zeronet

energy town

Uralla Case Study

Disclaimer

This report was prepared by Moreland Energy Foundation Ltd in good faith exercising all due care and attention, but no representation or warranty, express or implied, is made as to the relevance, accuracy, completeness or fitness for purpose of this document in respect of any particular user's circumstances. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect of, their situation. The views expressed within are not necessarily the views of the Office of Environment and Heritage and may not represent OEH policy.

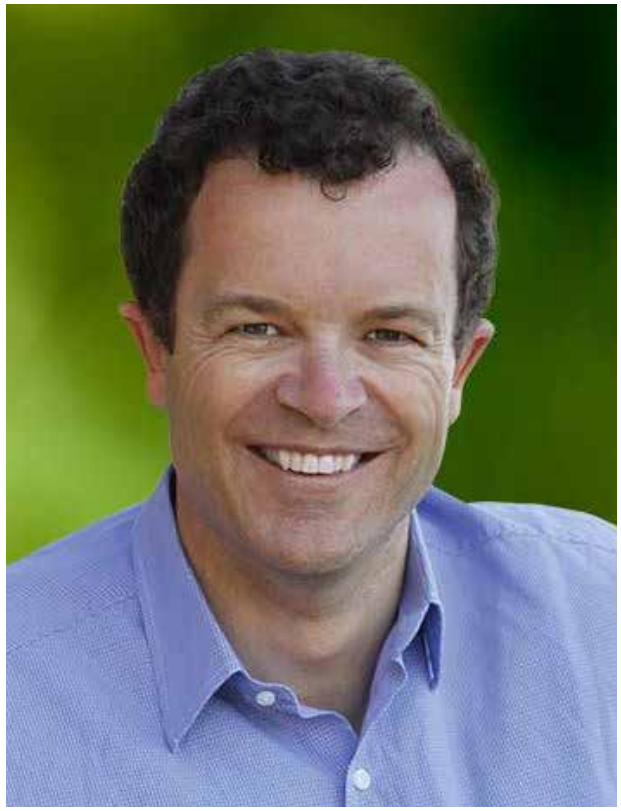
This report was prepared at the request the NSW Office of Environment and Heritage (hereafter "the Client") solely for the purposes of reporting the findings of the Zero Net Energy Town project and it is not appropriate for use for other purposes.

The Client and any other party other than the Client who access this report shall only do so for their general information only and this report should not be taken as providing specific advice to those parties on any issue, nor may this report be relied upon in any way by any party other than the Clients. A party other than the Clients accessing this report should exercise its own skill and care with respect to use of this report, and obtain independent advice on any specific issues concerning it.

In carrying out our work and preparing this report, Moreland Energy Foundation Ltd has worked solely on the instructions of the Client, and has not taken into account the interests of any party other than the Clients. The report has been constructed based on information current as of September 2015, and which have been provided by the Client. Since this date, material events may have occurred since completion which is not reflected in the report.

Except in respect of the Client, neither Moreland Energy Foundation Ltd, nor the parties which have endorsed or been involved in the development of the report, accept any responsibility for use of the information contained in the report and make no guarantee nor accept any legal liability whatsoever arising from or connected to the accuracy, reliability, currency or completeness of any material contained in this report. Moreland Energy Foundation Ltd and all other parties involved in the preparation and publication of this report expressly disclaim all liability for any costs, loss, damage, injury or other consequence which may arise directly or indirectly from use of, or reliance on, the report.

Ministerial foreword



Mark Speakman - Minister for the Environment

The NSW Government wants to empower local communities to develop community owned renewable energy, and achieve high levels of resource efficiency. Our Renewable Energy Action Plan and Energy Efficiency Action Plan set out goals to unlock energy productivity across the state.

In 2014 the NSW Government awarded $105,000 to a consortium to develop a business case on how a NSW community could satisfy all of its own energy needs from renewable energy sources. What's more, it would do so in a way which was competitive on price, quality, reliability and security. This blueprint became known ultimately as the 'zero net energy town', or Z-NET, initiative.

The Z-NET initiative is an exciting and ambitious project. Distributed renewable energy, although common in other parts of the world, is an emerging industry in Australia with opportunity for growth.

No Australian town to date has been able to satisfy its energy needs from renewable energy alone. Uralla stands at the forefront of this challenge by being the Z-NET case study town. The Z-NET blueprint provides Uralla with a roadmap to achieve, in the first stage, between 40 to 70 per cent of its energy goal within just 10 to 15 years. This will be achieved through energy efficiency savings and small scale renewable energy generation using existing programs and commercial products.

One of the reasons that Uralla was selected as the case study town was due to the support and commitment of the local community. I understand that community members have been active participants in the development of the blueprint and that their ownership of this business case will be central to ensuring they achieve their Z-NET goal.

The blueprint also provides a model for other towns throughout NSW and Australia, whether they are seeking to achieve 10 per cent of their energy consumption via renewable energy, or the full 100 per cent.

The success of community led renewable energy projects like this will be vital for regional NSW. I congratulate the team for their work with the Uralla community to date, and I look forward to following the progress of the Z-NET Blueprint in Uralla and across other towns in NSW.

Uralla Mayor's message

Councillor Michael Pearce

The Uralla Community's aspiration of becoming a sustainable community is one practical step closer with the release of the Zero Net (Z-NET) Blueprint applied to Uralla.

The challenges of creating environmentally, socially and economically sustainable regional communities can only be met with shared vision and strong leadership. Quite aside from the value of the technical research, Z-NET demonstrates the power that flows from creating comprehensive community orientated partnerships. In Z-NET the passion, drive and dedication of the community, represented by the Z-NET Uralla Reference Group (ZURG), has been matched by extensive technical expertise and skill from the Moreland Energy Foundation, and the Z-NET Project Team and Consortium. Achieving Z-NET is truly a whole of community enterprise that requires the support of all levels of government and the private sector.

Our community is now better placed to understand the character of energy use in our Shire, the barriers we face in transitioning to an alternative and renewable energy future, and the scale of work and investment required over the coming years to make Z-NET a reality.

Uralla is fortunate to be the focus of this model. A number of communities around Australia, and indeed the world, are in various stages of transition to sustainable energy models, while others may not know how or where to begin. We hope that our experience and the lessons learned here will serve those communities as well as they do ours.

The Uralla Community wishes to acknowledge the support of the Office of Environment and Heritage for providing the necessary finance for this project. We wish to thank and acknowledge the very hard work and expertise of the staff from the Moreland Energy Foundation and its partners. Their efforts in getting to know our community, to embrace our traditions and produce such valuable research is greatly appreciated. We gratefully acknowledge that without the exhaustive work of the local Z-NET Project Team and Consortium this project would not have eventuated. We thank them for their three years of exhaustive work behind the scenes.

The release of the Uralla Case Study marks a beginning, not an end. We look to our future with optimism and confidence in understanding what it holds.

Contents

Executive summary

Today there are significant drivers for a transformation in the way we source and use energy: rising costs, new and improved technologies and, of course, impacts on the environment. Communities across the world are becoming increasingly aware of the risks of inaction, and are coming together with industry and government to reshape the energy sector.

The New South Wales (NSW) Government, through the Office of Environment and Heritage, has supported the Zero Net Energy Town (Z-NET) initiative to develop a case study of how Uralla could be Australia's first 100% renewable community and to establish a blueprint for others to follow.

The Z-NET initiative initially encompasses stationary energy and excludes transport fuels such as petrol and diesel. Uralla's current stationary energy needs comprise electricity (49%) and firewood (45%) with a modest use of LPG gas (6%). Uralla energy consumers currently spend a total of approximately $12M per year to meet their energy needs.

The majority of electricity is imported from Australia's electricity grid and is largely non-renewable due to the current reliance on coal-fired power. There is an increasing renewable component driven by the Australian Government Renewable Energy Target and voluntary investment. At the local level 10% of households and a number of businesses in Uralla have rooftop solar photovoltaic (PV) systems.

Firewood is used extensively across the Uralla region for residential heating and is predominantly sourced from fallen timber on farming land. Wood is potentially a renewable resource, however, existing on-ground reserves in the region are becoming depleted.

This project assessed a range of possible options: use less energy; generate renewable energy locally or nearby; or import renewable energy from other regions. Each option was evaluated on its technical feasibility, financial viability and social desirability.

Currently in Australia there are barriers to the uptake of large-scale renewable generation. Despite these road blocks, there is a substantial business case for taking small-scale actions which together can achieve a large impact. Cost-effective energy efficiency actions, replacement of hot water units and residential solar PV alone could decrease demand in Uralla by almost 20%. These actions present the potential to save $2.2M per year and would allow participating households to save up to $1,000 per year (and businesses to save up to $3,000).

Better managing Uralla's firewood use presents a significant opportunity to become a Z-NET. Energy efficiency actions such as improving thermal fabric by draught sealing and insulation should reduce wood use by approximately 15% and improve comfort during winter. Firewood can be a renewable resource, but more research is required to understand how firewood collection and resource management practices in Uralla will need to change. Options include improving existing practices of collection, importing certified firewood from a nearby region, or funding reforestation projects.

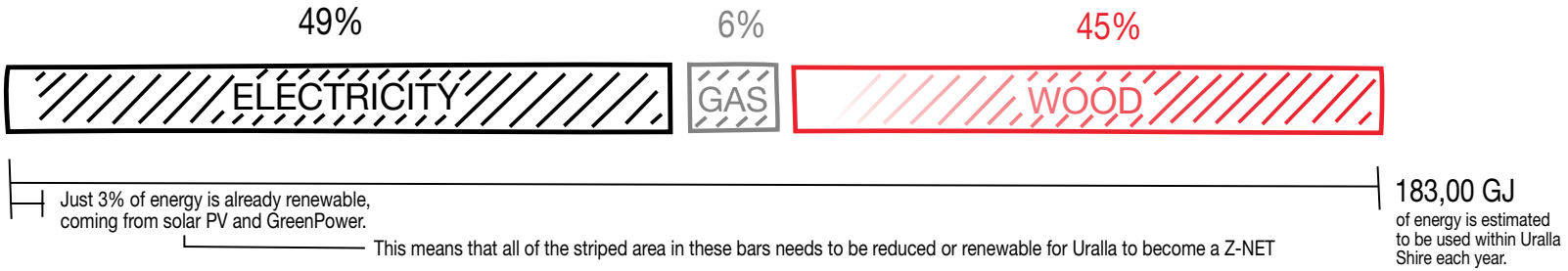
This report sets out a two-stage approach to achieve the Z-NET goal; a goal that is relevant to communities across Australia.

Stage 1 is about immediate practical action: using less energy and opportunities to generate renewable energy locally or nearby that have a positive business case relative to the cost of importing renewable energy. Combined, this cost-effective action could reduce overall energy use by 15% and deliver between 40 to 70% of the goal within ten years.

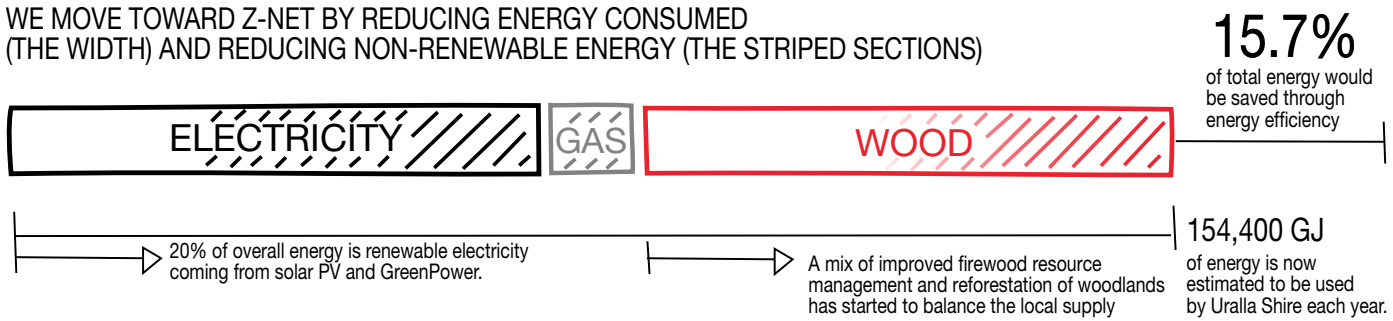
Stage 2 provides a framework for developing partnerships and joining policy and advocacy initiatives to remove barriers and establish a viable context for large-scale renewable electricity generation. For firewood, Stage 2 represents the culmination of local efforts to create a renewable firewood supply within a regional context.

The plan outlined in the Z-NET Uralla Case Study delivers immediate, measurable benefits to the local community. It also provides the foundations to develop large-scale generation or import renewable energy in the most competitive way. By implementing this plan, Uralla will be investing in the long-term interests of its own community and providing an example for other communities across Australia to follow.

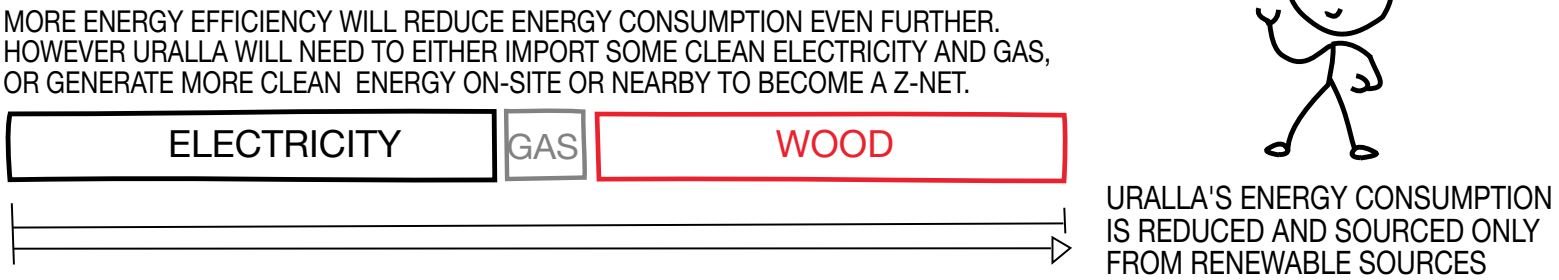
ENERGY CONSUMPTION IN URALLA TODAY



WHAT ENERGY CONSUMPTION MIGHT LOOK LIKE AFTER STAGE #1



WHAT ENERGY CONSUMPTION MIGHT LOOK LIKE AFTER STAGE #2



Introduction

About the project

Funding was provided by the NSW Office of Environment and Heritage Regional Clean Energy Program to evaluate the business case and develop the Uralla Case Study and a Blueprint which can be adopted by other communities seeking to become a Z-NET.

The project was managed by the Z-NET Consortium, led by Starfish Initiatives. The Consortium was responsible for community selection, engaging technical expertise and stakeholder liaison.

The Uralla community was selected from a competitive field based on its representative economic and social characteristics and its demonstrated community interest.

