate change
- Help develop a 'sense of place' by creating a connection to the surrounding environment in terms of the landscape and/or the community

4.5.3 Financial Benefit

A policy effectively addressing financial benefit as a perceived barrier to behavioural change will provide some sort of financial incentive, such as a feed-in tariff or cash savings, that motivates households to take pro-environmental action in the form of switching to renewable energies or making energy efficiency upgrades.

4.5.4 Knowledge and Financial Efficacy

Must do all of the following:

- Ensure that the household feels confident in its ability to choose the right option
- Ensure that the household has sufficient and reliable knowledge to make its own decision, or
- Enough trust in the ability of another stakeholder to make the decision
- Ensure that the household feels capable in its ability to pay for the system/equipment
- Ensure that the household has the ability to maintain the system/equipment, or
- Can call upon a reliable installer/system provider to do so

4.5.5 Habit

Must do at least one of the following (or another innovative approach):

- Provide incentives to <u>want</u> to change habitual behaviour
- Convince households to change habits (i.e. through information)
- Change household's perceptions of needs vs. wants
- Make the new behaviour a trend, enticing people's desire to be like everyone else
    - Get the majority of the community on board

4.6 Infrastructure

4.6.1 Structural Inefficiencies

A policy effectively addressing structural inefficiencies as a barrier is most relevant to energy efficiency. This policy would take measures to improve the household's dwelling structure in terms of energy efficiency. This could mean improving the home's insulation through building upgrades such as double glazing the windows and draught proofing.

4.6.2 Tenure Type

A policy that adequately addresses the barrier of tenure type will specifically target renters and those living in group housing. It will make implementing renewable energy technologies and/or making energy efficiency upgrades accessible to these two groups.

5. Existing Policies

5.1 Energy Efficiency Policies

Why energy efficiency?

As mentioned in the *Introduction,* the Z-NET project aims to improve the energy efficiency of households in Uralla to make the goal of 100% renewable energy easier to attain, so that less total energy is required to power the town (Z-NET, 2015c). Not only will increased energy efficiency help Uralla achieve its goals, but it will also contribute to making Uralla more sustainable. Through its research, the Office of Environment and Heritage has found that 28% of NSW energy use can be avoided through energy efficiency measures. This research has been confirmed through energy assessments of over 160,000 low-income households and 17,000 small to medium-sized businesses, which all together would account for $5.2 billion in energy savings through energy efficiency (2013, p.3). Energy efficiency measures include: improving the energy-efficiency of products, using products in a different way, and shifting consumption (Poortinga et al., 2003, p.52). Using the example of transportation via automobiles, improving the energy-efficiency of the car would be switching to a more fuel-efficient car, using the car in a different way would be reducing car use by taking public transportation instead, and shifting consumption would be buying a bike as an alternative method of transport.

5.1.1 The NSW Energy Efficiency Action Plan (EEAP)

The NSW Office of Environment and Heritage (OEH) has developed the Energy Efficiency Action Plan to reduce electricity bills for households and improve energy productivity for businesses. One of its primary goals is for NSW households and businesses to achieve annual energy savings of

16,000 GWh by 2020 (2013, para.1 &3). It aims to assist households in reducing their energy bills through the following energy initiatives: the Energy Efficient Homes Program, the Smarter Choice Retail Program, and the Energy Savings Scheme (NSW OEH, 2015a).

5.1.1.1 The Energy Efficient Homes Program

In 2015, the Energy Efficient Homes Program, also known as the Home Energy Action Program, will put $26.8 million towards high-return energy efficiency improvements for low-income households in NSW, including those who are renting their homes (OEH, 2015a). It will also work in partnership with community housing providers to upgrade community housing properties for low-income tenants (OEH, 2015b, para.3). The program will work with the Energy Savings Scheme (ESS) and the BASIX program to achieve its goals (OEH, 2013, p.12).

The OEH states that the program's first step in achieving its goal will be to influence energy consumption by changing consumer behaviour. This will happen by providing incentives through the ESS that encourage energy retailers and networks to develop new innovative behaviour change programs that save energy. For example, giving households information on how their energy usage compares with other households. The next step will be to address the limited time available to households to effectively assess energy efficiency options and determine the best one. To address this, the ESS will provide incentives for tradespeople to reduce the cost and increase the quality of household upgrades to lighting, fixed appliances, and building fabric. It will also train and license tradespeople in using the ESS home retrofit tool to identify the appropriate energy efficiency opportunities for each individual household (2013, p.12).

The program will also address the high upfront costs of energy efficient appliances by providing appliance retailers with access to ESS incentives to make high-efficiency appliances more affordable and accessible for households (OEH, 2013, p.13). Energy efficiency upgrades can also have expensive upfront costs, and the program will work to eliminate this by enabling affordable private financing for residential building energy efficiency upgrades that will reduce the overall costs, spread the upfront costs over time, and allow tenants and owners to share the costs and benefits of energy efficiency (OEH, 2013, p.15).

The OEH states that the Energy Efficient Homes Program will provide training for appliance retailer staff, who often provide other goods and services besides energy-efficient appliances, so that households can have access to reliable information when purchasing new, more efficient products. Information will be available both online and at the point of sale for customers to make informed decisions about the best energy efficient appliances available to them (2013, p.13). The program will

work with industries to provide households and their service providers with online access to energy savings tips, the ESS home retrofit tool, and household energy efficiency datasets (OEH, 2013, p.15).

Lastly, the Energy Efficient Home Program aims to address split incentives, both between tenants and owners, and vendors and home buyers (OEH, 2013, p.14). To encourage landlords and vendors to upgrade their properties and boost their sale price, the NSW Government will work on implementing a voluntary rating system for residential buildings at the point of sale or lease (OEH, 2013, p.14).

- ***Energy Efficient Homes Program and the Building Sustainability Index (BASIX)***

The NSW Office of Planning and Environment gives the following information about BASIX: BASIX, the Building Sustainability Index, is implemented under the Environmental Planning and Assessment Act and applies to all residential dwelling types. Its aim is to deliver equitable and effective water and greenhouse gas reductions across NSW by reducing water and energy consumption in NSW households. In other words, it regulates the energy efficiency of residential buildings by mandating that houses at the point of development meet certain benchmarks in terms of water efficiency, thermal insulation, and energy usage. An online assessment tool is provided to rate the expected performance of any residential development, and a certificate is required in order for the residential unit to be developed (n.d.).

- ***Energy Efficient Homes Program and the Home Power Savings Program***

Another aspect of the Energy Efficient Homes Program is in conjunction with the Home Power Savings Program. The NSW Home Power Savings Program (HPSP) started in 2010 and is ongoing, having already helped 225,000 low-income households in NSW to collectively save 120,000 MWh of electricity and over $36 million on their power bills each year (OEH, 2015a). The program works with low-income earners, pensioners, and renters, and has helped 30,000 homes where English is the second language (OEH, 2015a). It involves a visit to the household by an energy advisor who provides an in-home electricity assessment followed by a Personal Power Savings Action Plan and, in eligible households, a free Power Savings Kit (Rickwood et al., 2012, p.3). The Power Savings Kit includes a low flow showerhead, up to four energy efficient lightbulbs, an eco-switch to turn off standby power, a shower timer, a tap aerator, draught-proof strips for around the door, and door snakes (Rickwood et al., 2012, p.3).

The Energy Efficient Homes Program aims to build on the success of the HPSP and with its completion, the NSW Government will review energy efficiency programs to identify more opportunities to increase low income households' access to energy efficiency (OEH, 2013, pp.13-14).

5.1.1.2. The Smarter Choice Retail Program

The purpose of the Smarter Choice retail program is to enable households to make informed purchasing decisions when choosing between energy efficient household appliances (OEH, 2015a). Efficient appliances use less electricity to achieve the same level of performance of similar models (Energy Rating, 2014a, para.6). The program requires Energy Rating Labels, which are mandatory for a range of household appliances in Australia and New Zealand, to provide consumers with the product's energy performance information at point-of-sale (Energy Rating, 2014a, para.1 &4). Attached to each appliance, it allows the consumer to compare the appliance to other models by displaying the product's annual energy consumption and its star rating of between one and either six or ten stars, depending on the appliance; the greater the number of stars, the higher the efficiency (Energy Rating, 2014a, para.1).

The labelling goes along with Minimum Energy Performance Standards, which, "establish a minimum level of energy performance that products must meet or exceed before they can be sold to consumers" (Energy Rating, 2014a, para.3). These standards effectively increase the energy efficiency of products and are reviewed continuously to ensure they keep up with advancements in technology (Energy Rating, 2014b, para.5). The running costs over the lifetime of some electrical appliances can greatly exceed the purchase price, making it imperative to consider energy efficiency when looking for a product that has a high long-term value (OEH, 2015c).

5.1.1.3 The Energy Savings Scheme

The Energy Savings Scheme helps households and businesses purchase energy-efficient equipment at a discounted price (OEH, 2015a). The Independent Pricing & Regulatory Tribunal gives an explanation of how the scheme works: electricity retailers have to meet a certain amount of energy savings certificates, or else pay a penalty. Accredited Certificate Buyers, which are the accredited product and service providers, have the ability to create these certificates from energy savings products and activities and sell them to the electricity retailers. The ESS provides incentives for Accredited Certificate Buyers to assist householders with purchasing energy efficient appliances, removing inefficient appliances, installing more energy efficient lighting, or performing an in-home energy assessment and installing products to improve the overall efficiency of the home such as draught proofing and glazing. Accredited Certificate Buyers will either offer these services and products at a reduced cost or offer to install or replace equipment for free. The resulting energy savings are transferred from the householder to the accredited provider, who then creates energy savings certificates that are sold to the electricity retailers (n.d.).

5.1.2 Smart Meters

The NSW Office of Trade & Investment (OTI) describes smart meters as "electricity meters that measure your electricity consumption in real time, and are capable of being remotely read and operated. Installing a smart reader significantly improves your ability to manage your energy consumption and ultimately your bill" (n.d.). Smart Meters measure the amount of electricity used at any given time, providing households with up-to-date information on their energy use and costs (OTI, 2014, para.4). The data collected by the Smart Meter will be available through the internet, a 'portal,' or an in-home display (OTI, 2014, para.7). In most cases, electricity retailers or service providers will pay the up-front costs of the smart meter and its installation (OTI, 2014, para.5).

The OTI points out that, to save money, smart meters enable households to automatically control higher energy appliances, like air conditioners, to run at off-peak times so that high energy costs are avoided. This option is available in certain tariff types, which are available to households to choose from, providing them with access to new and innovative electricity pricing to save on their bills. Three of these tariff types are "1) a price that varies at different times of the day (peak, shoulder, and off-peak) depending on typical demand patterns and the cost of supplying energy at each time, 2) payments being offered back if consumption is reduced at certain times, and 3) the possibility of higher prices during pre-identified critical peaks in energy demand for a few days of the year, in exchange for lower energy prices for the rest of the year"(OTI, 2014, para.4 & 9).

The national regulatory framework for competitive metering is expected take effect in July 2016. NSW encourages competition in metering services and is supporting a voluntary, market led roll-out of Smart Meters to ensure consumer choice (OTI, 2014, para.6). NSW is promoting a uniform, flexible, and low-cost new and replacement meter policy (OTI, 2014, para.6).

The NSW Smart Meter Task Force has identified some issues, however, that may arise with the introduction of smart meters. A major concern is not so much the meters themselves, but the new pricing arrangements, such as Time of Use pricing, that would result. Time of Use pricing could result in some households facing a higher bill than they would have under current retail pricing arrangements. This could become an issue for vulnerable households who cannot change their consumption patterns in response to the new pricing arrangements (n.d., p.5).

The NSW Smart Meter Task Force also details the concern that the benefits would not be shared equally among all households. It specifically refers to vulnerable households (i.e. low income, public/social housing, disabilities), who may not be able to take advantage of the products and services made possible by smart meters without additional government assistance (n.d., p.14).

5.2 Renewable Energy Policies

5.2.1 The Renewable Energy Target

The Renewable Energy Target (RET) is a Federal Government policy with a goal of ensuring that at least 20% of Australia's electricity comes from renewable sources by 2020 (CEC, 2014a). The RET consists of two main schemes: the Large-scale Renewable Energy Target (LRET), which creates financial incentives for large-scale renewable energy power stations, and the Small-scale Renewable Energy Scheme (SRES), which encourages households to install small-scale renewable energy systems such as rooftop solar, solar water heaters, heat pumps, and small-scale wind and hydro systems (CEC, 2014a). The RET has already attracted $20 billion in investment, with more than 24,000 Australians employed in the renewable energy sector in 2012 (CEC, 2014c, sec.2-3).

5.2.1.1 Small-scale Technology Certificates (STCs)

The SRES creates financial incentives for installing renewable energy through the creation of small-scale technology certificates (STCs) (Clean Energy Regulator, 2014, para.1). On a quarterly basis, RET liable electricity retailers are legally required in accordance with the Renewable Energy Act of 2000 to buy and surrender a specific amount of STCs to the Clean Energy Regulator, based on the volume of electricity they purchase annually (Clean Energy Regulator, 2014, para.2).

When a household (homeowner, landlord, or renter) installs an eligible renewable energy system, it is able to claim a set number of STCs based on the amount of renewable electricity the system produces or the amount of electricity consumption it reduces (Commonwealth of Australia, 2014, para.3). The household will receive some sort of financial benefit for the certificates, such as a delayed cash payment or a discount on the invoice, in exchange for the right for the electricity retailer to create and sell the STCs (Commonwealth of Australia, 2014, para.6).

5.2.2 NSW Renewable Energy Action Plan

Released in 2013, the Renewable Energy Action Plan serves as a guide to NSW's renewable energy development (DTI, 2013). The NSW Government is spearheading the plan and is committed to promoting energy security through diversity in energy sources, particularly through increasing the supply of renewable sources (2014, p.3). NSW has the largest installed renewable energy capacity in Australia and an abundance of renewable energy resources (NSW, 2014, p.10). The plan supports the Renewable Energy Target's (RET) goal of achieving 20% of Australia's electricity supply from renewable energy by 2020 (DTI, 2013, p.3).

The Renewable Energy Action Plan has three main goals: attract renewable energy investment (in part to reduce the costs of renewable energy), build community support, and attract and grow

renewable energy expertise, all of which will work together to help NSW become a world leader in renewable energy (DTI, 2013, p.2).

5.2.2.1 Maintain a fair price for solar

The NSW Office of Trade & Investment states that, as part of the Renewable Energy Plan, it aims to provide a sustainable and stable future for the solar industry. It has requested the Independent Pricing and Regulatory Tribunal (IPART) to undertake a review to determine a fair price for small-scale generated solar energy that will not increase electricity prices, not require any additional government funding, be simple to administer, take into account impacts on retailer operations, and support a competitive electricity market in NSW (2013, p.14). In its 2014-15 determination, IPART found the benchmark range for solar electricity fed back into the grid to be between 4.9 and 9.3 cents per kilowatt hour; the NSW government is calling on retailers to offer feed-in tariffs within this range (OTI, 2014, p.4).

5.2.2.2 Online Information Portal

To inform households about the offers available to them in terms of small-scale renewable energy, the NSW Office of Trade & Investment is developing a regularly updated online information portal for small-scale solar PV, solar hot water, and wind generation (DTI, 2013, p.14). The portal will provide clear and relevant information about the various renewable energy technologies and how they can meet the specific needs of different stakeholders (DTI, 2014, p.6). For example, information will be available about renewable energy opportunities in the farming sector that will support investment and income diversification in regional parts of NSW (OTI, 2014, p.6).

5.2.2.3 The Regional Clean Energy Program

The Regional Clean Energy Program was developed to support community engagement in renewable energy projects, both large and small-scale, across a variety of renewable technologies (DTI, 2013, p.18). The NSW government wants local communities to play an active and informed role in discussing proposals for local and community renewable energy projects (DTI, 2013, p.17). For example, the government is currently developing planning guidelines for wind energy projects, which aim to balance the concerns of local residents with the industry and community's interest in the project's development (OTI, 2013, p.16).

Regional coordinators will support local communities and facilitate community ownership of renewable energy projects by providing data and information, tools, standard contracts, and project facilitation support (DTI, 2013, p.18). The program ensures that these communities have the necessary information and resources to understand and evaluate their renewable energy options for

the community's long-term social, economic, and environmental benefit (OEH, 2015). Community-owned renewable energy projects are important because they return profits to the community and build on local skills (DTI, 2014, p.6). To build leadership skills and capacity in regional parts of NSW, the OEH has partnered with the Centre for Sustainability Leadership to pilot a community renewable energy leadership program (DTI, 2014, p.6).

5.2.2.4 The Government Resource Efficiency Policy & GreenPower

The NSW Government Resource Efficiency Policy includes a measure requiring all general government sector agencies (except NSW Local Health Districts) to purchase a minimum of 6% GreenPower annually (DTI, 2014, p.7). GreenPower is a national accreditation program for renewable energy that enables households to purchase renewable energy from their energy providers as part of their energy consumption (GreenPower, 2011). Households agree to pay for a percentage of their energy consumption (10%-100%) to come from a renewable energy source (GreenPower, 2011). Once paid for, the GreenPower Provider buys the equivalent amount of renewable energy from a government accredited renewable energy source that is then added to the grid on behalf of the household (GreenPower, 2011).

It is estimated that if a household purchases 100% GreenPower, then it can reduce its greenhouse gas emissions by up to 50% (GreenPower, 2011). Buying GreenPower costs more than standard grid electricity, but it is estimated that costs will decrease as the infrastructure and demand for renewable energy grows, since the bulk of the premium paid to purchase GreenPower is invested directly back into Australia's renewable energy sector (GreenPower, 2011). Depending on the consumer's budget, energy retailers offer a range of GreenPower options, some offering 10% GreenPower at no additional cost, but typically it costs around $1 a week for 10 % to $7 a week for 100 % (DTI, n.d.a).

5.3 Solar PV Programs

Why Solar PV?