Technical analysis and preparation of the report was led by Moreland Energy Foundation along with partners Enhar, Little Sketches, Percepscion, ClimateWorks Australia and Rod Marsh.

The Consortium acknowledges the active contributions made by the advisory panel and local reference group and others (refer to acknowledgements at the end of the document).

About the concept

Communities across the globe are developing and implementing plans to meet their energy needs from renewable sources. While each has unique circumstances, they share a common approach of applying actions that suit the context, building a business case and engaging the community in participation. Key examples include:

» By 2009, the German town of Feldheim was producing all its own energy with renewable sources.

» Almost 20 years ago, the city of Växjö in Sweden set itself the goal of becoming fossil fuel-free by 2030 and is today more than halfway there.

» Dharnai village in the state of Bihar, one of India's poorest states, now sources its power from a solar micro-grid.

Our scope

Energy use

The Z-NET Uralla Case Study is a plan for stationary energy focusing on electricity, gas and wood. The Case Study excludes transport fuels such as petrol and diesel. Transport fuel is a significant long-term issue and will be an important next step for Uralla and other communities to consider.

Location

While the term Z-NET refers to 'Town', the Case Study is actually a plan for the whole Uralla Shire. Unless specified, all references to energy use or collective costs or benefits are considered to be within the Shire.

Report structure

This document provides a case study of how the Uralla community could become a Z-NET. The report structure follows our approach in identifying the context, establishing what's possible and what will work and understanding how it might work best. Each section is highlighted at the bottom of each page to assist navigation.

This approach, along with principles applied to assessment and implementation planning form a Z-NET Blueprint that can be utilised by communities across Australia. The Z-NET Blueprint is set out in the following pages and then applied throughout the case study. While each community has a different context, the approach and principles of the Blueprint have universal application.

The **Z-NET BLUEPRINT** approach

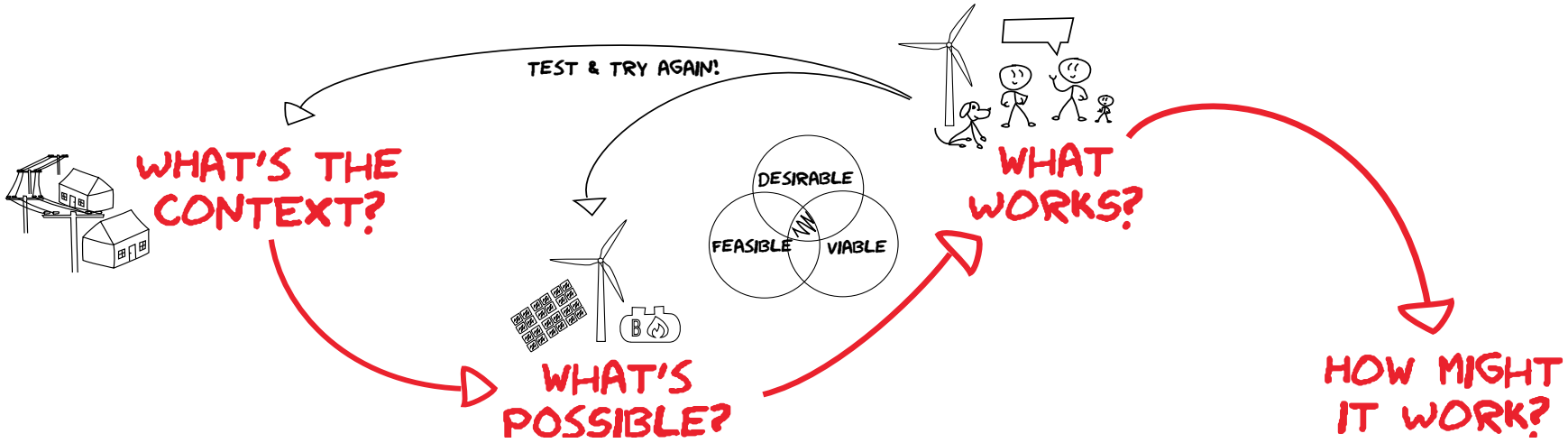
The Blueprint sets out the approach taken, the logic and principles applied in assessing options and the framework used for developing the implementation plan.The Blueprint and the Uralla Case Study are both useful resources for communities seeking to become a Z-NET.

What is a Z-NET?

A zero net energy town (Z-NET) is a community that reduces and balances its local energy needs with a 100% renewable energy supply. This is done firstly by reducing energy use and then importing or locally producing enough energy to meet or exceed the community's demand.

Becoming a Z-NET

Becoming a Z-NET sounds like a great idea—so where do we start? To become a Z-NET we need to find a path that's ambitious, realisable and in the long-term interests of the local community. To do this, it needs to be technically and practically feasible, financially viable and desirable to the local and wider community. The approach taken has been to carefully consider the context, identify all possible options and assess whether they will work and then resolve how they are best implemented.



What's the context?

The first step is to understand the context, which includes identifying the characteristics of the location and the community and its existing energy use. The context defines current and future energy requirements, identifies opportunities and highlights issues that present limitations or risks.

What's possible and will it work?

The next step is to understand all the possible options and determine the best fit within the local context. There are many options to reduce energy use and produce energy from renewable sources. To find the right approach we need to identify if options are feasible, viable and desirable.

How it might work?

Having a model is great but it's crucial to have a plan to ensure it gets done. Understanding who is responsible for what and being clear about the resource requirements are key to ensuring we have a practical and reasonable path to achieve the goal of becoming a Z-NET.

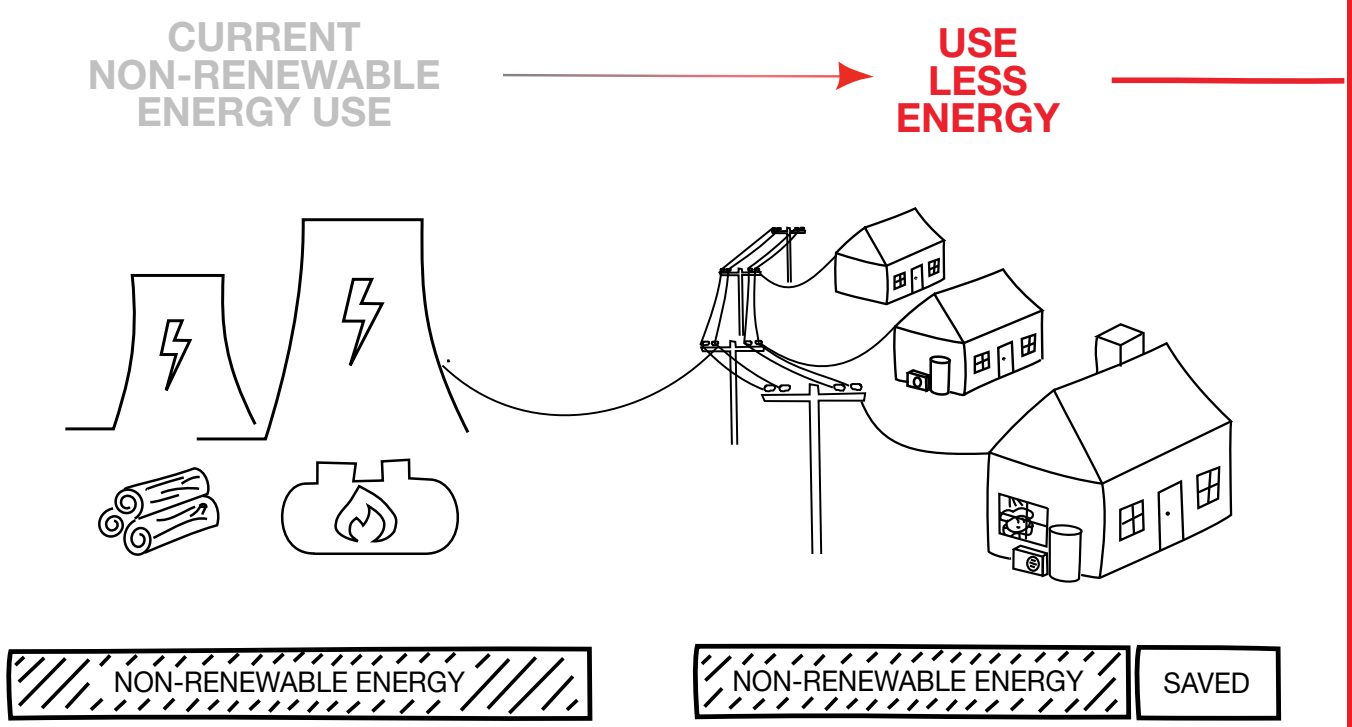
The **Z-NET BLUEPRINT** logic

The Blueprint sets out a simple logic for communities across Australia to establish a least-cost approach to becoming a Z-NET. Becoming Z-NET is technically possible today with available technology, however in practice cost is a key consideration for most if not all participants.

To establish the case for action, the community needs to weigh up the benefits and the costs of options available, such as using less energy for things like lighting and hot water, and compare these to other possible options. The Blueprint logic ensures that actions that have the most benefits or least cost are taken first.

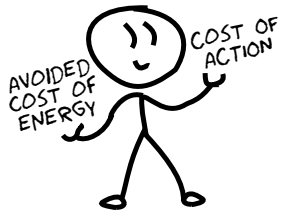
The Blueprint also recognises that benefits and costs of renewable energy options change over time. Recognising this allows a community to take practical action immediately whilst resolving the most appropriate long-term investment to reach the Z-NET goal.

Z-NET ACTIONS: A LEAST-COST APPROACH



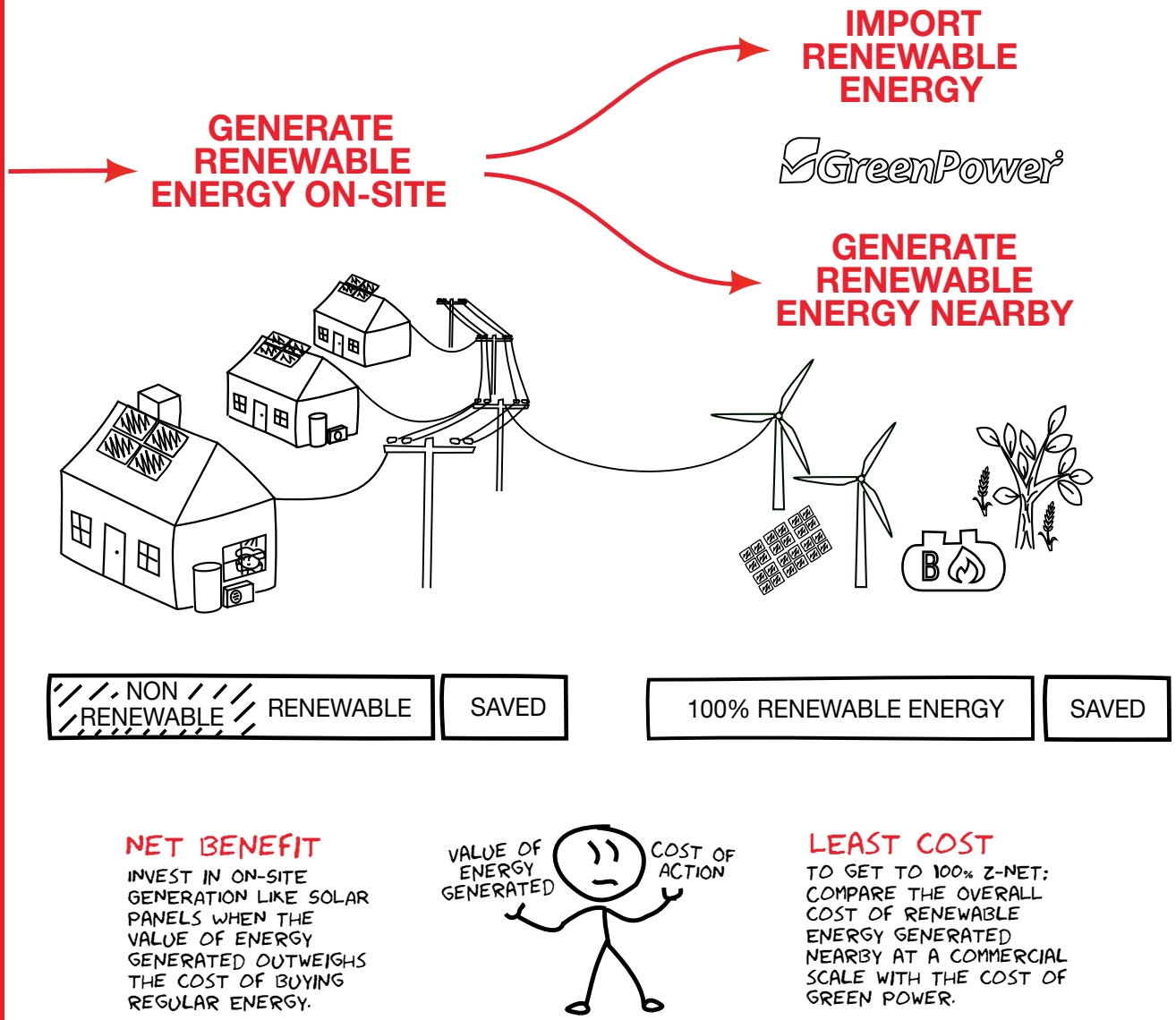
THE BUSINESS CASE

FOR ANY ACTION, COMPARE ALL THE UPFRONT COSTS AND ALL OF THE BENEFITS FROM NOT HAVING TO BUY NON-RENEWABLE ENERGY. IT MAKES SENSE TO TAKE ACTIONS THAT HAVE THE MOST BENEFITS OR LEAST COST FIRST.



NET BENEFIT

INVEST IN ENERGY EFFICIENCY MEASURES IF THE VALUE OF ENERGY SAVINGS OUTWEIGHS THE COST OF IMPLEMENTING THE ACTION.



Electricity costs

The price we pay to purchase electricity from retailers is made up of the costs to generate the electricity, cost to operate the networks that bring it to our door, and the retailer's 'margin'.

The cost of generation (wholesale electricity price) is approximately 25% of the retail electricity price, with transmission and distribution accounting for more than 40%.

Whenever we use less we are avoiding costs involved in generating and transporting the electricity to our homes. Equally when we generate on-site, like rooftop solar, we avoid these costs and in some cases get income from any excess generation that is fed into the grid.

When we generate renewable energy off-site, we need to factor in the cost of transportation to where it will be used, and compare this to importing renewable energy from elsewhere.

Programs to encourage renewable energy projects across Australia, like the Renewable Energy Target (RET), mean that some renewable energy is already being fed into the national grid. The cost of 'green' programs is shared by all energy users and adds a bit more to the retail prices of energy.

On a least cost basis, renewable energy projects will be more competitive where there is a high quality natural resource, and construction and connection costs are low. Communities considering generating renewable energy nearby need to consider the balance between least cost and net benefit.

The **Z-NET BLUEPRINT** option assessment

The following is an overview of the assessment approach applied to each of the possible options to achieve zero net energy, such as energy efficient appliances, solar PV and improved firewood resource management.