In the past five years, Australia and the rest of the world have experienced a significant decrease in the cost of solar PV systems, coinciding with an increase in retail electricity prices, making solar power a "real alternative and considerable player in the power markets" (Mitchell, 2015, para.1 & 6). Australia's solar industry is growing rapidly, with the price of an average solar PV system now competitive in some areas with daytime retail electricity prices (Flannery & Sahajwalla, 2013, p.4). As mentioned in the *Introduction*, the Z-NET project has indicated that there is great potential for the implementation of solar PV systems in Uralla (Z-NET, 2015**,** p.10).

5.3.1 "Our Solar Future"

The Southern Sydney Region of Councils (SSROC) and eight of its member Councils, partnering with Energy Matters, an Australia-based SunEdison Company, have launched a new initiative called "Our Solar Future" (Vorrath, 2015, para.2). The initiative's ultimate goal is to have at least 30% of the region's energy needs met by renewable sources (Vorrath, 2015, para.2). "Our Solar Future" will provide residents and small businesses in the region with easy access to inexpensive solar PV systems, solar hot water, and heat pumps (Vorrath, 2015, para.4). The "Our Solar Future" Website provides residents with a checklist to help them decide if a solar system is right for their home, what size system they might need, and approximately how much it will cost (Vorrath, 2015, para.5). Residents are then able to either contact a supplier directly or fill out a quotation request online that will be sent to a supplier (Vorrath, 2015, para.6).

The project has approved eleven suppliers of solar power panels, solar hot water systems, and heat pumps (Grennan, 2015, para.3). These suppliers have been asked to offer solar leasing, which Helen Sloan, the program manager for SSROC, said would "open up solar to people who previously could not afford the upfront cost, allowing them to save money. It may also prove to be a solution for tenants who want to install solar on their rented property-another group currently largely missing out on this savings opportunity" (Grennan, 2014, para. 5). Out of the various solar PV options that the "Our Solar Future" initiative recommends, the two types that I chose to present in this report are residential leasing and council brokering of a bulk-buy.

5.3.1.1 Solar PV Residential Leasing

In the Institute for Sustainable Futures' (ISF) report for the "Our Energy Future" Initiative, Ison et al. explain the concept of solar leasing as a viable option for low-income households that cannot afford the upfront costs of a PV system. With solar leasing, the solar developer owns, installs, and maintains the system, but the household still works with the developer and will typically initiate the project's development. The solar developer facilitates third party investors to pay for the upfront costs of capital and installation. The household is the "host" of the system and pays a regular lease payment or a per kWh payment to the developer, known as a power purchase agreement (PPA), to use the system, which the developer then uses to repay the investor. Essentially, the householder shares the ongoing profits of the system, seen by the householder in terms of an electricity bill reduction, with the funder and the developer, and because of this, the benefits available to the household are lower than they would be if the household owned the system outright. At any time in the term of the lease, if the household purchases the solar PV system outright, it will accrue the full ownership benefits and maximum profit (2013, pp.53-54).

Some major benefits of solar leasing are that 1) maintenance of the system, including replacements and repairs, are typically covered by the developer, 2) buy-out clauses may allow the household to purchase the system at a pre-determined price after a fixed time period, 3) the contract can be transferred to the next building occupant if that occupant agrees, and 4) the household incurs low transaction costs when installing the system (Ison et al., 2013, p.109)

Ison et al. identified solar utilization, in other words the proportion of a solar PV system's generation used by the building, as a major issue with solar leasing. For households with low daytime use, for example if residents work during the day, the economic benefits of the system may be low or even negative, resulting in an economic loss. Households with low solar utilization should use community solar instead or wait a few years until solar PV with storage becomes cost effective (2013, p.54).

5.3.1.2 Solar PV Council Brokering of a Bulk-Buy

Ison et al. listed council brokering of a bulk-buy for solar PV as an option for households and communities involved in "Our Solar Initiative." Councils would find a supplier to provide the systems at a discounted rate to community members, who would then contact the supplier directly to purchase the system at that rate. The community members would benefit through the savings on the cost of the purchase and installation of the panels, and would receive the full net benefits of owning the PV system that they would not receive under a lease or PPA. An example of a successful brokering of a bulk-buy for solar PV is Parkes Shire Council, which delivered savings of $1/watt for community members (2013, p.57).

The benefits of a bulk-buy program are that it can: 1) lower the upfront cost of solar PV, 2) lower the household's transaction costs associated with researching a supplier and installer and any uncertainty around the supplier or installer's credibility, and 3) overcome information barriers to renewable energy uptake through community education and decision-making support provided by the council (Ison et al., 2013, p.102).

The weaknesses in a bulk-buy system are that 1) the costs to the council for administering the bulk-buy may be high (i.e. finding skilled staff, promoting the bulk-buy in media and community circles, having information sessions, etc.), 2) it may limit the flexibility in the PV system types and sizes to choose from, and 3) because the solar PV market is competitive, the supplier and installers may not provide as much of a discount as desired (Ison et al., 2013, p.102).

5.3.2 NSW Solar Bonus Scheme

The NSW Solar Bonus Scheme, operating until December 2016, provides a feed-in tariff of 20 to 69 cents per kilowatt hour for eligible households with small-scale solar or wind generators that are connected to the grid (NSW DTI, n.d.b, para.1). Essentially, the government pays a set amount of money for clean energy fed back into the electricity grid by anyone who has installed a renewable energy system over an agreed period of time (Environment Victoria, n.d., para.1). The amount paid for the renewable energy is greater than the standard retail price of electricity to encourage the growth of the renewable energy industry (Environment Victoria, n.d., para.2). Feed-in tariffs are effective in stimulating the market because they greatly reduce the pay-back period for the initial costs of installing solar PV systems, thereby increasing the incentive to pay for the upfront costs (Environment Victoria, n.d., para.4).

There are two different types of tariff payments available through the scheme. The first is a gross meter, which exports all the generator's energy in return for credits of 60 cents per kilowatt, and the household then purchases their energy at the prevailing retail rate (NSW DTI, n.d., para.5). The other type is net metering, where a household exports any electricity not used at the time of generation back into to the grid and receives a 20 cent per kilowatt feed-in tariff (Ison et al., 2013, p.105). If a household is not a part of the scheme, it can receive unsubsidised feed-in tariffs at the competitive retail electricity market price (NSW DTI, n.d., para.5).

Under the scheme, more than 146,000 customers installed 342 megawatts of solar PV, but since it stopped accepting new applicants, another 152,000 customers installed 470 megawatts of solar PV (Parkinson, 2015, para.5). Feed-in tariffs are now voluntary in New South Wales, and because the tariff amounts are not sufficient, households are focused on consuming as much of their energy output as they can to offset the cost of grid electricity (Parkinson, 2015, para.7).

5.4 Financial Assistance Programs

5.4.1 NSW Government Financial Assistance

The NSW Department of Trade & Investment gives a range of government financial assistance measures available to help residents manage their energy bills. Direct financial assistance is available in the form of rebates to eligible customers, such as the low income household rebate and the family energy rebate. The low income household rebate provides around $235-258 a year to eligible households and can be combined with the family energy rebate. There is also the Energy Accounts Payment Assistance (EAPA) Scheme, which helps people experiencing a short-term financial crisis or emergency to pay their electricity or gas bill. This enables people to stay connected to essential

energy services during a financial crisis and is only temporary, although energy retailers have to follow rigorous procedures before they are allowed to disconnect a customer. Retailers will also offer payment plans that allow customers to pay their bills in more regular, affordable instalments (n.d., para.1-4). (*Note:* Financial assistance from the NSW Government is not included in the policy assessment because it does not directly relate to the uptake of renewable energy and energy efficiency. It is included here as a reference for the available assistance offered by the NSW government to vulnerable households).

5.4.2 CORENA Revolving Donations Fund

Citizens Own Renewable Energy Network Australia Incorporated (CORENA) is a not-for-profit group that provides a method of funding new renewable energy installations through a revolving donations fund (Energy Matters, 2015, para.2). Through donations, CORENA provides interest-free loans to pay for solar installations and energy efficiency measures (Energy Matters, 2015, para.3). After the loans are repaid from the resulting savings on power bills, the original donations are then used again to fund new projects (Energy Matters, 2015, para.3). Eventually the revolving pool of funds is big enough to continue to fund small-scale projects even if all donations stop (Energy Matters, 2015, para.8). All running costs are covered by membership fees and admin-specific donations (Energy Matters, 2015, para.9).

5.4.3 Green Loans

There are various banks that offer loans with discounted interest rates for the purchase of renewable energy systems. One example of this is the Green Home Loan supplied by Bendigo Bank, which has a discounted variable interest rate of .50% p.a., no monthly service fee, and a long available loan term (Bendigo Bank, 2015, para.4). Another example is the Community First Credit Union's Green Loan, which is available for residents anywhere in Australia (Community First Credit Union, n.d., para.1). Their Green Loan is offered at a low personal loan rate of 6.12% p.a., has no monthly fees, a loan term from 1-5 years, and multiple options for viewing and managing the loans (i.e. Internet, Mobile, Over the Counter) (Community First Credit Union, n.d., para.2,4, &5). Both types of loans cover a variety of renewable energy products, including solar PV panels and systems (Bendigo Bank, 2015, *Table B*; Community First Credit Union, n.d., para.3).

5.4.4 Sungevity "Pay As You Go" Solar Loan & Solar $aver Program for Pensioners

The Sungevity "Pay As You Go" Solar Loan helps households install solar power by confronting the barrier of high upfront costs (Sungevity Australia, 2015, para.4). Sungevity designs and installs a system customised to the individual household without requiring any upfront costs (Sungevity

Australia, 2015, para.5). The household then makes flexible monthly payments at no interest to Sungevity so it can begin realizing its savings immediately through reduced electricity bills (Sungevity Australia, 2015, para.7).

Similarly, the Darebin City Council in partnership with Energy Matters and Positive Charge has developed the Solar $aver Program for Pensioners, which offers eligible homeowners solar power installation at no upfront cost (City of Darebin, 2014, p.1). Homeowners receiving a pensioner rate rebate can install a solar panel system at no upfront cost and instead pay 10% of the system's cost every year over a ten-year span (City of Darebin, 2014, p.1). The program claims that most households will end up saving more each year on their electricity bills than they pay in the rates solar prepayment (City of Darebin, 2014, p.1). The program is targeted towards senior homeowners and has already had success with almost 300 pensioners experiencing energy bill reductions (Energy Matters, 2014, para.1 & 3).

5.4.5 Environmental Upgrade Agreements

Environmental upgrade agreements allow the owners of commercial buildings to access funds from a financial provider for energy, water, and other environmental improvements (OEH, 2015d). Ison et al. gives an explanation of how the agreements work. First, the commercial building owner enters into an agreement with the council and a finance institution. The financial institution advances funds to the building owner for environmental retrofitting upgrades, the council levies an "environmental upgrade charge" on the building through rate collection, and the council then uses the charge to repay the loan from the financial institution. The charge remains on the land until all the funds advanced by the financier are repaid in full (2013, p.116).

Where the agreement is made with tenant's consent, the property owner can pass part of the environmental upgrade charge on to the tenants given that they are offset by reductions in energy and water bills (NSW OEH, 2015d). Although funds are usually repaid with interest to the financial institution, it is possible that no interest loans could be established (Ison et al., 2013, p.116). Through the Energy Efficient Homes Program, the NSW government will provide households with standard contracts for Environmental Upgrade Agreements to finance upgrades to multi-unit residential buildings (OEH, 2013, p.15).

6. The Assessment

Table 1 displays the percent and number of barriers to the uptake of renewable energy and energy efficiency measures addressed by each policy. The barriers are on the horizontal axis and the policies and programs are on the vertical axis. As stated in the *Methods,* two different types of analysis are possible; analysing the number of barriers each policy addresses, or analysing the number of policies addressing each barrier. The focus for this report is to assess the adequacy of the policies themselves, the prior option. Sections 6.1-6.4 present the results from the table for each type of policy (i.e. energy efficiency, renewable, solar power, and financial assistance), followed by a discussion. Section 6.5 pulls some data from the number of policies addressing each barrier to specify which barriers still need to be addressed.

When analysing the results, it is important to remember that many of the policies and programs could and should be used in conjunction with one another, and that some policies may have scored low in the numbers of barriers addressed because they are focused on addressing particular ones. This last point is vital because the percentages and analysis do not determine to what extent the policies are successful in addressing these barriers, rather they only show if they do or do not address them at all. For example, one policy could address 75% of the barriers, while another policy only addresses 5%, but that does not mean that the prior policy is more successful in addressing the specific barriers than the latter; it only means that more barriers are addressed. There were many factors involved in the assessment of these policies and a more accurate estimate of their effectiveness is beyond the scope of this report.

Table 1. Number of Barriers Addressed by each Policy and Program

	F&E: High Upfront Costs	F&E: Lack of Affordable Credit	Lack of Awareness & Information	Internet Access	TECH: Technological Complexity & Maintenance	TECH: Feedback	Split Incentives	BEH: Comfort & Sacrifice	BEH: Environmental Values & Connection	BEH: Financial Benefit	BEH: Knowledge & Efficacy	BEH: Habit	INF: Structural Inefficiencies	INF: Tenure Type	*Totals*	Percent of Barriers Addressed
Policy/Program																
Energy Efficiency Policies:																
NSW Energy Efficiency Action Plan																
Energy Efficient Homes Program	✓		✓	✓	✓		✓					✓	✓	✓	8	**57%**
Home Power Savings Program			✓	✓	✓	✓				✓	✓	✓	✓	✓	9	**64%**
Smarter Choice Retail Program			✓	✓						✓	✓				4	**29%**
Energy Savings Scheme	✓				✓								✓		3	**21%**
Smart Meters	✓		✓	✓	✓	✓		✓		✓	✓				8	**57%**
Renewable Energy Policies:																
Commonwealth Renewable Energy Target																
STCs										✓					1	**7%**
NSW Renewable Energy Action Plan			✓							✓					2	**14%**

Regional Clean Energy Plan			✓		✓					✓	✓				4	**29%**
GreenPower					✓	✓		✓	✓					✓	5	**36%**
Solar Power Policies:																
"Our Solar Future"																
Solar PV Residential Leasing	✓				✓	✓				✓				✓	5	**36%**
Solar PV Council Brokering of a Bulk-Buy	✓		✓		✓					✓					4	**29%**
NSW Solar Bonus Scheme						✓				✓					2	**14%**
Totals:	5	0	7	4	8	5	1	2	1	9	4	2	3	4		
Percent of Policies	**45%**	**0%**	**64%**	**36%**	**73%**	**45%**	**9%**	**18%**	**9%**	**82%**	**36%**	**18%**	**19%**	**36%**		
Financial Assistance Programs:																
Environmental Upgrade Agreements		✓					✓									
CORENA Revolving Donations Fund		✓														
Green Loan		✓														
Sungevity Pay-as-you-go & Solar $aver Program for Pensioners	✓	✓														

Note: Financial assistance programs are not included in the percentage analysis.

Note: The NSW Renewable Energy Action Plan is included as its own category in the analysis because it contains certain elements separate from its individual programs (i.e. The Regional Clean Energy Program and GreenPower).

6.1 Energy Efficiency Policies

Results: The Energy Efficient Homes Program addresses over half of the barriers (57%) and is the only program that addresses split incentives and one of two programs to address habit as a behavioural barrier. The other program that addresses habit is the Home Power Saving Program, which includes measures to deal with 64% of all barriers, more than any other program, followed by Smart Meters at 57%. The Smarter Choice Retail Program meets 29% of all barriers, followed by the Energy Savings Scheme at 21%. The latter two programs are the only ones to address structural inefficiencies. If all the energy efficiency policies were implemented together, all barriers except for lack of affordable credit, comfort and sacrifice, and environmental values and connection would be met.

Analysis: From the framework, it appears that the energy efficiency policies are quite adequate in addressing the barriers to the uptake of energy efficiency in vulnerable households. It makes sense that only the energy efficiency policies address structural inefficiencies, since the barrier is more relevant to energy efficiency than renewable energy. It is important to remember that all the programs except Smart Meters are a part of the NSW Energy Efficiency Action Plan. This would imply that the NSW Energy Efficiency Action Plan coupled with the Smart Meters Initiative would be successful in addressing almost all of the barriers. Since there are already existing financial assistance programs that can provide affordable credit to vulnerable households, the only barriers left to address would be comfort and sacrifice and environmental values and connection.

Encouraging households to become more energy efficient (i.e. reducing energy use and purchasing more energy efficient technologies) is a challenge because of the perceived notions that it will result in great discomfort and a sacrifice of current living standards (Lorenzoni et al., 2007, p.453). Programs are needed that can help make energy efficiency seem less daunting, perhaps by creating awareness on simple ways to reduce energy use. Programs like the Home Power Savings Program have been successful in making homes more energy efficient at no cost through measures like the Power Savings Kit.

Due to the increasing prices of electricity in Australia, however, vulnerable households have already had to take extreme measures in reducing their energy use and are experiencing great discomfort and sacrifice as a result (Chester, 2013, p.121). Rather than focus on reducing energy use, energy efficiency policies for vulnerable households need to focus on enabling them to replace their costly inefficient appliances with high-efficiency ones. Since high-efficiency products tend to have high upfront costs, despite being more cost-effective in the long run, policies need to make these

products affordable to vulnerable households (OEH, 2013, p.4). Two programs that are working to do this are the Energy Efficient Homes Program and the ESS (OEH, 2015a; OEH, 2013, p.13).

Structural inefficiencies are another important barrier to energy efficiency that must be addressed, as they can result in huge energy losses (DRET, 2012, p.101). Since home energy efficiency upgrades can have expensive upfront costs, both the Energy Efficient Homes Program and the ESS are working to make these upgrades accessible and affordable for vulnerable households (OEH, 2013, p.15; IPART, n.d.).