What's possible?

Each option has characteristics that determine whether it will suit a local context and contribute to the Z-NET goal.

The technology or resource

» What is the technology or resource and what are its characteristics?

The local context

» What is the local context that the option responds to?

The impact

» What impact on the goal of zero net energy can this option have?

Will it work?

A number of factors need to be considered in order to evaluate technology and resource options.

Risk

» What are the risks associated with the option?

Social benefit

» What are the social benefits of the option?

Regulatory

» What are the regulatory opportunities and constraints?

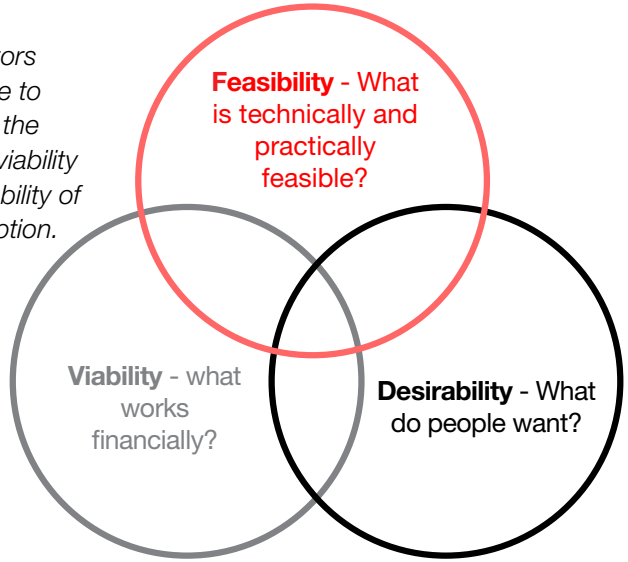
Technical

» What are the technical considerations for this option?

Economic benefit

» What are the additional economic benefits of the option?

These factors all combine to determine the feasibility, viability and desirability of any one option.



Business case

» What is the financial business case for the option?

Customer market

» What is the size of the customer market that the option would service?

Environmental benefit

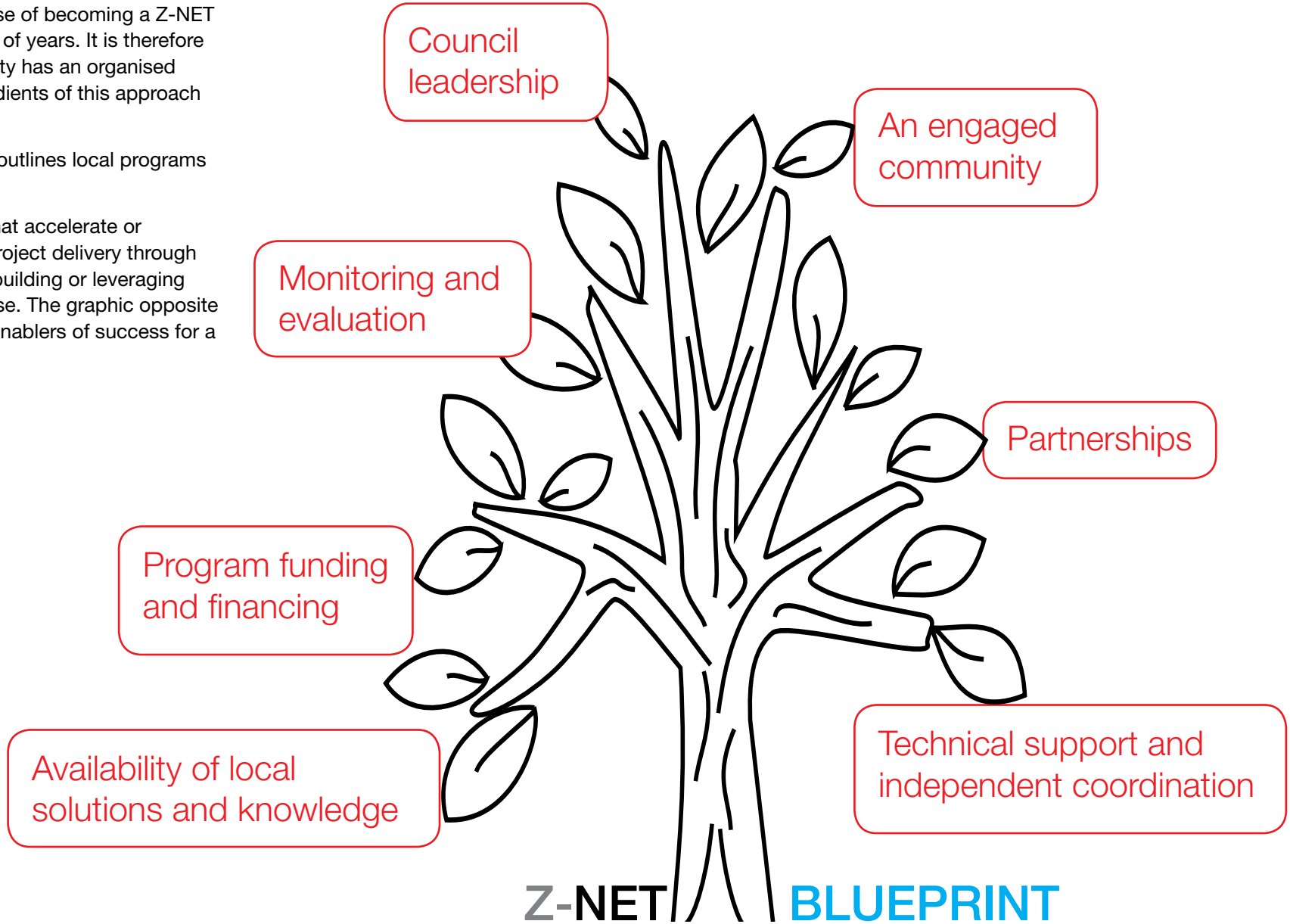
» What are the environmental benefits of the option?

The **Z-NET BLUEPRINT** implementation

The implementation phase of becoming a Z-NET can extend for a number of years. It is therefore crucial that the community has an organised approach. The key ingredients of this approach are:

» an action plan which outlines local programs and projects

» a range of enablers that accelerate or assist program and project delivery through leadership, capacity building or leveraging investment or expertise. The graphic opposite demonstrates these enablers of success for a Z-NET.



What's the context?

Understanding the community

Understanding the local economy, geography and demographics is a first step in understanding current energy use and to identifying opportunities and limitations to become a Z-NET.

Understanding the community is critical to determining whether options are appropriate and acceptable.

Community profile

The Uralla community is home to over 6,000 people in approximately 2,200 dwellings.

It has some thriving local businesses (including several foundries) and a strong tourism base. Most daily needs can be met locally; other needs require travel to a regional centre such as Armidale. There are 240 businesses in the Shire which employ at least one person. Many of the people living in Uralla take the daily trip to Armidale for work.

Agriculture forestry and fishing; education and training; health care and social assistance; and retail trade are the highest employment categories in the shire.

Two factors which will affect the ability of community members to undertake action are tenure and income. Approximately 20% of occupied dwellings in Uralla Shire are rented, which is lower than the NSW average but still significant (refer split incentive discussion in Program funding and financing). Business tenure figures are not available. Income levels are approximately 70% of the NSW average. Even with the lower cost of housing in rural areas this may impact ability for some households to meet the up-front cost of actions.

Town	Population	Households
Bundarra Area	805	293
Bundarra Township	404	149
Invergowrie	747	254
Kentucky	325	135
Kingstown	320	122
Rocky River	258	102
Saumarez Ponds	422	129
Uralla Township	2,388	911
» (Sub total)	5,669	2,095
» **Uralla Shire**	» 6,034	» 2,203

Geography

Uralla is part of the New England Region and is nestled to the west of the Great Dividing Range approximately half-way between Brisbane and Sydney. The main township is located 22 km to the south-west of Armidale in NSW.

Its elevation makes the winters very cold with overnight temperatures as low as -10°C during the winter. Summers are generally mild.

Understanding energy use

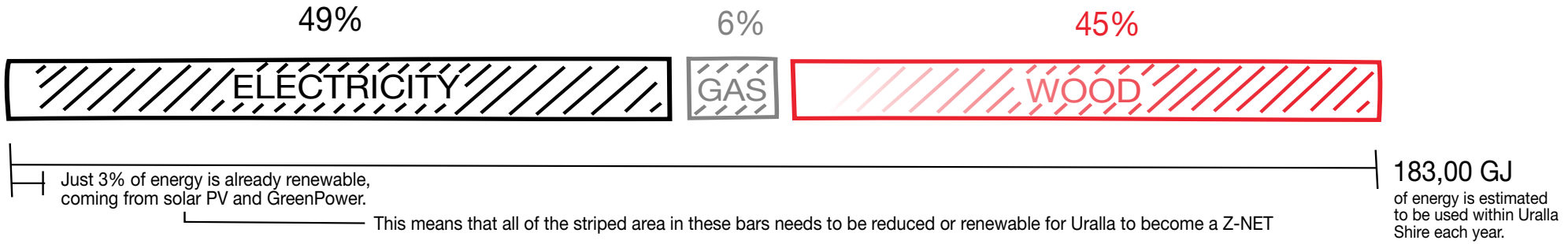
Uralla's primary stationary energy needs are met by electricity and firewood, with a modest use of LPG gas. Electricity is used for a range of daily business and household needs such as lighting, heating, hot water, and operating equipment and appliances. Firewood is used extensively across the region for heating households.

Understanding energy supply

Electricity supply

There are three key components to the physical supply of electricity: generation, transmission and distribution. Generation has predominantly been from large coal-fired power stations, though gas and wind are now common fuel sources. These generation units are connected by a high-voltage transmission network across south-eastern Australia forming the National Electricity Market. The transmission network transports electricity significant distances to supply low-voltage distribution networks. These distribution networks provide the direct connections to households and businesses. The distribution network also allows electricity generated by small distributed generators such as rooftop PV systems and gas fired cogeneration plants to be redistributed to other parts of the network where there is demand.

The sources of Uralla's energy use



Electricity use

Currently, the electricity in Uralla is mostly from non-renewable sources, however, the uptake of rooftop solar PV is increasing, with 10% of Uralla residents now owning a system. The Uralla Shire uses around 25,000 MegaWatt hours (MWh) of electricity each year, with the township of Uralla using about 40% of this. Analysis indicates that about 75% of electricity is for household use, with the bulk of this being used for electric hot water and appliances.

Gas use

The Uralla area does not have a gas pipeline connection however LPG bottled gas is used for heating, cooking and some industry.

Firewood use

Approximately 70% of households use firewood for heating, sourced predominately from fallen timber on farm land at a rate of approximately three tonnes per household or 5,150 tonnes for the Uralla Shire per year. Wood is potentially a renewable resource however the rate at which on-ground resources are being replenished by natural processes is unclear, and consideration needs to be given to other environmental impacts (e.g. habitat loss). Improved firewood resource management is required to ensure a long-term balance. In addition, there are ways that wood-heating systems and homes can be improved so that they require less wood to keep homes warm.

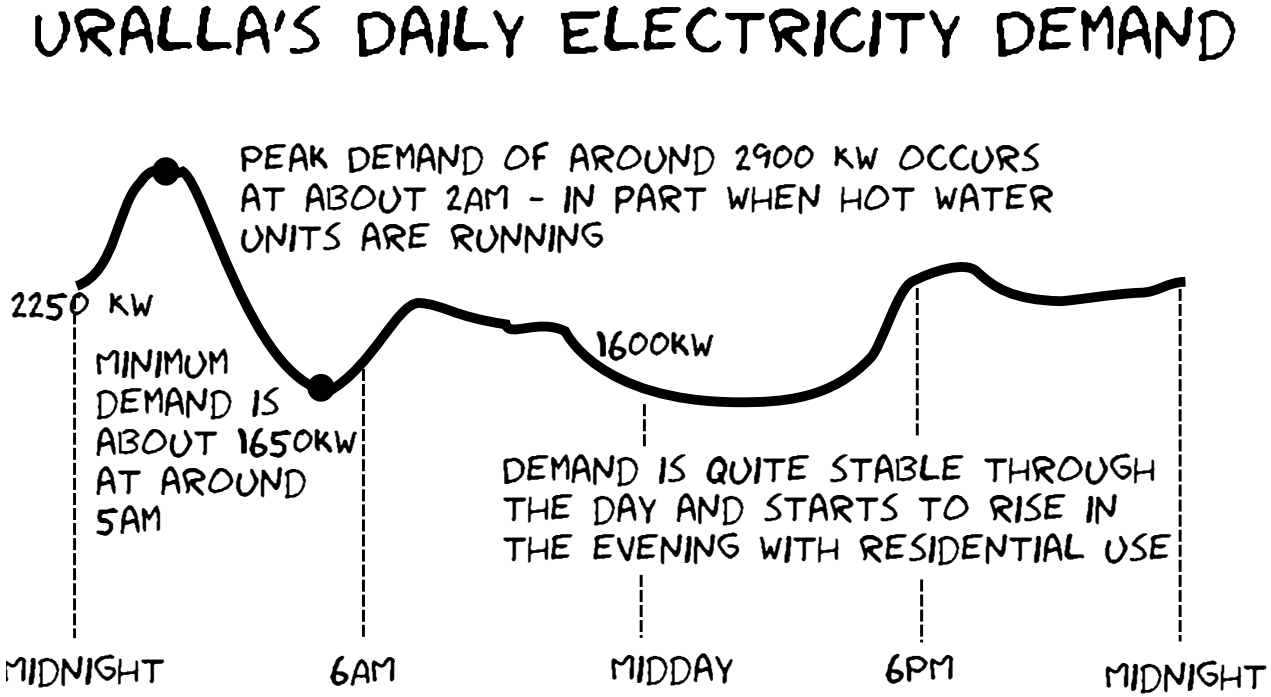
The distribution network in Uralla region is managed by Essential Energy, a NSW Government-owned corporation with responsibility for building, operating and maintaining the electricity distribution network across regional NSW.

The Uralla region is physically connected to the National Electricity Market by four 11kV feeders. Zone substations transform the 11kV high-voltage supply to 415V low-voltage for use in households and businesses across the shire.

Our demand for energy is not constant; it varies throughout the day and across the year. Electricity network infrastructure needs to manage this variability and maintain a secure supply to users.

In Uralla, the most significant peak in energy demand is the overnight use of electricity for heating water. The hot water units are ripple-controlled allowing Essential Energy to centrally control when the units turn on. These units, widely used in regional NSW, were originally promoted to balance day-time load for coal-fired power stations.

The majority of Uralla's electricity use is from households. During the day the demand profile is fairly flat. As people return home in the evening the demand rises to support lighting, appliances and heating. The combination of low commercial and industrial use, cold winters and low uptake of air-conditioning means that winter demand is higher than the summer demand in the region.