6.2 Renewable Energy Policies

Results: Small-scale Technology Certificates (STCs) only address one of the barriers, financial benefit as a barrier to behavioural change. The NSW Renewable Energy Action Plan, including its involvement with the Regional Clean Energy and GreenPower Program, addresses 57% of all barriers. Out of all the programs and initiatives analysed, GreenPower is the only program to address environmental values and connection. Even if all the renewable energy policies were implemented together, almost half of the barriers would still be unmet, including high upfront costs, lack of affordable credit, Internet access, split incentives, habit, and structural inefficiencies.

Analysis: The Commonwealth's STCs serve a specific purpose of providing a financial incentive to install renewables, which could be effective so long as it is implemented along with other measures that can address the rest of the barriers to the uptake of renewable energy in vulnerable households. There is strong evidence that combining financial incentives with information can be much more effective in influencing behaviour change than employing each separately (Stern, 1999, p.467). This could be done by employing the STCs with other elements of the Renewable Energy Action Plan. STCs could be of particular use in addressing the barrier of tenure type. If the financial benefit were great enough, it could motivate landlords to install a small-scale renewable energy system. The policy would also have to address the barrier of split incentives, however, and ensure that the landlord also benefits from the system, instead of the tenant realizing all the benefits through reduced energy bills (Reddy & Painuly, 2004, pp.1436-7).

The Regional Clean Energy Program is the most effective policy option available in terms of addressing knowledge and efficacy. The program works to supply community members with all the information they need to evaluate renewable energy options for themselves and the community (OEH, 2015). Most importantly, it aims to make the community self-sufficient by building on local skills and training community leaders (DTI, 2014, p.6). Becoming self-sufficient is particularly important for Uralla and its transformation into a zero net energy town. Through working with this

program, the Uralla community and local government would be armed with sufficient knowledge and resources to determine what policy options would work best for the town and its residents.

Although the NSW Renewable Energy Action Plan addresses over half of the barriers when the Regional Clean Energy and the GreenPower Program are included, there are still many barriers that are not addressed. Specifically, the plan does not address the issue of high upfront costs, which is commonly cited as one of the greatest barriers facing vulnerable households in the uptake of renewable energies (Beck & Martinot, 2004, p.366; Reddy & Painuly, 2004, p.1436; Painuly, 2001, pp.79-80; Cabraal, Cosgrove-Davies, & Schaeffer, 1996, p.xi; Dillahunt, Mankoff, Paulos, & Fussell, 2009, p.6). While this is a major issue with the plan, it is possible that financial assistance programs like Sungevity and the Solar $aver Program could help by covering the upfront costs. Even still, these programs only spread the costs out over time and government policies are needed to make sure that the prices for small-scale renewable energy are not too expensive for vulnerable households to afford, despite the time period they are paid for.

Habit as a barrier would be difficult to change, since not only do people tend to resist change, but they also do not want to be different from the crowd (Reddy & Painuly, 2004, p.1437; Lorenzoni et al., 2007, p.453). This may explain why habit is only addressed by energy efficiency policies, since switching from retail electricity to renewables could be considered a relatively new trend. Innovative behaviour change programs are needed to persuade households to stop receiving energy from fossil fuel sources and adopt renewables energies instead. In Uralla, having the transition to 100% renewables be a community-wide event would address habit, as all community members would be undergoing change together, making it the new social norm. As it is imperative that all Uralla residents take part in the Z-NET project for it to be successful, there will need to be community-wide support and acceptance of renewable energy. Creating awareness, providing incentives to participate in the project, and providing all residents with adequate information is key.

The barriers of Internet access and split incentives are also crucial to vulnerable households, and are not touched upon by the plan. Since so many important barriers are not included, it suggests that the renewable energy policies are not adequate in supporting vulnerable households to transition to renewable energy sources.

6.3 Solar PV Programs

Results: The two solar PV programs suggested by the "Our Solar Future" initiative address around a third of the barriers. Solar PV residential leasing meets 36% of all barriers, while solar PV council brokering of a bulk buy meets 29%. The NSW Solar Bonus Scheme addresses two barriers,

feedback and financial benefit. There are many barriers that are not met including behavioural change; out of all five subsets of behavioural change only one (financial benefit) is met by the solar PV policies. Furthermore, Internet access, split incentives, and structural inefficiencies are not addressed by any of the solar PV policies.

Analysis: The NSW Solar Bonus Scheme is specifically focused on financial incentives to encourage the installation of solar PV systems, which could be effective as a barrier-specific policy so long as it was successful in reducing that barrier's presence. It is similar to the STCs in that it should be implemented along with other policies to be most effective (Stern, 1999, p.467). Although the NSW Solar Bonus Scheme is being discontinued, another sort of feed-in tariff could and should be implemented to go along with either of the "Our Solar Future" initiative's solar PV options, more so the council brokering of a bulk-buy since the household would own the system.

Solar leasing and bulk-buy are very similar in the barriers they address, which include high upfront costs, technological complexity and maintenance, and financial benefit. Based on the framework, the benefits residential leasing has over the bulk-buy are immediate bill savings (i.e. addresses barriers involved with feedback) and ability to work with any tenure type as contracts can be passed on to the next tenant (Ison et al., 2013, p.109). The council brokering of a bulk-buy has benefits over leasing, too, one being that the council will provide households with accurate and reliable information about solar PV systems, as well as providing additional support in decision-making (Ison et al., 2013, p.102). Both the bulk-buy and residential leasing, however, neglect to address most aspects of behavioural change and the role it plays as a barrier to implementing solar PV systems.

It must be considered that the behavioural barriers are preventing households from wanting to install renewables in the first place. Thus, while the "Our Solar Future" initiative's policies offer solar PV options that would be appealing for households *already* considering installing a system, they neglect to address crucial barriers that are preventing households from wanting to install a system at all.

To address the behavioural barriers, information sessions and stands run by community groups or the local government council could be a potential solution. This would be easier in the bulk-buy system since the council is already running the program, but at the same time may require the council to do more than it can manage (Ison et al., 2013, p.102). These sorts of measures are necessary, however, to generate awareness about solar PV and explain to households the benefits of switching from grid electricity to a renewable energy source like solar (i.e. for the environment, for the

community, for themselves, for future generations). It will, of course, be important to provide information on other alternative energies as well, to let households choose what energy source will work best for them. The Regional Clean Energy Program would be a good resource for the community to utilize here.

The solar programs are inadequate in addressing the barriers on their own and would need to be implemented along with both the financial assistance programs and the NSW Renewable Energy Action Plan. The Renewable Energy Action Plan is a more general initiative for implementing renewables that can assist energy-specific programs like "Our Solar Initiative" with the implementation of solar PV systems in communities. Given that structural inefficiencies are met by energy efficiency policies and affordable credit is taken care of by financial assistance programs, implementing the two types of policies together would address almost the barriers. For example, if implemented together, the Renewable Energy Action Plan and solar PV residential leasing would meet all barriers except Internet access, split incentives, and habit. Still, there are major barriers that remain unaddressed.

6.4 Financial Assistance Programs

Results/Analysis: The financial assistance programs were not included in the percentage analysis because they are only applicable to two specific barriers: high upfront costs and lack of affordable credit. The exception is Environmental Upgrade Agreements, which meet the barrier of tenure type by allowing the property owner to pass part of the environmental upgrade charge on to the tenants, given that the charges are offset by reductions in energy and water bills (OEH, 2015d). This type of loan could provide a partial solution to encouraging landlords to make energy efficiency building upgrades, as both the landlord and the tenant are paying for the improved services.

While all the programs provide affordable credit to vulnerable households, Sungevity and the Solar $aver Program also eliminate the barrier of high upfront costs by offering no upfront costs for the installation of a solar system. Since consumers' willingness and capacity to pay are influenced more by the size of the down payment than by the number or size of the monthly payments, these programs could effectively encourage households to adopt solar PV systems by spreading the upfront costs into monthly payments (Cabraal et al., 1996, p.25). For vulnerable households specifically, Sungevity and the Solar $aver Program may be potential solutions to affording renewable energy and/or energy efficient appliances and upgrades.

If the financial assistance programs are implemented in conjunction with other policies, then it is possible that they can address the barriers of both high upfront costs and affordable credit for these policies.

6.5 Barriers that still need to be addressed

6.5.1 Information Barriers

The fact that more than half (64%) of the policies aim to provide reliable information to vulnerable households speaks highly of the adequacy of these policies in supporting households to transition to renewables or become more energy-efficient. In fact, both the energy efficiency and renewable energy policies make reliable and sufficient information a top priority.

A major concern, however, is that a lot of these policies that are supplying information are doing so through online portals. For households that do have access to the Internet, this retains lack of awareness and information as a major barrier. In Uralla, more than a third of its population does not have Internet access (ABS, 2012f). The energy efficiency policies provide a couple ways of getting around this barrier, such as the Home Power Savings Program, which provides households with an in-home electricity assessment and a detailed plan that tells them how they can become more energy efficient (Rickwood et al., 2012, p.3). Even so, it cannot be expected that an in-home assessment can be done in all vulnerable households, and there still needs to be additional ways to access information.

Households need to learn about the various types of renewable energy options and ways to become more energy efficient before being asked to implement a system or take a certain measure. If Uralla is going to supply all of its energy from renewables, it needs to ensure that all residents have access to information so they can play an informed and active role in the community's transition. This is also relevant to households who have members that are illiterate and not proficient in English. Although only 3% of Uralla's population born overseas does not speak English well or at all, in a community-wide initiative like the Z-NET project it is imperative that all members of the community are catered to (ABS, 2012c).

6.5.2 Split Incentives

As mentioned earlier, only one policy, the Energy Efficient Homes Program, addresses the issue of split incentives. Considering that 68% of low economic resource households in Australia are renters, split incentives are a huge barrier (ABS, 2013, sec.6). In Uralla, 23% of the population are renters, making up nearly a quarter of the population that could be prevented from implementing renewable energy and/or energy efficiency measures (ABS, 2012e).

While the Energy Efficient Homes Program is working to address split incentives in regard to energy efficient property upgrades, there is no aspect of the Renewable Energy Action Plan that does so (OEH, 2013, p.14). Addressing this barrier is crucial in helping vulnerable households and rental housing residents adopt renewable energies. There needs to be either a compulsory mandate or incentive for landlords to install renewable energy systems on their buildings. Both the landlord and the tenant will need to be able to receive the benefits of implementing the renewable energy system.

6.5.3 Environmental values and connection

GreenPower is the only program to address environmental values and connection. It does so in the sense that it is getting households to change their behaviour and purchase some or all of their energy from renewables because they want to help the renewable energy industry (GreenPower, 2011). The household takes part in the program out of environmental concern or as a morale booster, and although it is a step in the right direction, it does not directly establish a connection between households and their environment or community. It also costs money, which is not feasible for vulnerable households.

In order to motivate households to switch to renewable energy (or become more energy efficient) out of concern for their environment and community, renewable energy (and energy efficiency) policies and programs need to work on instilling a "sense of place" within the community. This could be seen in the form of community gardens, increased participation in community groups, and community activities and events focused around the theme of renewable energy and/or energy efficiency. Community groups or the local government council should initiate these measures. Making the transition to renewables a community-wide transformation, as it is in Uralla, can also be beneficial in bringing the community together and creating a sense of connection amongst the community and with the town itself.

6.5.4 Tenure Type

While there are several energy efficiency policies that address tenure type, the renewable energy policies are inadequate in meeting this barrier. As mentioned previously, the majority of low economic resource households and almost a quarter of Uralla's population are renters, representing a decent proportion of households that may be inhibited from installing renewable energy systems without the landlord's consent (ABS, 2013, sec.5; ABS, 2012e).

The GreenPower program is the only renewable energy program that was marked as meeting the barrier of tenure type. GreenPower does not face an issue with tenure type because it is separate from the homeowner in the sense that the person paying the electricity bills can choose where the

electricity is generated since it is not generated on-site. This program alone is not enough to help vulnerable households supply their home energy needs through renewable energy because they would have to pay additional money. In other words, their electricity bill would be larger each week than it would if they just purchased electricity from the grid.

It is, however, worth thinking about having a system where vulnerable households could consume energy from an off-site but nearby renewable energy source at a lower price than the retail electricity price. This would involve the development of a community or council-owned mid-scale renewable energy source, such as a wind turbine farm or solar plant, which would serve as the households' energy supply. This would solve the issue of tenure type and it would return profits to the community. The other option would be to create incentives for landlords to install a small-scale renewable energy system on the building.

7. Conclusions.

This research study aimed to answer the question, *"Do policies and programs in NSW adequately support vulnerable households in transitioning to renewable energy?"*. To answer this question, I assessed each policy based on the amount of barriers to the implementation of renewable energy and energy efficient measures they addressed. The study has revealed two major patterns, the first being that the existing energy efficiency policies and programs are adequate in supporting vulnerable households to uptake energy efficiency measures. While there are still behavioural barriers left unaddressed, these are not much of a concern since low-income households in Australia are already being forced to reduce their energy consumption because of high electricity prices (Chester, 2013, p.121. Instead of focusing on getting vulnerable households to reduce their energy use, energy efficiency policies and programs should focus on supplying vulnerable households with high-efficiency appliances and residential building upgrades, which both the Energy Efficient Homes Program and the Energy Savings Scheme aim to do.

The second pattern relates to both the available renewable energy policies and the existing solar PV programs. The study found that both types of policies are inadequate in supporting vulnerable households to uptake renewable energy. The NSW Renewable Energy Action Plan in particular does not address the issue of high initial costs, which is a great barrier to vulnerable households in implementing renewable energy (Beck & Martinot, 2004, p.366; Reddy & Painuly, 2004, p.1436; Painuly, 2001, pp.79-80; Cabraal, Cosgrove-Davies, & Schaeffer, 1996, p.xi; Dillahunt, Mankoff, Paulos, & Fussell, 2009, p.6). Even if the plan was implemented with the financial assistance programs, the initial costs are not eliminated, just spread out over time. The plan does address many

of the barriers (57%), but certain crucial barriers to vulnerable households like Internet access and split incentives are left unaddressed.

The plan also neglects to address habit, which is an essential barrier to the successful implementation of renewable energy in the Uralla community. It is imperative that the whole community is on board with the Z-NET project and is willing to implement renewable energy in their household in order for the project to be successful. Additional measures to generate community awareness and support of the project are needed.

The solar PV options are specific examples of renewable energy programs that could be implemented in vulnerable households in Uralla. While they provide solutions to various barriers facing vulnerable households, they each have their own downfalls and would need to be implemented along with both financial assistance programs and the Renewable Energy Action Plan. The Regional Clean Energy Program in particular would make these solar PV programs more adequate by providing assistance to communities and households in deciding which solar PV option works best for them.

The financial assistance programs are essential components to all of the policies and programs mentioned in this report. They are the only programs providing vulnerable households with affordable credit to purchase renewable energy systems and energy efficient appliances and upgrades, and a couple of them even provide installation at no upfront costs.

There are still multiple barriers that need to be addressed and a further analysis of the percentage of policies addressing each barrier would be better suited to determine which barriers need increased representation in existing policies and programs. From the data gathered on the adequacy of each policy, it appears that Internet access, split incentives, environmental values and connection, and tenure type are underrepresented. Meeting all of these barriers is crucial to making Uralla a zero net energy town. Since a third of Uralla's population does not have Internet access and almost a quarter of the population is renting their home, measures to address these barriers are essential in ensuring that all residents can take part in the project (ABS, 2012f; ABS, 2012e).

Environmental values and connection are mentioned as an important barrier because the Z-NET project requires the whole community to work together. Measures need to be taken to strengthen the "sense of place," or connection to the environment and the community. All community members need to play an active and supportive role in helping Uralla achieve its goal of 100% renewable energy, and therefore need to strengthen their relationships with one another.

If the Z-NET project is to be successful in making all of Uralla's energy come from renewables, it will need to take additional measures to help vulnerable households transition to renewable energy. The project should take advantage of the available policies and programs offered in NSW and use this report to be conscious of the barriers that the policies do not meet so that it can take additional measures to address them. While the energy efficiency programs were the only ones deemed adequate in addressing the potential barriers facing vulnerable households, it does not mean that the other programs should not be used as a resource. This study provides general assessments of the policies' adequacy in supporting vulnerable households to transition to renewable energy, and further analysis and evaluation is necessary to determine if a policy is appropriate for Uralla.

As electricity prices continue to increase, the nation-wide movement towards renewables seems inevitable. Transitioning vulnerable households in Uralla to renewable energy may help reduce their economic hardship and stress. Through the uptake of renewable energy, households can reduce their power bills, while the overall improvement to the home's energy efficiency may be able to reduce their suffering and increase their well-being (Frischknecht, 2013, sec.3; Chester, 2013, p.124). As part of the Z-NET project, the policies and programs in this report that provide adequate assistance for these opportunities should be considered for implementation Uralla.

7.1 Further Research

This research only looked at the adequacy of each policy in terms of the amount of barriers it addresses. Further research is needed on the extent to which each policy addresses each barrier. It would be beneficial to have a detailed assessment of each policy and how effective it is in addressing the barriers to the uptake of renewable energy and energy efficiency measures in vulnerable households. This may require time since some of the policies have not been fully implemented yet, but once completed it would give a more accurate depiction of the quality of each policy. This would involve an ongoing evaluation of the success of each program, including testimonies from participant households. This research would be the best determinant of the adequacy of each policy in supporting vulnerable households.