Physical networks and their operators have different abilities to connect additional generation and manage variable generation with variable demand. However, when designed appropriately, distributed generation can benefit the existing network, reducing or matching peak demand and avoiding costly upgrades.

Essential Energy has indicated that there was considerable 'headroom' in the local substation capacity and there is no need for augmentation in the short- to medium-term. This means that there are no immediate opportunities for renewable energy to offset network investment, and conversely there are no distinct impediments to increasing distributed generation.

The physical supply of electricity is changing rapidly due to technology and the way we use it. The ability to store energy, with the emergence of affordable battery technology will have a profound impact on managing supply and demand.

Gas supply

For Uralla, there is no gas pipeline connection with the 'network' of supply relying on distribution of bottled gas by regional operators.

Wood supply

There are a number of different ways in which firewood is sourced in the Uralla community, but the predominant sources are outlined below:

» Purchased firewood – this involves the direct purchase of firewood, with an average cost of $200 per tonne, through one of a number of local suppliers. It is estimated that approximately half of town residents and only

zeronet energy town

a small portion of rural residents with wood heating source timber in this way

» Self collected/free firewood – either for rural residents on their own land (fallen or dead trees) or for town residents through an informal relationship with a land owner. It's estimated that half of town residents and the majority of rural residents with wood heating collect firewood in this way.

A small number of residents may purchase third party or voluntary certified firewood through local suppliers.

Understanding energy policy

Energy policy and regulation is complex and multi-faceted. Policy and regulation covers security and quality of supply, physical safety, tariff structures, environmental protection and industry support.

This context is important to understanding what's possible now and what might need to change in the future for certain opportunities to become zero net energy to be feasible or viable.

Historically the energy infrastructure in Australia was predominantly built and controlled by state governments. In recent years there has been a shift across Australia to corporatise or privatise generation, transmission, distribution and retail and establish a nationally-regulated grid.

NSW today has a competitive electricity market with generation and retail privatised and contestable. The transmission company TransGrid and distribution companies AusGrid, Endeavour Energy and Essential Energy are state-owned companies. The current NSW Government policy is to lease these networks to private operators, with the exception of the Essential Energy network which services regional NSW (Uralla is located within the Essential Energy network).

The Australian Energy Regulator (AER) regulates energy markets and networks under national energy market legislation and rules. The AER is responsible for setting the prices charged and connection arrangements for using electricity transmission and distribution networks in NSW. The AER also monitors wholesale electricity and gas markets and regulates the retail energy markets in NSW including customer protections and licensing of retailers.

In recent times, energy policy and regulation is increasingly required to develop policies to manage greenhouse gas emissions and encourage renewable energy.

National climate policy in Australia remains intensely politicised, with carbon pricing mechanisms removed or wound back and recent protracted negotiations over the Renewable Energy Target creating further investment uncertainty for the sector. However international developments such as the recent climate agreement between the USA and China, are building momentum for strengthening global commitments and can be expected to influence policy over the next decade.

Meanwhile the NSW government has taken a proactive approach to supporting renewable energy. The Government's Renewable Energy Action Plan sets out three goals: attract renewable energy investment, build community support, and grow renewable energy expertise.

The Plan intends to position the state to increase energy from renewable sources at least-cost to the energy customer and with maximum benefits to NSW.

The strategy seeks to work closely with NSW communities and the renewable energy industry to increase renewable energy generation in NSW.

The NSW Government also has an Energy Efficiency Action Plan which intends to support wide-scale adoption of energy efficiency through market mechanisms such as the Energy Savings Scheme, and respond to barriers through targeted programs for households and businesses.

Local government has a role to play in determining planning and land use matters associated with renewable energy projects. The Uralla Shire Council is very supportive of the Z-NET project.

Many local governments have developed renewable energy plans and targets and taken steps to develop renewable energy projects and attract renewable energy investment to their regions. Lismore City Council, for example, is the first regional Council to commit to a plan to meet its operational needs with 100% renewable energy.

zeronet energy town

What's possible and will it work?

Now that the context has been established, the options for becoming Z-NET need to be evaluated. This requires an assessment of opportunities to reduce energy use, to assess generation options both on-site and nearby and compare this to importing renewable energy for other regions.

Potential contributions

Using less energy

Reducing energy consumption through measures such as increasing insulation or installing energy efficient appliances. All these actions together reduce the amount of energy required to power the town, making the goal of 100% renewable energy more achievable to reach.

Generating energy on-site

Generating energy on residential, commercial and community properties, both to off-set energy consumption (behind the meter) and to potentially export energy for use by others. Battery storage enables energy generated on-site to be stored for later use.

Generating energy nearby

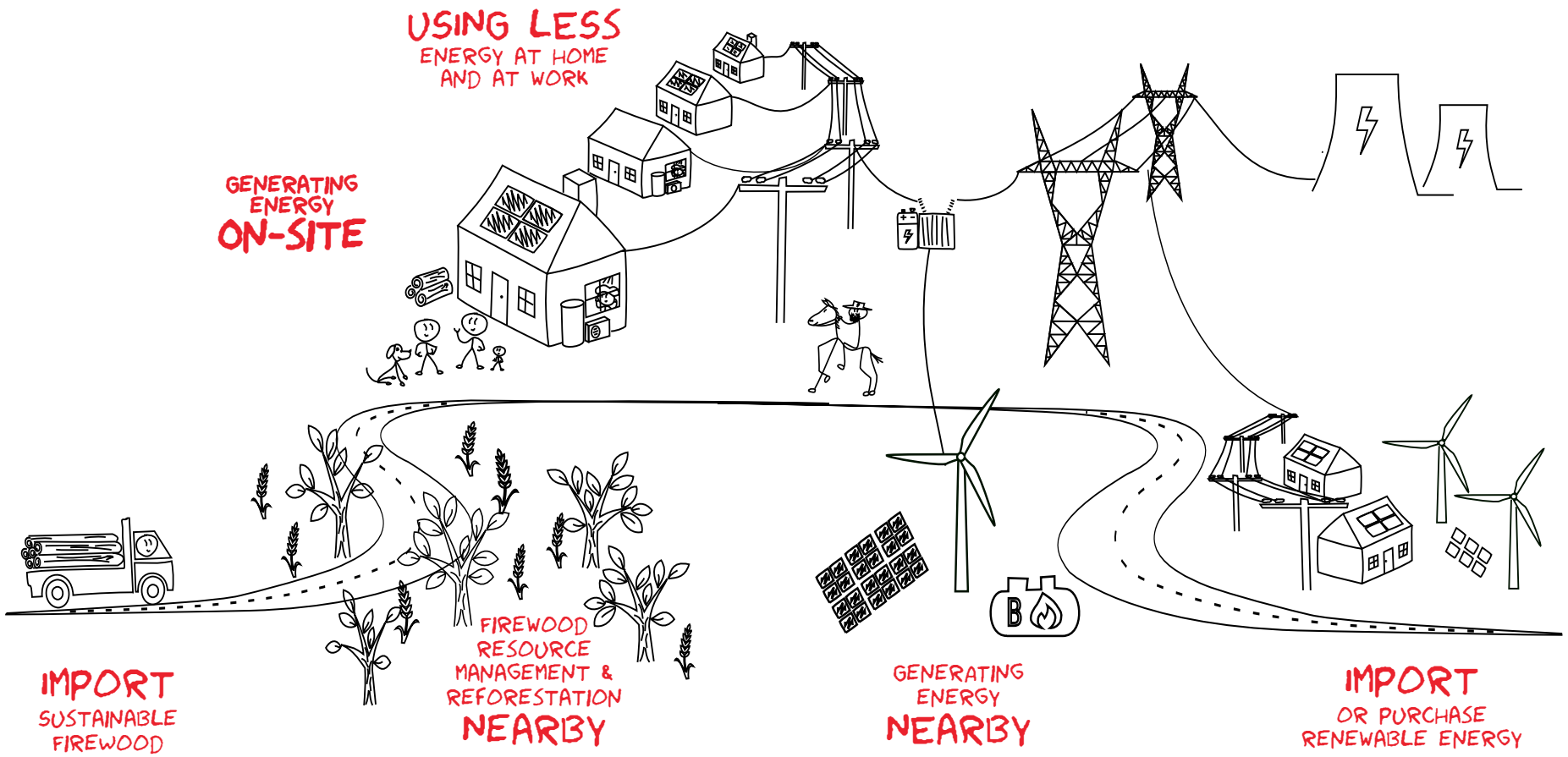
Generating renewable energy within the Shire boundary from places such as appropriately located wind turbines and solar farms. For wood energy this means improved management and reforestation on sites in and around Uralla, that help balance the firewood supply of the region.

Importing energy

Uralla purchasing renewable energy from other regions, rather than generating it on-site or nearby. For electricity this can be via a purchase agreement with a specific project or via an electricity retail premium such as GreenPower. For firewood this could involve sourcing from suppliers outside of Uralla that have been third party certified.

SO IF URALLA WANTS TO TAKE ACTION TO BECOME A Z-NET...

WHAT CAN CONTRIBUTE TO ZERO NET ENERGY



Zero net electrical energy

As previously identified, almost half of Uralla's current energy use is electricity. To achieve the Z-NET goal a number of actions need to be considered and compared based on their impact and their cost. A summary of the options is presented in the accompanying table and the visual 'cost curve' overleaf.

The cost curve prioritises options from lowest cost to most expensive. It shows that:

» The most attractive option in terms of financial viability (height below the line) are lighting upgrades and residential solar PV.

» Options that have the most impact on Z-NET while providing positive returns to investors are solar PV, appliance upgrades and domestic hot water (heat pump upgrades).

» Local wind and other utility-scale generation have the potential to have the greatest contribution to Z-NET but come at a substantial cost if pursued within the current operating environment.

The detailed evaluation of options is shown in the following section and summarised in the table below.

Paybacks

» The payback represents the number of years it takes for the benefit of the action to offset the initial capital cost. If $20 LED light saves $5 of electricity (benefit) each year the simple payback is 4 years. However a discounted payback takes into account the 'time value of money'. This recognises that an amount of money is worth more today than the same amount of money in the future, because money today can be invested to generate an expected annual return. The discount rate used in our modelling is 6% p.a.

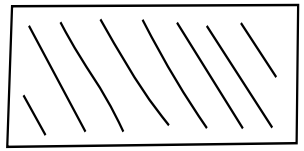
Summary of electricity option evaluation

Options	Impact (% Electricity)	Business Case	Technical	Regulatory	Managing risk	Customer market	Enviro benefit	Social benefit	Economic benefit
Using less energy – Hot water	6.6	✓✓	✓✓	✓✓	✓✓	✓✓✓	✓✓	✓✓	✓
Using less energy – Lighting	4.7	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓
Using less energy – Appliances	6.5	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓
Using less energy – Business energy efficiency	2.0	✓✓✓	✓✓	✓✓✓	✓✓✓	✓	✓✓	✓✓	✓
Generating on-site – Residential and business solar PV	26.9	✓✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓	✓
Generating nearby – Utility-scale electricity generation	?	✗	✓	✓	✗	✓	✓✓✓	✓	✗
Importing renewable energy (GreenPower)	?	✓	✓✓✓	✓✓	✓✓✓	✓	✓✓✓	✓	✗

Reading a cost curve

1. Each block represents an option that contributes to a ZNET

The height and position of a block either below or above the x-axis, shows the relative cost of the option compared to the cost of grid sourced energy.



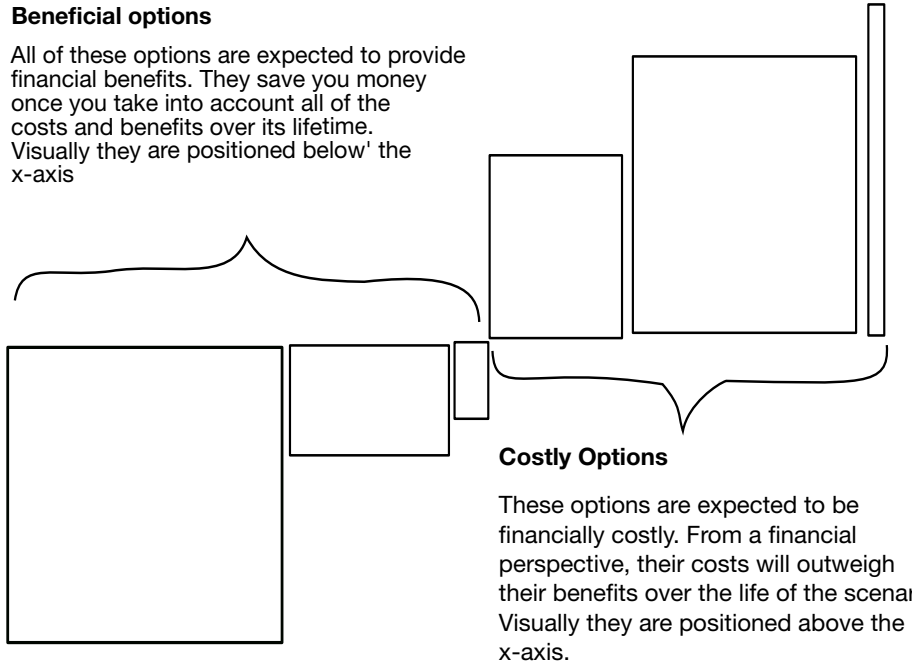
The width of a block shows the how much the option can contribute to a Z-NET.

2. The difference between 'costly' and beneficial options

Beneficial options

All of these options are expected to provide financial benefits. They save you money once you take into account all of the costs and benefits over its lifetime. Visually they are positioned below' the x-axis

3. The blocks 'build' left to right towards achieving the Z-NET target.



Costly Options

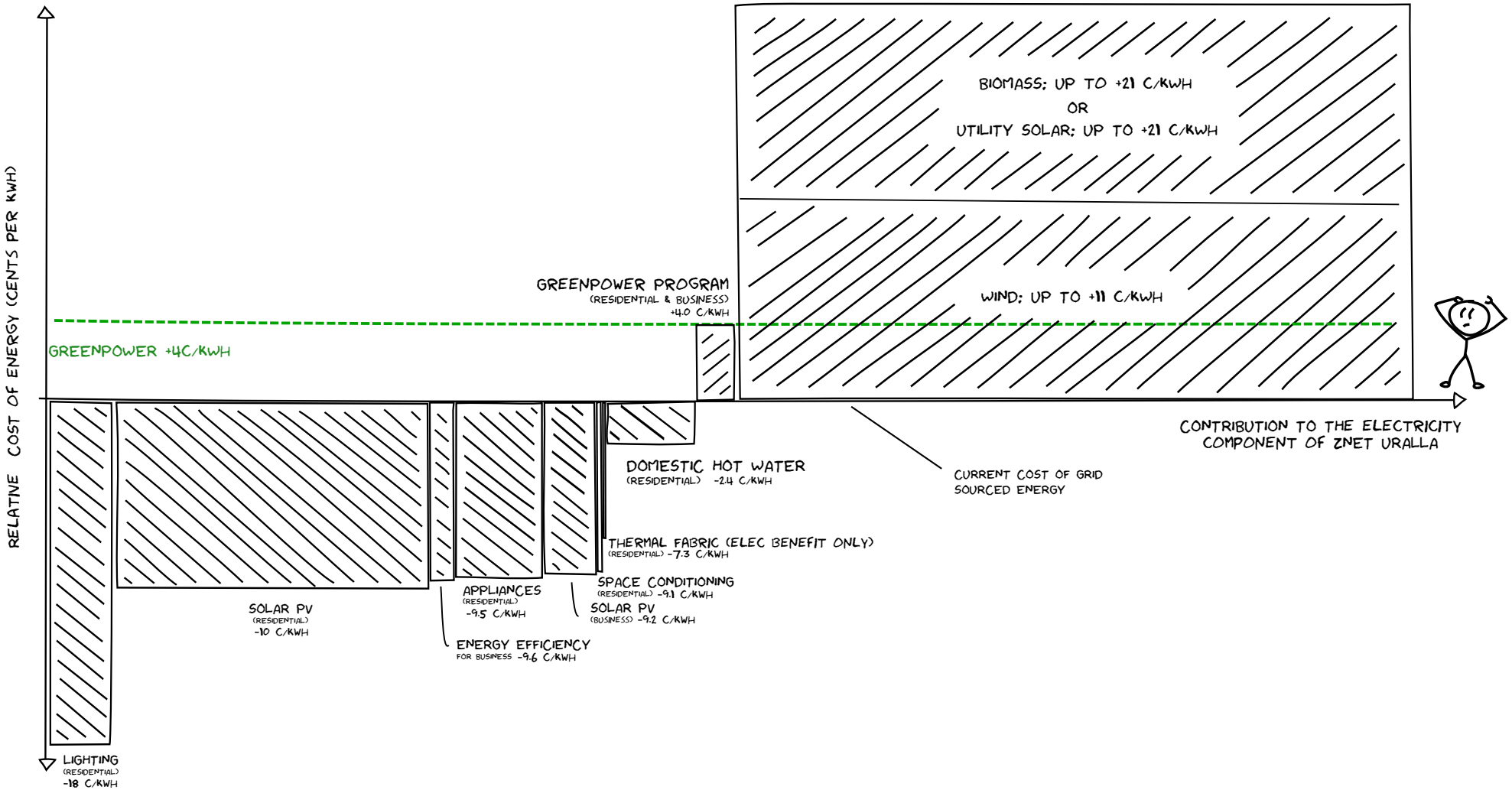
These options are expected to be financially costly. From a financial perspective, their costs will outweigh their benefits over the life of the scenario. Visually they are positioned above the x-axis.

TOWARDS Z-NET: ELECTRICITY COST CURVE

COMPARING SCENARIOS IN TERMS OF COST OF ENERGY AND CONTRIBUTION TO GETTING TO....

50%

AND UP TO 100%
OR MORE OF CLEAN ELECTRICITY IN URALLA



Hot water (using less energy)

What's possible?

The technology

Domestic hot water uses energy from either solar, gas, electricity or wood (or a combination) and is frequently the largest energy consumer for residential buildings. A significant percentage of households in rural NSW use electric water heating which is generally not efficient. Replacing these systems with more efficient water heaters offers significant energy savings.

It is important to clarify that this option does not involve using less water, rather using less energy to produce the hot water by adopting more efficient water heaters.

The Uralla context

» Hot water is approximately 25% of household energy consumption depending on what system is used and what other energy consumption exists on site

» Approximately 85% of local households have an electric storage hot water system (some of these have a solar system integrated)

» The peak local network demand for electricity is at 2am when inefficient electric storage hot water systems are turning on

The impact

» Two main opportunities to improve efficiency in Uralla - electric heat pumps or solar hot water heaters

» Subject to testing for local climatic conditions heat pumps offers a better alternative with the following impacts possible with good uptake of a coordinated program of replacement

Energy saving (GJ)	5,580	
Energy saving (MWh)	1,550	
Contribution to reaching Z-NET %	Total	3.1%
	Elec	6.6%

Profile

Mayor Michael Pearce

Mick had an old storage system in his roof that he wasn't happy with. Apart from the cost it used to leak once in a while which was pretty inconvenient. A mate recommended a heat pump system telling Mick it was more sustainable and was cheaper to run.

Mick reckons it's a winner. "I don't have all the facts and figures but it saved us a considerable amount of energy compared to the old one".

The process was pretty simple and now Mick is reaping the benefits (and has no worries about the tank in his roof leaking). As smart meters are rolled out Mick will be able to take advantage of a time of use tariff by getting his heat pump to do most of the work when energy costs are low overnight.

Will it work?

Technical

» No obvious technical constraints to installation

» Only selected models of heat pumps or solar hot water will be efficient in the Uralla climate (some heat pumps do not perform as well in high frost areas)

» Heat pump energy consumption can be time-controlled to take advantage of solar PV generation if installed

Regulatory

» No regulatory impediments - the industry is already a mature one

» Heat pumps are still eligible for Small Technology Certificates (i.e. Renewable Energy Certificates or RECS) from the Federal Government which reduces their cost

» Rebates are also available for solar hot water

Risk

» Strong due diligence process required for any preferred provider

» Trial required to confirm efficiency benefits of heat pumps in local climate

» Landlord and low income investment may be lower due to split incentive and upfront cost respectively

Customer market

» Over 85% of households have an electric storage hot water system

» Replacement more attractive to households when combined with solar PV

» The market available is outlined below

No. households initially targeted (Shire)	1,263
Total no. households in Uralla Shire	2,203
Estimated program uptake rate by 2025	67%

Business case

» The overall business case for replacement of electric storage hot water systems with an electric heat pump is reasonable, however not as attractive as some other household options

Discounted payback	10.0 yrs
Ave. saving per household (p.a.)	$148

» The business case is significantly improved for households with solar as they can make better use of their solar systems during the day to heat hot water

» For those without solar PV and who own electric storage systems which have reached replacement age there is limited financial benefit but a strong environment benefit to replace with a heat pump.

Environmental benefit

» 1,535 tonnes of CO_2 saved per annun

Social benefit

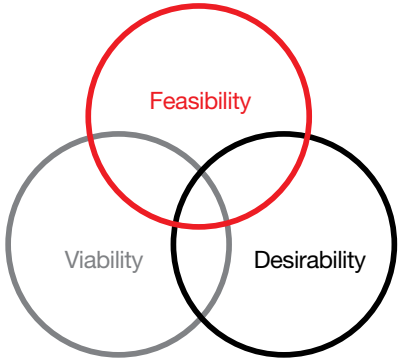
» There is strong potential to target replacement programs at low-income households

Economic benefit

» Local business opportunity for installer

» Approximately $600 to $800 to install per system (labour), a proportion of which will be spent locally

» Opportunity for large manufacturer to prove efficiency of heat pumps in colder climate



Conclusions

Feasibility

Feasible—there is available commercial technology, but some technical risk

Viability

Viable—the business case for immediate replacement exists for households when combined with solar

Desirability

Desirable—a weaker business case is balanced by the importance of the contribution to Z-NET

First step

Initiate a local trial of a variety of heat pumps in Uralla to confirm efficiency savings.

Lighting (using less energy)

What's possible?

The technology

Replacing lighting can play a significant role in reducing energy use for households. Highly efficient LED lights for example, use approximately one-fifth the energy of a halogen downlight.

The Uralla context

» Lighting makes up around 4% of energy use in a typical Uralla house, but nearly 10% of electricity use

» Incandescent or halogen types are obvious targets for replacement

The impact

» The majority of households would replace all of their lights over ten years

» The impact of a staged changeover of lighting to high efficiency LEDs provides a strong contribution to Z-NET as shown below

Energy saving (GJ)	4,023	p.a.
Energy saving (MWh)	1,118	p.a.
Contribution to reaching Z-NET %	Total	2.2%
	Elec	4.7%

Profile

Replacing halogen lighting

Low-voltage halogen downlights are popular feature with interior designers, used in homes and businesses. However, low voltage doesn't mean low energy use - watts are the measurement to look out for.

Standard halogen globes use 50 watts each, plus each globe is wired to a transformer in the ceiling space. Transformers use about 10 watts each, meaning each downlight generally uses about 60 watts in total. When you pair this with the fact that you need about six downlights to achieve the same light output as you get from one standard incandescent or compact fluorescent lamp, you can see the energy use starting to add up.

» Like incandescent globes, halogen globes put out a lot of heat. This means that on a hot day, halogen downlights will increase the temperature of your rooms and add to the strain on your air conditioner, if you have one

» Unfortunately, they don't perform any better on cold days - because downlight fittings are recessed into the ceiling space and heat up to high temperatures, insulation must be kept clear of the fittings. This means that wherever downlights are installed, the insulation in the ceiling is full of holes

» Recessed downlights also often create draughts through gaps in the fitting - this leads to the 'thermal chimney' effect, where warm air rises up to the ceiling and disappears through the gaps

LEDs are a collection of small, solid light bulbs that are extremely energy efficient. Replacing halogen downlights with LEDs could save you up to 80% on household lighting bills. Due to their low heat output they also avoid impacts on insulation.

Will it work?

Technical

» High efficiency lighting is available commercially in the market

» No obvious technical constraints, however some lighting upgrades require an electrician

» Installers of high efficiency lighting are available in Uralla and surrounding district

Regulatory

» No regulatory impediments

» The industry is already a mature one

» The likelihood of further increases to minimum lighting standards will assist in driving change-overs

» Lighting upgrades are often incentivised through State Government energy efficiency programs

Risk

» Need for tradesperson to be involved in some changeovers creates a barrier to uptake

Customer market

» A large potential customer base exists due to the remaining prevalence of halogens and compact flourescent lights in most homes

» The market available is outlined below

No. households targeted (Shire)	1,983
Total no. households in Uralla Shire	2,203
Estimated program uptake rate	90%

Business case

» Undertaking the activity represents a strong return on investment as outlined below

Discounted payback	1.9 yrs

» This represents the following yearly savings per average household that undertook the activity

Ave. energy saving per h/h	$155 per year

Environmental benefit

» 1106 tonnes of CO_2 saved per annum

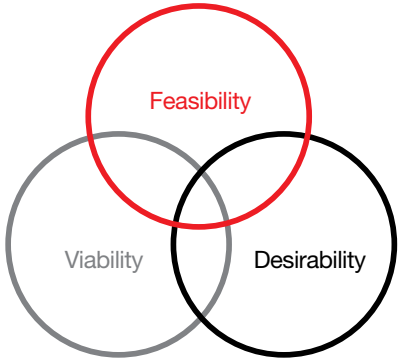
Social benefit

» Improved lighting amenity is often achieved through lighting changeovers

» This low cost option is more financially viable for low income households

Economic benefit

» Local business opportunity for installer and other suppliers for DIY installations



Conclusions

Feasibility

Feasible—no significant practical technical constraints exist

Viability

Viable—there is a strong business case to replace lighting with more efficient options over time

Desirability

Desirable—the market will drive much of the change required

First step

Raise awareness in the community of efficient lighting options to improve lighting choice

Appliances and in-home monitoring (using less energy)

What's possible?

The technology

Appliances (such as televisions and fridges) and IT equipment (such as computers) can consume substantial amounts of electricity. Fortunately there has been significant progress in improving both their efficiency and the information available to consumers to assist with both better product selection and improved energy monitoring to allow residents to monitor their energy usage. Appliance efficiency can be influenced by

- Minimum Energy Performance Standards (MEPS) which help to increase average product efficiency across the market over time by specifying a minimum energy performance level
- Consumers using the associated Energy Star rating information to select energy efficient products
- In-home energy monitoring which allows the energy consumption of appliances to be monitored, and households and businesses to take the required behaviours to manage their energy better

The Uralla context

- Electrical appliances account for the largest proportion of household electricity consumption (45% of a typical Uralla house)
- Old appliances (such as fridges) generally draw higher operating and standby power and are particularly good targets for upgrades—survey results indicated a high number of second fridges
- Opportunity to improve direct feedback through home energy monitors through a rollout of local smart meters and in-home energy displays that can help improve energy literacy. Previous studies have indicated the potential for a 4% to 12% electricity saving following the introduction of this combination of devices
- Rollout of smart meters in combination with in-home energy displays would likely require engagement with Essential Energy as the local distributor, and potentially some private investment

The impact

- The majority of households would replace several key appliances over ten years
- The overall impact outlined below combines replacement with modest actions based on response to energy usage information from smart meters and in home displays

Energy saving (GJ)	5,525 p.a	
Energy saving (MWh)	1,535 p.a	
Contribution to reaching Z-NET %	Total	3.1%
	Elec	6.5%

Profile

Locheil Park

Residents of Lochiel Park in South Australia use detailed in-home-displays to monitor overall energy use and the contribution of solar to household energy. This allows residents to understand where their energy is being used and to make the best choices to reduce energy and their bills. Lochiel park has a benchmark 7.5 star NatHers rating and solar PV as standard, making it a leadership project in South Australia and nationally.

At a whole of community level the data the development is the subject of detailed research by the University of South Australia in partnership with the CRC for Low Carbon Living. The aggregate data is currently being analysed in a longitudinal study.

Will it work?

Technical

» No obvious technical constraints to upgrading of appliances, distribution channels well established

» Technical constraints associated with any rollout of smart meters—requires engagement with Essential Energy

Regulatory

» No regulatory hurdles in terms of voluntary appliance upgrades

» MEPS improvements need to continue at regular intervals to deliver energy reductions

» Some regulatory hurdles involved in a smart meter installation or rollout, however, the NSW Government has recently announced these would be available to electricity customers across the state through a voluntary, market-led rollout

Risk

» Communication associated with any smart meter rollout needs to be carefully managed to avoid the type of community backlash experienced in the Victorian context.

Customer market

» Information campaigns about energy labelling are low-cost, simple to communicate and effective

» Customer market is driven by a natural replacement rate. Below is the impact over ten years

No. Households targeted (Shire)	1,542
Total no. households in Uralla Shire	2,203
Est. uptake	70%

Business case

» Energy savings associated with appliance efficiency improvements are achieved at no cost premium

» The combined business case for appliance improvements and in-home monitoring is strong—if smart meters were to be funded by Essential Energy the business case improves even further

Discounted payback	5.1 yrs
Avg. energy saving per h/h	$102 per year

Environmental benefit

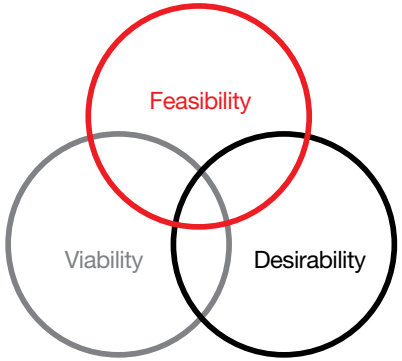
» 1,519 tonnes of CO_2 saved per annum

Social benefit

» Increased energy literacy achieved through information campaigns and technology

Economic benefit

» Potential benefit to Essential Energy if improved grid management can be achieved through remote appliance control enabled through smart meters



Conclusions

Feasibility

Feasible—there is a national precedent for a rollout of smart meters and associated energy information equipment.