References

ABS (2013): Australian Bureau of Statistics. *Household Income and Income Distribution, Australia, 2011-12,* cat. no. 6523.0. Retrieved on April 11, 2015 from, http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/6523.0Feature%20Article12011-12?opendocument&tabname=Summary&prodno=6523.0&issue=2011-12&num=&view=

ABS (2012a): Australian Bureau of Statistics. *Australian Social Trends, March Quarter 2012,* cat. no. 4102.0. Retrieved on April 11, 2015 from, http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4102.0Main+Features10March+Quarter+2012

ABS (2012b): Australian Bureau of Statistics 2011 Census of Population and Housing, 'Uralla (NSW) (State Suburb), Age by Sex, Table B04', viewed on April 18, 2015 from, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/SSC12357?opendocument&navpos=220

ABS (2012c): Australian Bureau of Statistics 2011 Census of Population and Housing, 'Uralla (NSW) (State Suburb), Proficiency of Spoken English/Language by Year of Arrival in Australia by Sex, Table B11', viewed on April 18, 2015 from, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/SSC12357?opendocument&navpos=220

ABS (2012d): Australian Bureau of Statistics 2011 Census of Population and Housing, 'Uralla (NSW) (State Suburb), Total Household Income (Weekly) By Household Composition, Table B28', viewed on April 18, 2015 from, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/SSC12357?opendocument&navpos=220

ABS (2012e): Australian Bureau of Statistics 2011 Census of Population and Housing, 'Uralla (NSW) (State Suburb), Tenure and Landlord Type by Dwelling Structure, Table B32', viewed on April 18, 2015 from, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/SSC12357?opendocument&navpos=220

ABS (2012f): Australian Bureau of Statistics 2011 Census of Population and Housing, 'Uralla (NSW) (State Suburb), Type of Internet Connection by Dwelling Structure, Table B35' , viewed on April 18, 2015 from, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/SSC12357?opendocument&navpos=220

ACOSS (2013): Australian Council of Social Service. *Energy Efficiency & People on Low Incomes*. Retrieved on April 25, 2014 from, http://acoss.org.au/images/uploads/ACOSS_ENERGY_EFFICIENCY_PAPER_FINAL.pdf

ARENA (n.d.): Australian Renewable Energy Agency. What is renewable energy?. Retrieved on May 5, 2015 from, http://arena.gov.au/about-renewable-energy/

Beck, F., & Martinot, E. (2004). Renewable Energy Policies and Barriers. *Encyclopedia of Energy, 5,* pp.365-383. Retrieved on March 26, 2015 from, http://www.martinot.info/Beck_Martinot_AP.pdf

Bendigo Bank (2015). *Green Home Loans.* Retrieved on April 28, 2015 from, http://www.bendigobank.com.au/generationgreen/green_loans/generation_green_home_loan.asp

Boyce, J. K., & Riddle, M. (2007). *Cap and dividend: how to curb global warming while protecting the incomes of American families*. pp.1-24. Retrieved from the University of Massachusetts Amherst, University Libraries Website: http://scholarworks.umass.edu/peri_workingpapers/108/

Brown, M.A. (2001). Market failures and barriers as a basis for clean energy policies. *Energy Policy, 29*, pp.1197-1207. Retrieved from http://econ.tu.ac.th/archan/Chalotorn/on%20mkt%20failure/brown.pdf

Cabraal, A., Cosgrove-Savies, M., & Schaeffer, L. (1996). Best Practices for Photovoltaic Household Electrification Programs (World Bank Technical Paper Number 324). Washington, D.C: The World Bank. Retrieved April 10, 2015 from, http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=564385&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D564385

Casey, J. & Scott, K. (2011). Environmental concern and behaviour in an Australian sample with an ecocentric-anthropocentric framework. *Journal of Pyschology, 58*(2), pp.57-67. doi:10.1080/00049530600730419

CEC (2014a): Clean Energy Council. *Renewable Energy Target*. Retrieved on April 28, 2015, from https://www.cleanenergycouncil.org.au/policy-advocacy/renewable-energy-target.html

CEC (2014b): Clean Energy Council. *About electricity prices.* Retrieved on May 1, 2015 from, https://www.cleanenergycouncil.org.au/policy-advocacy/electricity-prices.html

CEC (2014c): Clean Energy Council. *Why we need the RET*. Retrieved on May 1, 2015 from, https://www.cleanenergycouncil.org.au/policy-advocacy/renewable-energy-target/why-we-need-the-renewable-energy-target.html

Chester, L. (2013). The impacts and consequences for low-income Australian households of rising energy prices. Retrieved on May 5, 2015 from, http://www.householdenergyuse.com/resources/Summary_and_implications.pdf

City of Darebin (2014). *Solar $aver Program for Pensioners*. Retrieved on April 29, 2015 from, http://www.energymatters.com.au/images/news/2014/solarsaver-bulkbuy.pdf

Clean Energy Regulator (2014). *The Small-scale Renewable Energy Scheme*. Retrieved on April 28, 2015, from http://ret.cleanenergyregulator.gov.au/About-the-Schemes/Small-scale-Renewable-Energy-Scheme--SRES-/about-sres

Commonwealth of Australia: Department of Industry and Science (2014). *Renewable power incentives*. Retrieved on April 26, 2015 from http://yourenergysavings.gov.au/rebates/renewable-power-incentives

Community First Credit Union (n.d.). *Green Loans.* Retrieved on April 28, 2015 from, http://www.communityfirst.com.au/Green-loans

CORENA fund (2015). Retrieved on April 24, 2015 from, http://corenafund.org.au/what-we-do/

Dillahunt, T., Mankoff, J., Paulos, E., & Fussell, S. (2009). It's not all about green: energy use in low-income communities. *Proceedings of the 11th international conference on Ubiquitous computing,* 255–264. Retrieved on March 29, 2015 from http://www.tawannadillahunt.com/wp-content/uploads/2013/01/Its-not-all-about-green.pdf

DTI (2013): NSW Department of Trade & Investment. *NSW Renewable Energy Action Plan*. Crown Copyright. Retrieved April 26, 2015 from, http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0010/475318/Renewable-Energy-Action-Plan.pdf

DTI (2014): NSW Department of Trade & Investment. *Progressing the NSW Renewable Energy Action Plan: Annual Report 2014.* Crown Copyright. Retrieved on April 28, 2015 from, http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0005/537197/NSW-Renewable-Energy-Action-Plan-Annual-Report-2014.pdf

DTI (n.d.a): NSW Department of Trade & Investment. *Cost of GreenPower.* Retrieved on April 25, 2015 from, http://www.resourcesandenergy.nsw.gov.au/energy-consumers/sustainable-energy/greenpower/cost-of-greenpower

DTI (n.d.b): NSW Department of Trade & Investment. *Solar Bonus Scheme*. Retrieved on April 28, 2015 from, http://www.resourcesandenergy.nsw.gov.au/energy-consumers/solar/solar-bonus-scheme

Eady, S. (2015). Coordinator or the Z-NET Community Reference Group. Personal Communication via face-to-face discussion, 10th April 2015.

Elkington, John (1994). Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development. *California Management Review*, *36 (2),* 90–100.

Energy Matters (2014). *Solar Power Slashes Energy Costs For Australian Pensioners*. Retrieved on April 29, 2015 from, http://www.energymatters.com.au/renewable-news/darebin-solar-saver-em4582/

Energy Matters (2015). *Revolving Donations Fund 35kW of Community Solar PV.* Retrieved on April 24, 2015 from, http://www.energymatters.com.au/renewable-news/revolving-solar-donations-em4781/

Energy Rating (2014a). *The Energy Rating Label*. Retrieved on April 26, 2015 from, http://www.energyrating.gov.au/about/energy-rating-labels/

Energy Rating (2014b). *Minimum Energy Performance Standards (MEPS).* Retrieved on April 26, 2015 from, http://www.energyrating.gov.au/about/other-programs/meps/

Environment Victoria (n.d.). *Feed-in tariffs: How do feed-in tariffs work and how are they so effective?* Retrieved on April 26, 2015 from, http://environmentvictoria.org.au/content/feed-tarrifs

Flannery, T. & Sahajwalla, V. (2013). *The Critical Decade: Australia's Future- Solar Energy.* Retrieved on May 4, 2015 from, http://www.climatecouncil.org.au/uploads/497bcd1f058be45028e3df9d020ed561.pdf

Fuller K., & Ingall, J. (27 November 2014). Uralla to become State's first town OFF the energy grid. *ABC New England North West.* Retrieved on March 29, 2015 from, http://www.abc.net.au/local/stories/2014/11/27/4137142.htm

Frischknecht, I. (15 October 2013). *All-Energy Australia 2013*. Transcript of a keynote address by ARENA CEO Ivor Frischknecht. Retrieved on May 5, 2015 from, http://arena.gov.au/speech_presentation/all-energy-australia-2013-keynote/

Greenpower (2011). *Overview.* Retrieved on April 28, 2015 from http://www.greenpower.gov.au/Homes/

Grennan, H. (1 December 2014). Solar power cheaper in scheme set up by Sydney councils. *The Sydney Morning Herald.* Retrieved on April 23, 2015 from, http://www.smh.com.au/nsw/solar-power-cheaper-in-scheme-set-up-by-sydney-councils-20141201-11xhfk.html

Grennan, H. (5 April 2015). Our Solar Future helps Sydney residents choose best solar system. *The Sydney Morning Herald*. Retrieved on April 23, 2015 from, http://www.smh.com.au/nsw/our-solar-future-helps-sydney-residents-choose-best-solar-system-20150405-1mesy3.html

Guevara-Stone, L. (29 August 2014). *Making solar PV accessible to low-income families*. Retrieved on April 10, 2015 from, http://reneweconomy.com.au/2014/making-solar-pv-accessible-low-income-families-u-s-92435

HPSP (2013): Home Power Savings Program. Aggregate, de-identified household data provided to ACOSS by NSW Home Power Savings Program, data supplied March 2013.