Viability

Viable—the investment per household is very low and the appliance change-over represents no marginal cost.

Desirability

Desirable—better energy literacy will improve the ability of Uralla to reach the overall goal.

First step

Engage with Essential Energy about the potential for Uralla to be one of the first towns to be part of a market led roll out of smart meter infrastructure.

Business energy efficiency (using less)

What's possible?

The technology

Rather than a technology in its own right, business energy efficiency employs a suite of technologies based on business type. The most obvious opportunities to use less energy are dependent on the business, for example, lighting and heating are relevant for retail, however the majority of energy use in a food processing industry could be refrigeration.

The Uralla context

» There is a limited number of large businesses, with most businesses employing less than four people

» Business energy efficiency is a very challenging area, given the time-poor nature of many business owners and competing priorities - Uralla is no different

» A significant number of actions have already been undertaken at varying scales by small, medium and large businesses (e.g. lighting upgrades at Foodworks, solar at Phoenix Foundry)

The impact

» Business energy efficiency has a modest impact on overall town electricity, but never-the-less offers good scope for interested businesses to better manage their electricity costs

» The impact of business energy efficiency is shown below

Energy saving (GJ)	1,683	
Energy saving (MWh)	468 p.a	
Contribution to reaching Z-NET %	Total	0.9%
	Elec	2.0%

Case study

Foodworks

Foodworks has replaced their lighting with LEDs with great results. The lights have paid themselves off in 18 months and ongoing maintenance costs have also reduced.

Matt Ryan made the decision to change the lighting for financial reasons, but he was also aware of the value to the environment. Matt said "It's mainly a financial decision, as it has to be in business, but it also helps knowing you are doing the right thing".

Now that the lights have repaid the cost of installing, any savings can be re-invested in more energy efficiency or other areas of the business, or retained as profits.

Will it work?

Technical

» There are technical challenges associated with the implementation of some energy efficiency measures, but others such as lighting and refrigeration upgrades are relatively straightforward

Regulatory

» Business energy efficiency is often incentivised through dedicated state government programs

» Recently announced small business tax incentives may provide instant tax write-offs for energy efficiency and solar PV projects up to $20,000

» Some regulatory barriers associated with specific upgrades may exist

Risk

» Concern from some businesses over the ability to work through a split-incentive barrier that exists between tenants of buildings and their landlords

» Engagement with businesses on energy efficiency is extremely challenging and actions which have more than a 2-year payback are often not pursued

» Tailored energy-opportunity assessments would be required to uncover site specific opportunities

Customer market

» Given the challenges associated with business energy efficiency it's suggested that businesses will only implement efficiencies with very good returns

No. businesses expected uptake	120
No. businesses with 1-4 employees	145
No. businesses with 5 > employees	95
Estimated uptake rate	50%

Business case

» The business case for investment in energy efficiency for businesses is very strong, however to be conservative the modelling assumes that only the 'low hanging fruit' is acted upon

» The payback consists of both reduced energy costs and reduced maintenance costs

» Undertaking activity represents an overall payback as outlined below for business

Discounted payback	2.6 yrs
Avg. saving per business (p.a.)	$637

» OEH has specific guidance around financing business energy efficiency and renewable energy projects: http://www.environment.nsw.gov.au/business/project-financing.htm

Environmental benefit

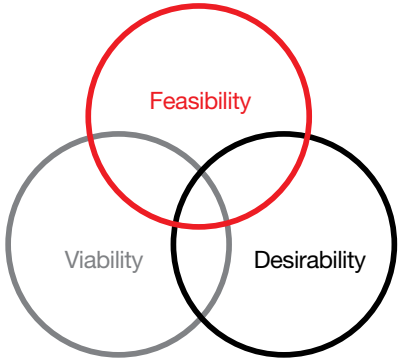
» 463 tonnes of CO_2 saved per annum

Social benefit

» Increase in energy literacy for business owners

Economic benefit

» The benefit of reduced energy costs can be reinvested in other business activity



Conclusions

Feasibility

Feasible—there is commercial precedent for a large range of business energy efficiency actions

Viability

Viable—the business case on many energy efficiency actions is strong

Desirability

Somewhat desirable—competing priorities of businesses make implementation challenging

First step

Align local effort behind existing programs such as Northern Inland Sustainable Business Network (NISBW) to ensure communication to businesses is targeted and clear.

Solar PV—Residential and business (generating on-site)

What's possible?

The technology

Solar electricity, also known as solar photovoltaic (PV) electricity, is electricity generated by converting sunlight directly into electricity using solar panels. It is increasingly becoming the 'go to' solution for electricity generation 'behind the meter'.

The Uralla context

Uralla has good climatic conditions for solar. The total residential rooftop solar capacity in Uralla is estimated to be nearly 8MW (the equivalent of 2,000 large household systems of 4kW each), calculated based on an available rooftop area of around 82,000 m^2 and on 90% of homes being able to accommodate solar.

Using all of this roof space could potentially meet about 40% of Uralla's total annual electricity demand.

There are less significant, but still worthwhile opportunities for business solar.

The impact

A reasonable modelled impact of household and business uptake of solar PV makes a strong contribution to zero net energy.

Residential

Energy generation in Shire (GJ)	19,570	p.a
Energy generation in Shire (MWh)	5,436	p.a
Contribution to reaching Z-NET %	Total	10.8%
	Elec	23.0%

Business

Energy generation in Shire (GJ)	3,298	p.a
Energy generation in Shire (MWh)	916	p.a
Contribution to reaching Z-NET %	Total	1.8%
	Elec	3.9%

A note about batteries

Residential and business battery systems are likely to become increasingly widespread in coming years as the Australian market matures and prices decline. Given current costs, their role in storing rather than generating energy, and some uncertainty over operational lifetimes, they are not assessed here in detail as a Z-NET option.

However, as batteries become competitive, it will become economic for households and businesses to size larger solar PV systems. This will enable them to store excess generation and further avoid the need to import electricity from the grid.

Case study

New England Brewing

New England Brewing has the potential to install a 15kW system that would generate 34% of the electricity it uses and pay back in less than 5 years. But to Ben, it's about a lot more than the dollars.

Ben from New England Brewing told us "The financials are important but branding the business to show we are doing our bit is also important".

Using renewable energy makes good business sense. It also demonstrates how a business can remain competitive while contributing to the town's goal of zero net energy.

Will it work?

Technical

» No obvious technical constraints to installation

» Available commercially with a high degree of certainty over energy generation outcome and associated savings

» Essential Energy may require modifications to local network if saturation levels exceed 40% of households and businesses

Risk

» May be some increased cost for installation in isolated locations

» Varying quality of panels and inverters, however easily managed through due diligence process with a preferred provider e.g. through bulk buy scheme

» Change in tariff structures that penalise grid connection or export at certain times

Customer market

» Most household and business premises are suitable for a solar PV system of some size

» Consideration needs to be given to rental properties to overcome the split incentive

» Size of market increased through availability of variable financing options e.g. rates mechanisms, lease to buy

» Solar leases could expand the customer market by providing an alternative to upfront payment or borrowing. The asset (solar PV) remains the property of the financial institution/lessor until the end of the contractually agreed leasing period, at which stage the lessee (home owner/business) may purchase the asset with a final payment.

» A modelled penetration of 60% would create a significant local market

No. households (uptake in Shire)	1,190
Total no. households in Uralla Shire	2,203
% households unable to have solar	10%
Current installed solar in Uralla	880kW
Modelled penetration (of available roofs)	60%

Business case

» A typical Uralla household getting solar has a payback as outlined below

Discounted payback	6.7 yrs

» The business case for solar PV for residential modelled a relatively large system size which would 'future proof' against a switch from electric storage to heat pumps and allow for battery storage as prices decline

» Business solar has the following paybacks

Discounted payback	7.1 yrs

» The price of equipment continues to decline

Environmental benefit

» 6,289 tonnes of CO_2 saved per annum

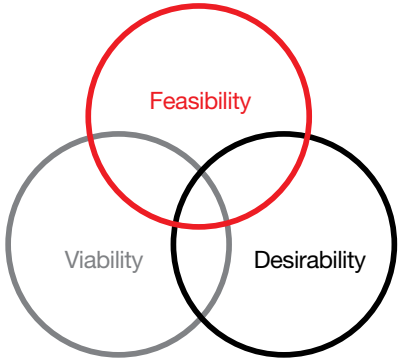
Social benefit

» Increased resilience to higher electricity costs for business and households

Economic benefit

» Potential business opportunity for local tradespeople to be employed in bulk buy program

» Businesses able to reinvest funds previously spent on energy to core business needs



Conclusions

Feasibility

Feasible—it is a commercially proven technology and 10% of Uralla households have already undertaken the activity

Viability

Viable—for most households and businesses the payback represents a reasonably strong business case

Desirability

Desirable—there is a very strong community perception and acceptance

First step

Develop a bulk-buy program for Uralla residents and businesses

Local utility-scale electricity generation (generating nearby)

What's possible?

Technology and resources

Utility-scale generation refers to large-scale, grid-connected generators. There are a number of technology options which can be considered for local utility-scale generation. Local projects using these technologies must compete with wholesale generation electricity prices and factor in the costs of transportation of energy to a customer base. The generation cost is significantly influenced by the resource quality and construction and connection costs associated with specific sites. Options for generation are presented below.

Wind

Wind power captures the energy of the wind by turning the blades of a wind turbine, which drives a generator that in turn produces electricity. Wind power is one of the fastest growing and most cost-effective renewable energy sources, having expanded globally at an average of 30% per annum over the past 10 years (GWEC).

» Wind generation has some potential as Uralla is situated on tablelands with a reasonable to good wind resource and predominantly grazing farmland that is suitable for wind turbines.

» Previous investigations however, have indicated only a limited number of sites with resources approaching a commercial wind speed.

Large scale solar PV

Utility scale solar PV uses the same technology as rooftop solar panels. Utility-scale solar PV is suited to country locations with low population density but with close proximity to appropriate grid connections.

» Accounting for appropriate land uses, elevations, and population data, the solar farm capacity in the Uralla area was estimated at 2,000MW, more than 100 times the current electricity needs of the Shire

» While Uralla has a reasonable solar exposure and available land for utility-scale solar, it is not considered a premium resource compared to other locations nationally

Concentrated solar thermal

Concentrated solar thermal (CST) technology uses the heat of the sun rather than light, to generate electricity. It uses lenses and reflectors to concentrate sunlight, which then heats water, oil (or another fluid) to produce steam to drive a turbine to produce electricity.

» As for solar PV, Uralla has a reasonable solar exposure and available land, however CST is considerably more expensive than solar PV

Biomass

Electricity generation from biomass uses the burning of organic matter to produce heat energy or electricity. It can be used directly for heating at all scales.

On a commercial scale biomass (for example crop stubble) is burnt to produce either heat to supply district heating or to produce steam for power generation.

» Productive land in the Uralla Shire is primarily pasture land for grazing, so crop stubble is minimal

» Forestry activity and saw-milling occur in neighbouring shires, but not within the shire

» Niche resources such as animal waste are not sufficient in quantity to be viable for commercial or community scale generation but may be appropriate for mid-scale 'behind the meter' applications subject to further feasibility

The Uralla context

» Both the wind and solar resource in Uralla are reasonable, but not considered a premium resource compared to other locations nationally

» There is interest in a commercial- or community-scale electricity generator to be sited locally within the Uralla Shire

» A commercial-scale operation would be designed to connect to the national grid and would have to compete with other generators

» A community-scale operation could contribute to meeting local demand. Any design would need to consider the ability to meet the

technical and regulatory requirements in a financially viable manner

The impact

- Should a commercial scale wind farm or solar farm be sited in Uralla Shire, the generated electricity would greatly exceed the local requirements leading to Uralla effectively going beyond zero net energy and becoming a net exporter
- Functionally, the electricity would be sold to the broader electricity network and be 'virtually' available to Uralla residents and businesses through retailers
- As Uralla is not a premium wind or solar resource, electricity generated may be less than in other more premium resource areas
- Should a community-scale windfarm be sited in Uralla Shire, the generated electricity would be capable of matching or exceeding the (current) local requirements with three 2.5MW wind turbines operating at a capacity factor of between 25% and 30%
- If Uralla is successful in significantly reducing energy use and generating on-site, two 2.5MW turbines would likely be sufficient to match the remaining demand (over a calendar year)

Wind energy yield and capital cost estimates for Uralla

	Uralla sub-station	Town	Shire
Demand total MWh p.a. (Av. Estimate)	15,000	10,147	23,627
No turbines (GW 121 turbine)	2	1	3
Capacity of wind generation (MW)	5	3	8
Annual yield after all losses MWh/yr	17,155	8,860	25,732
% of town net annual demand matched by wind generation	114%	87%	109%
Capital cost $M @ $2.7M/MW including grid connection	13.5	6.8	20.3

Profile

New England Wind

Individuals and community organisations have been championing the New England Wind (NEW) project which aims to establish the first community wind farm in NSW. NEW's vision is for a small windfarm of 4-6 turbines which could produce the equivalent of half the residential electricity use of the high country region.

Establishing a community wind farm is a significant undertaking and likely to require 4-7 years of development. A cooperative, the New England Wind Cooperative (NEW Coop) will be formed to manage the project. Results of the feasibility study have shown strong community support for wind farms in New England with more than 120 landholders offering to host wind turbines on their properties as well as strong investor interest. The community response has shown a strong desire to move beyond coal-fired electricity.

Will it work?

Technical

» Both solar and wind are established, mature technologies

» There are potential capacity issues for the local electricity network when connecting commercial-scale generation

» Some of the more favourable sites within the region are further from the 66kV transmission line. A technical feasibility process would determine the capacity of local infrastructure (11kV line and Uralla substation) to handle the generation of a community-scale wind farm

» Suitable wind farm sites within the Shire tend to be smaller and are able to accommodate approximately 5 turbines each

» Several smaller sites are available, however attracting interest from a suitable land owner is not straightforward

» Wind integrates easily into grazing farmland with minimal footprint, while solar PV, although spread over much less land, reduces usability of the land for grazing

» Connection for solar PV farms is most economically acheived at larger scale

» Major biomass reserves are located outside of Uralla Shire

Regulatory

» Highly uncertain policy environment generally, with changes in the Renewable Energy Target (RET) Emissions Reduction Fund and Energy White Paper release

» Strong encumbancy bias for existing electricity generators makes it difficult for new connections to be made cost effectively

» The current retail regulations do not allow residential customers to enter into the long-term contracts that would be required to give investment certainty

» There are significant additional regulatory barriers associated with a community investor model that are presently the subject of advocacy efforts

Risk

» Lack of commercial return on a wind or solar farm investment in an area with a good, but not premium wind resource

» Highly unlikely that a commercial wind farm developer would see a locational advantage in Uralla

» Landholder negotiations for siting of a renewable energy generator will remain a challenge

Customer market

» There is some local interest in generation nearby, and an expectation that the community would participate. However, current uptake of GreenPower nationally and locally suggests low participation in voluntary schemes (the cost of local generation would likely exceed GreenPower)

» The opportunity is not constrained by the Shire boundary with the potential for Uralla residents and those in the broader region to be part of a market for locally produced energy

» A relationship with a commercial generator model may be possible through a retailer partnership

» In place of a local customer base, the local community could establish an investment model, however, financial returns are governed by how competitive the project would be compared to other generators

» By way of example, the size of investment upfront in a community-scale wind farm of two turbines would be $13.5 million

Business case

» No business case currently exists for the development of a commercial- or community-scale electricity generator nearby to Uralla

» The table below sets out the levelised cost of energy (LCOE) for various utility-scale generators. The range for wind, solar and biomass is influenced by the quality of the resource and connection costs. The RET provides a subsidy for these renewable generators, allowing projects with a low LCOE to reach parity with conventional fossil fuel generators. In the current market, this has typically been large-scale wind projects with a premium resource located near the grid

» Unfortunately, such conditions do not prevail in Uralla, as the wind, solar and biomass opportunities will be towards the higher end of the LCOE range

» Project viability may improve over time as technology costs reduce and the regulatory environment changes

Technology	LCOE
Wind	9c–15c/kWh
Solar PV	15c–25c/kWh
Biomass	10c–25c/kWh
Existing GreenPower	8c/kWh
Existing Grid Supply	4c/kWh

Environmental benefit

» 11,151 tonnes of CO_2 per annum for a community scale wind farm (based on 100% electricity Z-NET contribution minus energy efficiency and on-site generation)

Social benefit

» The social capital built through a community local generation option could be significant, and build on demonstrated community activity in using less energy and generating on-site

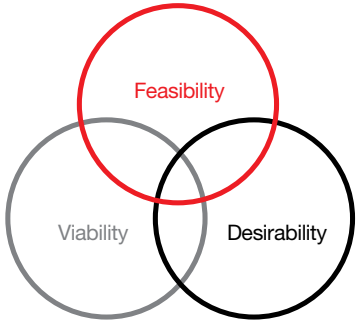
» Across Australia there is a growing interest in community-based energy models. Organisations such as Embark Australia, the Community Power Agency along with alliances like the Coalition for Community Energy (C4CE) are bringing together like-minded groups to advocate for effective policy and share knowledge and experiences

Economic benefit

» The direct economic benefit would be modest following the initial construction of a local generator (likely less than 1 FTE employee)

» Investing in a community-scale generator in the current operating environment would actually see economic cost, however these conditions may improve over time

» Additional tourism and branding benefit could be derived from Uralla meeting its target of zero net energy through this option, but these have not been quantified due to significant uncertainties



Conclusions

Feasibility

Not currently feasible—technical and regulatory constraints can largely be overcome, but substantial risks to governance and investment remain within the current operating environment.

Viability

Not currently viable—local utility-scale renewable generation remains costly compared to both GreenPower and fossil fuel generation.

Desirability

Unclear—there is community interest in the concept, however pursuing it in such challenging circumstances may distract from action where there is clearly more benefit for the community.

First step

Establish collaborative working arrangements with others in the community energy industry.

Importing renewable electricity

What's possible?

The resource

Many renewable energy sources already exist in Australia outside the Uralla region. Achieving zero net energy (electricity) for this option involves the purchase of energy from existing renewable sources. Renewable electricity can be purchased through a coordinated power purchase agreement (PPA) directly with a renewable energy supplier, or by choosing GreenPower from an energy retailer.

The Uralla context

Uralla could easily make its electricity supply renewable if every business, household and institution in Uralla bought accredited electricity from renewable sources. This is a significantly more cost-effective source of renewable electricity than generating nearby.

If it is cheaper to source renewable energy from the market than to generate it nearby, then there is no current business case for local generation.

The impact

» There is no physical constraint to the amount of renewable electricity that can be sourced through the market, and this would make Uralla's electricity supply 100% renewable

» This action would promote investment in locations where renewable energy is most viable and feasible, but not directly impact the local economy

» A modest uptake of importing renewable energy would make the following contribution to ZNET by 2020

Imported energy (GJ)	2,498	
imported energy (MWh)	694	
Contribution to reaching Z-NET %	Total	1.4%
	Elec	3.0%

Profile

Enova Energy

Enova Energy, is a group of concerned local citizens who have been successful in winning a $54,000 grant to develop a business plan and conduct a feasibility study into establishing a renewable energy company.

The new consortium hopes to become Australia's first community owned retailer, with big plans to build, generate and sell renewable energy in the northern rivers region of NSW around Byron Bay and Lismore. The plan involves creating a company that will be involved in retailing and generation, as well as developing an asset management arm to facilitate investment in energy generation and finance small scale solar for low income households.

Will it work?

Technical

» There are no technical constraints to importing renewable energy.

Regulatory

» The certification process for renewable electricity is relatively straightforward and robust—so consumers can trust that the equivalent of their consumption is being delivered to the electricity network

» It may be difficult to secure a town-scale power purchase agreement (PPA) due to retail contestability regulations preventing long-term customer contracts, but this does not prevent individuals from purchasing

Risk

» Given individual consumers may enter or leave the program there may be variability over time. An active community bulk buy program may assist uptake and retention

» Monitoring individual uptake rates would present a challenge for measuring performance against the Z-NET goal

Customer market

» A large customer market exists, e.g. all those who do not already source their electricity from renewable sources. Current GreenPower adoption rates in the general population are still very low (approximately 2% nationally)

» A GreenPower changeover program could however be linked to promotional programs for other options, such as energy efficiency and rooftop solar PV to reach a larger market

Business case

» Currently, importing certified electricity requires a willingness to pay a premium on standard electricity prices

» A program which aggregates a large number of customers to a retailer offering a GreenPower deal may be able to reduce this premium and more closely compete with standard electricity prices

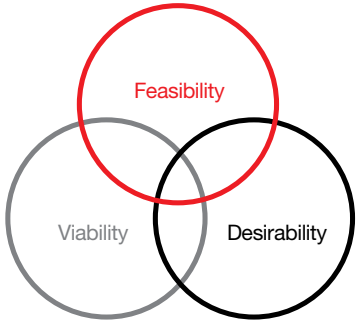
Environmental benefit

» The environmental benefit is directly driven by the participation level

Economic benefit

» No tangible local economic benefit is derived

» A large program and association with a renewable retailer may have the potential to support local community projects



Conclusions

Feasibility

Feasible—there are no technical or regulatory impediments to purchase of renewable energy on an individual basis but some regulatory barriers and risks exist for a town-scale PPA

Viability

Viable—however there is a small price premium above standard cost

Desirability

Unclear—this is low cost and low risk way for communities to invest in renewable energy, however historical take-up of GreenPower has been approximately 2%

First step

Investigate partnership opportunities with an energy retailer for an aggregated group of Uralla residents and businesses to switch to GreenPower.

Zero net gas energy

Due to the relatively low use of gas in Uralla (6% of total energy) options are focused on electricity and wood reduction and generation. It is highly likely that the use of gas in Uralla will decline further as heating systems that have traditionally relied on gas are switched to electric. This is beneficial for a number of reasons:

» Gas prices will likely increase at a greater rate than electricity prices over the foreseeable future

» Gas is a fossil fuel and although renewable gas (biogas) may be commercially available, in the future, clean electricity is likely to be more competitive

» Electric appliance efficiency is improving at a faster rate than gas appliances

Remaining gas usage at 2025 could then be effectively replaced with either a biogas supply, if it becomes available, or 'offset' by export of electricity or wood energy above what is used by Uralla residents.

Zero net wood energy

In order to create a zero net energy wood supply long-term balancing of a renewable local supply with demand needs to be ensured.

Ultimately the definition of what consitutes a renewable wood supply is open to interpretation. At its strictest this means that all firewood needs to be independently certified and managed under a forestry management plan. The other extreme is to simply ensure that firewood supplies are not being depleted. The Uralla community has signalled an intention to work to better understand and improve existing collection and management practices, rather than a forestry approach. Ultimately other communities which seek to apply the Z-NET Blueprint may adopt an alternative approach.

Three options are available for achieving zero net for wood energy. A summary of the options is presented below.

Thermal fabric (insulation) improvements have an immediate benefit and can provide an approximate 14% contribution for zero net wood energy.

Regardless of the interpretation of a renewable supply, if demand outstrips renewable supply, the most effective way of addressing this is through a combination of better management of existing resources and reforestoration of under-utilised farming land. Preferably this should take place under a forestry management plan (or an appropriate equivalent for on-ground reserves) which provides for good management practices. Such an approach may allow for certification of a firewood supply (which may increase its value).

Given the historic and cultural link with wood heating within the shire, it is not realistic to assume that electric heating will provide a desirable alternative to wood heating in the short-term. In any case, the greenhouse gas emissions intensity of wood heating is far less than even the most efficient electric heating alternative (unless it is powered by 100% renewable energy). If Uralla was to achieve a 100% renewable energy supply in the medium to long-term, electric heating would be preferred. In the short term, while wood heating remains so widespread and the energy supply is still largely fossil-fuel based, the most effective

Summary of wood option evaluation

Options	Impact (% wood)	Business Case	Technical	Regulatory	Managing risk	Customer market	Enviro benefit	Social benefit	Economic benefit
Using less energy – Thermal comfort	14.0	✓✓	✓✓	✓✓✓	✓✓	✓✓	✓	✓✓✓	✓
Generating nearby – Improved firewood resource management and reforestation	80.0	✓	✓✓	✓✓	✓	✓	✓✓✓	✓✓	✓
Importing energy – Purchase of a third party certified firewood supply	?	✓	✓✓✓	✓✓✓	✓	✓	✓✓	✓	✗

action to contribute to zero net energy is using less energy by improving thermal fabric.

Potential improvements in wood heating efficiency were also considered, however given the extremely long lifespan of slow combustion wood stoves (30+ years) it is unlikely to deliver energy reductions in the medium term. Further there is opportunity to investigate wood pellet heaters as an alternative to traditional slow combustion stoves, however this would require private sector finance and would be largely driven by pollution reduction (particularly suitable for Armidale) rather than energy savings.

There is also opportunity to educate the community about burning practices that can assist in burning less overall.

Given uncertainty around what may be realistically achieved by these measures, these opportunities were not specifically modelled but would remain important for information campaigns.

Detailed evaluation of wood energy options is shown in the following section and summarised in the table on the previous page.

Thermal fabric (using less energy)

What's possible?

The technology

Improving the 'thermal fabric' of buildings (the walls, roofs and floors) can be an effective way of limiting the heating and cooling required to keep indoor spaces comfortable. Key measures include insulating walls, ceilings and floors, double glazing and covering windows, and draught proofing.
The key measurement for residential thermal performance is heating and cooling demand, which in Australia is generally measured in a star rating of up to 10 stars (the minimum requirement for a new dwelling is 6 stars). The type of energy which is reduced by thermal fabric upgrades is dependent on the predominant heating and cooling energy source.

The Uralla context

» Most houses built before the year 2000 have limited or no insulation unless it has been retrofitted. Approximately 70% of Uralla houses have inadequate ceiling insulation, which means poor thermal performance. An average house without insulation can be improved by 3 to 4 stars with the addition of insulation. This equates to a 50% energy saving for space conditioning

» Draughts and large glazed areas are also factors in poor thermal performance

The impact

» Ceiling insulation alone can improve heating and cooling efficiency by 40%

» Initiatives such as draught proofing can further assist in retaining the warmth over winter

Contribution to reaching Z-NET %	Total	7.0%
	of wood component	14.0%
	of electricity component	0.2%
	of bottled LPG component	5.8%

Profile

Ruth—a Uralla local

When Ruth first moved into her fibro house, it was cold in winter and hot in summer. Within the first year, she installed insulation in the ceiling and a shaded pagola on the north-west wall.

"These sorts of things made a huge difference to the climate in my house quickly and cheaply", Ruth said.

The day Ruth installed insulation in her ceiling, it snowed. Ruth remembered back, saying "That night I had friends over for dinner and I was snug as a bug in a rug".

Extended awnings over the windows and along the house have also made a big difference. They've been positioned to block out the hot summer sun but let the winter sun in. Ruth supplements all these measures with thick insulated curtains. She is looking forward to being a part of Uralla becoming a Z-NET.

Will it work?

Technical

» No obvious technical constraints

» Available commercially in the market

» Installers are available in Uralla and surrounding district

Regulatory

» No regulatory impediments

» Many uninsulated homes are rentals - split incentive barrier exists

Risk

» A legacy of concern about insulation installation following the Federal Government insulation program. This would need to be managed

Customer market

» Market demand in Uralla for insulation upgrades well established through Z-NET survey

» An analysis of the available customer market for a ceiling insulation upgrade is shown below

Households targeted	771
Total no. households in Uralla Shire	2,203
Households without adequate roof insulation	70%
No. households (uptake from program)	50%

Business case

» A reasonable business case is presented for undertaking a ceiling insulation retrofit (noting that individual paybacks vary on the highly variable cost of wood)

Discounted payback	5.4 yrs

» This represents the following yearly savings per household depending on current heating type

Saving per wood heater h/h (p.a.)	$253
Saving per electric heater h/h (p.a.)	$176
Saving per gas heater h/h (p.a.)	$63

Environmental benefit

» Reduced use of firewood results in some benefits in CO_2 reduction and air quality improvements

Social benefit

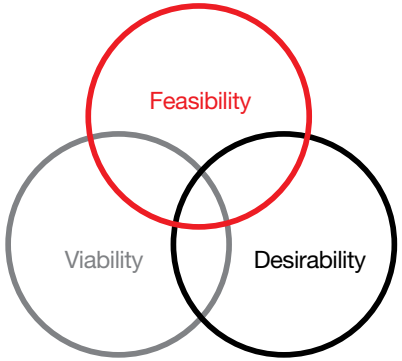
» Greater thermal comfort for occupants

» More certainty over winter heating costs for low income households

Economic benefit

» Local business opportunity for installer and/or hardware store as supplier for DIY installations

» Approximately $400 to $500 labour per home (a proportion of which will be spent locally)



Conclusions

Feasibility

Feasible—there is an established industy and no substantial technical or regulatory risk

Viability

Viable—good business case exists with additional direct local economic benefit

Desirability

Desirable—there are strong co-benefits and a local willingness to undertake the action

First step

Undertake analysis of potential ceiling insulation rollout with aligned state programs

Firewood resource management and reforestation (generating nearby)

What's possible?

The resource

Firewood resources generally constitute local hardwood species with good heat and burn longevity.

Firewood is typically sourced through informal networks with landowners or from a firewood supplier.