IPART (n.d.): Independent Pricing and Regulatory Tribunal. *Energy Savings Scheme: How the scheme works for householders*. Retrieved on April 26, 2015 from, http://www.ess.nsw.gov.au/How_the_scheme_works/Overview_of_the_scheme/For_householders

Ison, N., Ross, K., Cooper, C., Brennan, T., Langham, E., Wynne, L., Riedy, C., and Downes, J.(2013). *Our Energy Future*: Renewable Energy Master Plan. Prepared for the Southern Sydney Regional Organisation of Councils by the Institute for Sustainable Futures, UTS. Retrieved on April 28, 2015 from, http://ssroc.nsw.gov.au/wp-content/uploads/2015/04/20130900-Our-Energy-Future-Renewable-Energy-Master-Plan.pdf

Jackson, T. (2005). *Motivating Sustainable Consumption: A report to the Sustainable Development Research Network*. Retrieved on April 18, 2015 from, http://www.sustainablelifestyles.ac.uk/sites/default/files/motivating_sc_final.pdf

Johansson, T.B, Kelly, H., Reddy, A.K.N, Williams, R.H (1993). *Renewable Energy: Sources for Fuels and Electricity*. Washington, D.C.: Island Press.

Kortenkamp, K. V., & Moore, C. F. (2001). Ecocentrism and anthropocentrism: Moral reasoning about ecological commons dilemmas. *Journal of Environmental Psychology*, *21*(3), 261-272. doi: 10.1006/jevp.2001.0205

Lorenzoni, I., Nicholson-Cole, S., & Whitmarsh, L. (2007). Barriers perceived to engaging with climate change among the UK public and their policy implications. Global Environmental Change, 17(3–4), 445–459. doi: 10.1016/j.gloenvcha.2007.01.004

Morgan, M.I., Hine, D.W., Bhullar, N., & Loi, N.M. (2015). Landholder adoption of low emission agricultural practices: A profiling approach. *Journal of Environmental Psychology, 41*, 35-44. http://dx.doi.org/10.1016/j.jenvp.2014.11.004

Mitchell, B. (2015). There's a sunny future ahead for rooftop solar power: here's why. *The Conversation*. Retrieved on April 29, 2015 from, https://newsroom.unsw.edu.au/news/science-tech/there%E2%80%99s-sunny-future-ahead-rooftop-solar-power-here%E2%80%99s-why

NSW Department of Planning and Environment (n.d.). *About BASIX*. Retrieved on April 26, 2015 from, http://www.basix.nsw.gov.au/basixcms/about-basix.html

NSW Government (2014). *Review of the Renewable Energy Target: Response to Expert Panel's Call for Submissions Paper.* Retrieved on April 28, 2015 from, http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0018/518211/NSW-Government-Submission-to-the-RET-Review.pdf

NSW Smart Meter Task Force (n.d.). *NSW Smart Meter Task Force Final Report*. Retrieved on April 25 2015, from http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0008/536696/NSW-Smart-Meter-Task-Force-Report.pdf

OEH (2013): NSW Office of Environment and Heritage. *NSW Energy Efficiency Action Plan.* Retrieved on April 25, 2015 from, http://www.environment.nsw.gov.au/resources/energyefficiencyindustry/130588-energy-efficiency-action-plan.pdf

OEH (2015a): NSW Office of Environment and Heritage (2015a). *Government programs and financial assistance.* Retrieved on April 23, 2015 from, http://www.environment.nsw.gov.au/households/government-programs.htm

OEH (2015b): NSW Office of Environment and Heritage. *Home Energy Action Program: FAQs.* Retrieved on April 23, 2015 from, http://www.environment.nsw.gov.au/resources/households/heap-faq.pdf

OEH (2015c): NSW Office of Environment and Heritage. *Energy-efficient household appliances.* Retrieved on April 23, 2015, from http://www.environment.nsw.gov.au/households/appliances.htm

OEH (2015d): NSW Office of Environment and Heritage. *Environmental Upgrade Agreements (EUA).* Retrieved on April 23, 2015 from, http://www.environment.nsw.gov.au/business/upgrade-agreements.htm

OEH (2015e): NSW Office of Environment & Heritage. *The Regional Clean Energy Program.* Retrieved on April 26, 2015 from http://www.environment.nsw.gov.au/communities/clean-energy.htm

Oliver M., & Jackson T. (1999). The market for solar photovoltaics. *Energy Policy*, *27*, pp. 371–85. ISSN 0301-4215

OTI (2014): NSW Office of Trade and Investment. *Smart Meters in NSW Fact Sheet.* Retrieved on April 26, 2015 from, http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0008/536624/Smart-Meters-in-NSW-Fact-Sheet.pdf

Painuly, J. P. (2001). Barriers to renewable energy penetration; a framework for analysis. *Renewable energy*, *24*(1), 73-89. doi: 10.1016/S0960-1481(00)00186-5

Parkinson, Giles (16 January 2015). NSW solar uptake doubles after Solar Bonus scheme dumped. *Renew Economy*. Retrieved on April 30, 2015 from, http://reneweconomy.com.au/2015/nsw-solar-uptake-doubles-solar-bonus-scheme-dumped-10916

Poortinga, W., Steg, L., Vlek, C., & Wiersma, G. (2003). Household preferences for energy-saving measures: A conjoint analysis. *Journal of Economic Psychology, 24,* pp.49-64. Retrieved from http://naulibrary.org/dglibrary/admin/book_directory/Environmental_management/8435.pdf

Raysam, R. (10 March 2012). German Village Becomes Model for Renewable Energy. *The Community Power Report.* Retrieved on March 25, 2015 from http://www.communitypowerreport.com/2012/03/energy-independent-german-village.html

Reddy S., & Painuly, J.P. (2004). Diffusion of renewable energy technologies- barriers and stakeholders' perspectives. *Renewable Energy, 29,* 1431-1447. doi:10.1016/j.renene.2003.12.003

Reardon, C. (2010). *Your Home Technical Manual.* (4th ed.). Canberra: Department of Climate Change and Energy Efficiency.

Rickwood, P., Mohr, S., Nguyen, M., & Milne, G. (2012). *Evaluation of the home power savings program – Phase 1.* Prepared by the Institute for Sustainable Futures, UTS for the NSW Office of Environment and Heritage, Sydney. Retrieved on April 28, 2015 from, http://www.environment.nsw.gov.au/resources/climatechange/140051hpsp.pdf

Rogers, Z. & Bragg, E. (2012). The Power of Connection: Sustainable Lifestyles and Sense of Place. *Ecopsychology, 4*(4), pp. 307-318. doi:10.1089/eco.2012.0079

Singh, T. (21 August 2011). German Village Produces 321% More Energy Than It Needs! *Inhabitat.* Retrieved on March 27, 2015 from http://inhabitat.com/german-village-produces-321-more-energy-than-it-needs/

Sovacool, B. (2009). The importance of comprehensiveness in renewable electricity and energy-efficiency policy. *Energy Policy, 37,* 1529-1541. doi:10.1016/j.enpol.20 08.12.016

Stern, P. C. (1999). Information, incentives, and proenvironmental consumer behavior. *Journal of Consumer Policy*, *22*(4*)*, 461–478. doi: 10.1023/A:1006211709570

Stern, P. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*(3), 407–424. doi: 10.1111/0022-4537.00175

Sungevity Australia (2015). *Pay $0 Upfront with our "Pay As You Go" Solar Option.* Retrieved on April 28, 2015 from http://www.sungevity.com.au/pay-as-you-go-solar

United Nations World Commission on Environment and Development (1987). *Report of the World Commission on Environment and Development: Our Common Future.* Retrieved from http://www.un-documents.net/our-common-future.pdf

Vorrath, S. (20 April 2015). NSW local govt solar initiative partners with SunEdison. *Renew Economy.* Retrieved on April 28, 2015 from, http://reneweconomy.com.au/2015/nsw-local-govt-solar-initiative-partners-with-sunedison-34445

Whitmarsh, L. (2009). Behavioural responses to climate change: Asymmetry of intentions and impacts. *Journal of Environmental Psychology, 29*(1), pp.13-23. doi: 10.1016/j.jenvp.2008.05.003

Z-NET (2015a): Zero-Net Energy Town. *The Uralla Z-NET Project.* Retrieved March 25, 2015 from, http://z-net.org.au

Z-NET (2015b). Zero-Net Energy Town. *About Z-NET.* Retrieved March 25, 2015 from, http://z-net.org.au/about-z-net/

Z-NET (2015c): Zero-Net Energy Town. *ZNET Uralla: What's Possible?.* Retrieved on May 1, 2015 from, http://z-net.org.au/project-uralla/whats-possible/

Z-NET (2015d). *Z-NET Postcards*. Retrieved via email in a personal communication to Eady, Sandra on 12th April 2015.