The Uralla context

» The amount of forested area in the Uralla Shire is very low compared to areas further east

» The size of the current firewood resource (mostly fallen trees) is unclear

» Incidences of dieback have increased the size of the on-ground resource (as dead trees fall over), however this is a poor environmental outcome in other ways as live tree numbers reduce

» Uralla has approximately 61,000 tonnes (wet weight) of timber in standing reserves of varying quality in commercial forests and non-commercial forests and approximately 39,000ha of grazed woodland (the source of the majority of local firewood) noting potential overlap between these sources

» The Z-NET Householder Survey showed an average of 3 tonnes of firewood being used per year per household (comparable with the NSW wide figure of 3.17 tonnes). This translated to approximately 5,150 tonnes of firewood each year across Uralla

» The community must better understand what collection and management practices exist, how they relate to broader environmental objectives and to what extent they can already be defined as renewable

» Subject to resolving these research questions, which will assist in developing a clear baseline for what is renewable, it is likely that a combination of improved management practices and some local reforestation will be required

This combination of activities requires input from researchers, community groups, land holders, firewood collectors and potential partners such as CSIRO, Landcare, Regional Development Australia or Forest Stewardship Council

The impact

» Subject to a sufficient on-going firewood resource being confirmed, the impact of improving existing grazed woodland management and firewood collection practices to a level deemed 'renewable' can potentially deliver a 100% renewable firewood supply

» If the replacement of dead timber and the natural recruitment of young trees is insufficient, or improvements to management practices are not at a level that can satisfy the local definition of renewable, then reforestation is required

» The impact of restoring 10% of Uralla's existing 5,395 hectares of commercial forestry reserves (through improved management practices) would yield improved growth rates. The firewood itself is a by-product of improved management practices (thinning)

Contribution to reaching Z-NET %	Total	3.8%
	Wood	7.9%

» Subject to the above, to fully realise a zero net energy wood supply may require reforestation.

It is likely to take at least ten years to reach a zero net energy wood supply. However, if Uralla is able to export renewable firewood, this could offset residual non-renewable firewood use in the shire.

Will it work?

Technical

» Good land management practices can improve growth rates (through thinning in more dense forestry areas and grazing management in grazed woodlands).

» A newly seeded, well managed, engineered woodland (native not plantation) can yield approximate growth rates of 1m^3 per hectare, but is not suitable for meaningful harvesting for at least 20 years

» The natural loss of trees or tree limbs in Uralla, which provide potential firewood resources, is not well understood and needs to be the subject of further research

» Dieback has accelerated the rate of natural loss

Regulatory

» A voluntary code of practice for firewood merchants was developed through the Firewood Association of Australia (FAA) but certification practices ceased in 2011.

» NSW legislation restricts the thinning of native vegetation in general beyond 75m^3 per hectare, therefore only a proportion of existing woodlands may be permitted to be thinned (and therefore harvested) for firewood

» Careful partnership planning and legal frameworks are required for partners in any coordinated forestry activity e.g. agreements with landowners or certification bodies may be required

Risk

» Governance risk is attached to any agreement with land owners or third parties

» Risk of community not seeing the value in improving management practices

» Risk of low uptake to any firewood collection or land management practice change

Customer market

» The large proportion of wood heating in Uralla creates a significant market for a local supply of firewood from well managed sources

» The size of the market for firewood from well managed sources is not constrained by the Shire boundary with the potential for Uralla residents and those in the region to be part of a larger market for sustainably managed firewood

Business case

» Costs associated with improving firewood collection and land management practices are not known, but would likely include modification of land management practices (e.g. for fencing off livestock from areas of regrowth) and the cost of researching current practices in more detail and developing and operating a support system

» A third party certified source of firewood attracts a premium in the market ($225 per tonne compared with $200 per tonne). Certification requires a forestry management plan to be in place

» The business case for restoration (with application of a forestry management plan and third party certification) is stronger than for reforestation because some firewood would be available for harvest in the initial years (thinning/drying)

» A forestry approach would require some economies of scale and local processing capacity to provide some certainty for farmers to invest. A forestry managed investment scheme (MIS) could be a potential investment model

» Given the extended period before an initial firewood supply is available for harvest, a commercial business case for reforestation doesn't exist. Reforestation could potentially be funded through a small optional donation for firewood which has met a locally devised definition of a renewable wood supply, for example, a $10 donation per tonne on 10% of the firewood used by Uralla in any one year would raise approximately $5,000 per year

» Commercial return for carbon farming has not been included, but could be an additional revenue source

Environmental benefit

» CO_2 saved is significant but would be the subject of a separate analysis due to its complexity

» Very significant biodiversity, habitat and ecology value improvement would occur as a result of undertaking improved firewood collection and land management as well as reforestation

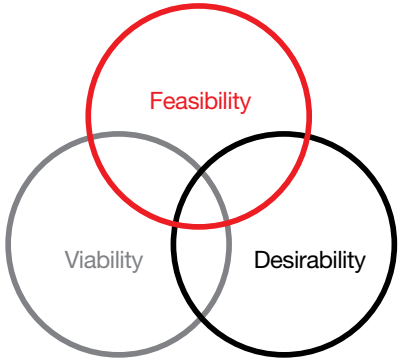
Social benefit

» Access to nature increased

» Opportunity to improve social capital through community involvement in sustainable land management.

Economic benefit

» Forestry management practices would provide employment opportunities, but the direct and indirect benefits have not been quantified in this evaluation



Conclusions

Feasibility

Somewhat feasible—several risks have to be effectively managed

Viability

Somewhat viable—a reasonable business case exists for improved management, but reforestation is far more challenging

Desirability

Desirable—because despite challenges, the non-economic benefits are particularly strong and solving this problem is essential for meeting broader ZNET goal

First step

Commence a research phase in partnership with other stakeholders which seeks to better understand existing firewood collection and land management practices

Importing certified firewood

What's possible?

The resource

Achieving zero net energy for wood is possible through the purchase of third party certified firewood from outside the Shire.

The context

If every household and institution in Uralla bought third party certified wood, this would meet the definition of zero net energy for wood. The wood would be sourced from nearby regional forestry areas rather than being grown within the Uralla community.The cost of the firewood from a source such as this would be higher than most existing sources.

The impact

» Nearby forests in Gloucester which are certified under the Forestry Stewardship Council and managed under a forestry management plan, for example, can meet Uralla's overall demand through a process of thinning (which promotes better growth rates)

» The potential contribution to Z-NET can be as much as 40% (85% of wood) however the uptake of an import option (given cost premium and availability of fallen and dead trees) is likely to be significantly less

Profile

Gloucester FSC certified firewood

James Felton-Taylor and his partner Annabel Kater run their company Australian Sustainable Timbers (AST) from their 300ha property at Monkerai NSW.

James said "traditional logging degrades the forest condition thru repeatedly harvesting out the best trees and favoured species, a process known as 'hi-grading' or 'creaming'. We are rehabilitating our forests through our bush regeneration management process."

As a result, their systems are focused on restoring the ecological function as well as the commercial productivity to the forest. Annabel Kater said "Each forest is unique and we cannot simply apply a recipe book to management."

Through this regenerative forestry AST produce a range of FSC certified timber decking, flooring, posts and beams, however the largest product of this restorative process is FSC certified firewood as a by-product of management processes.

Will it work?

Technical

» There are no technical constraints to importing a renewable, certified firewood supply to Uralla, as there are woodlands in the wider region which meet this criteria

Regulatory

» Compliance with a certification process and maintaining ongoing customer buy-in when a price premium exists represents some challenges

Risk

» Lock-in of customers within the Shire to ensure the 100% renewable supply target is met would be problematic

Customer market

» The large proportion of wood heating in Uralla creates a significant market for a local supply of firewood from well managed sources

» The size of the market is reduced by the amount of households who have free or low-cost access to a firewood source (arrangement with farmer)

» The size of the market is further reduced by the cost premium attached to a source which receives third party certification (through forestry management plan)

» Whereas this method of meeting zero net energy for wood requires that all of Uralla buys into a program, improved management and reforestation could be undertaken locally but serve a regional market

» Importing firewood may be more suitable as a transitionary step as further research takes place and support systems to improve local practices are being developed

Business case

» No business case for importing certified firewood for an individual exists on purely economic grounds as it requires a willingness to pay a premium on traditional sources

» Large aggregation of a customer base may reduce this premium.

Environmental benefit

» The environmental benefit of import is difficult to quantify as it is dependent on a number of factors

» CO_2 saved is significant but would be the subject of a separate analysis due to its complexity

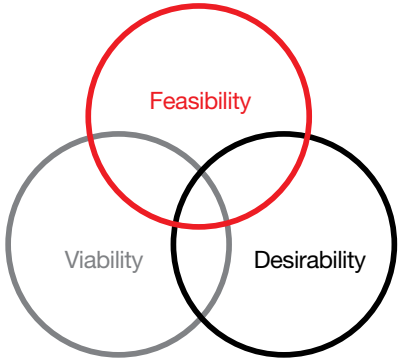
» The revenue from the sale of the certified firewood may be reinvested in improving biodiversity, habitat and ecology value improvement

Social benefit

» None locally

Economic benefit

» No tangible economic benefit is derived locally



Conclusions

Feasibility

Feasible - because no technical or regulatory constraints exist

Viability

Not viable - combination of restricted market size and cost premium dictate that this would be restricted to being applied in combination with other wood solutions

Desirability

Somewhat desirable - because it provides a quick win to provide a foundation for broader restoration and reforestation efforts

First Step

Further investigate the market demand for a local bulk buy of certified firewood.

What does the options analysis tell us?

Considering the options analysis, a two-stage approach to becoming a Z-NET is to most effective and realistic.

Stage 1 should focus on:

» using less energy

» generating energy on-site

» developing improved firewood collection and land management practices

» importing renewable energy.

These actions align with the Blueprint logic of a least-cost approach and combined make a significant contribution to becoming a Z-NET.

Stage 1 gets Uralla 'fit' by reducing overall demand for energy and building community participation.

Stage 2 seeks to resolve the balance of energy generation from renewable sources. This involves increasing the amount of renewable energy which is imported or pursuing utility-scale generation of electricity if and when it is comparable with importing renewable energy.

In summary, a two-stage approach is preferred because:

» Using less energy and generating on-site currently offer the most attractive financial returns

» Generating electricity nearby currently lacks a commercial business case, but with declining costs of renewables relative to fossil fuels this business case is likely to improve over time

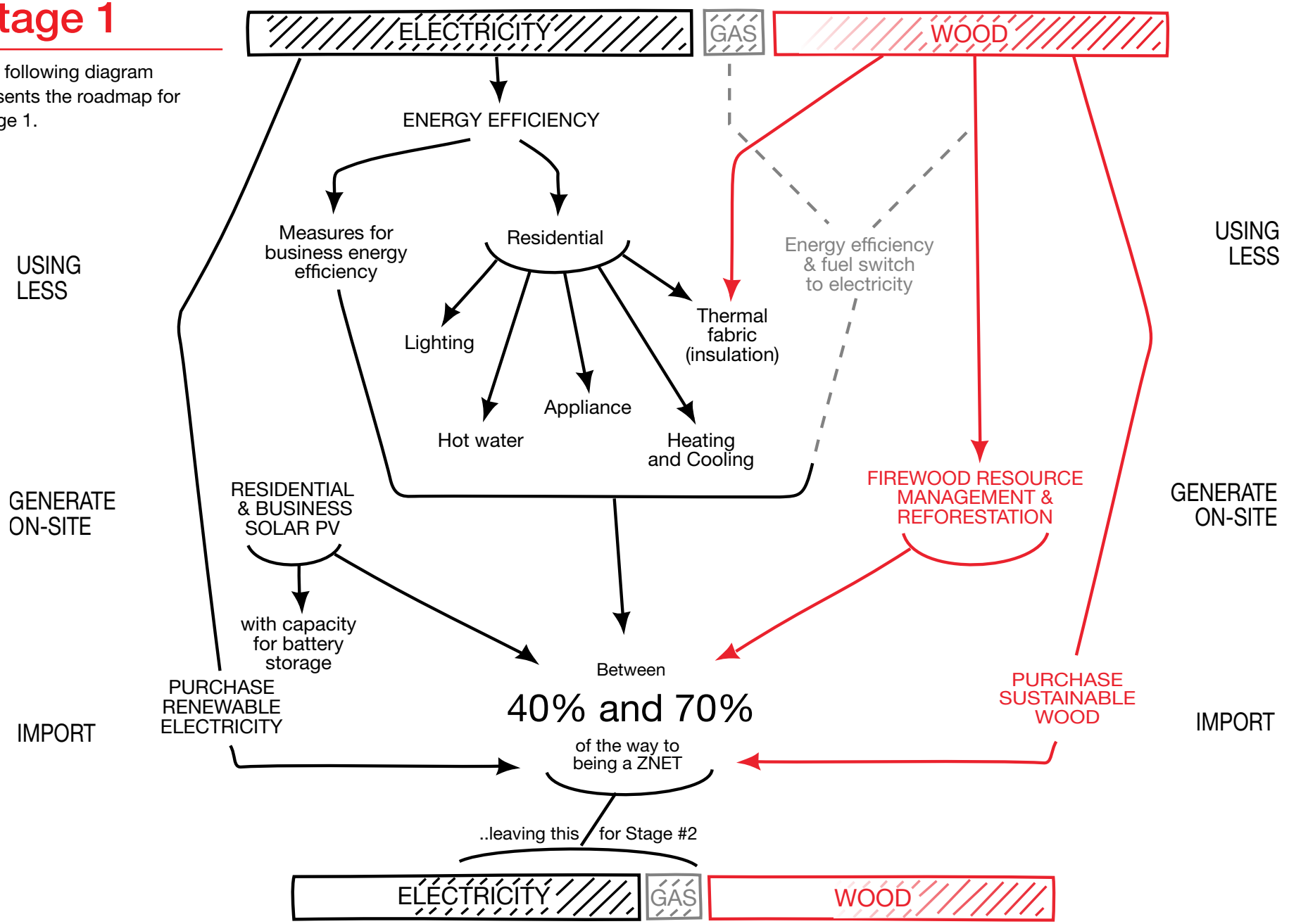
» Community-scale generation options require the overcoming of significant governance and regulatory barriers in order to be feasible or viable

» The community experience associated with Stage 1 will build capacity to take on the governance and regulatory challenges associated with Stage 2

Successful implementation of Stage 1 would result in a 40–70% contribution to zero net energy. It would also reduce the energy spend of the local community by up to $3 million, money which could be reinvested into more action.

Stage 1

The following diagram presents the roadmap for Stage 1.



What's the overall impact of Stage 1?

Energy impact

Implementing Stage 1 takes a major step toward the Z-NET Goal, reducing overall energy consumption by 16% and increasing the renewable energy contribution significantly.

Electricity use:

» 19% reduction in the annual use of electricity

» 44% of annual electricity use generated locally from solar PV

Wood use:

» 14% reduction in the annual use of wood

» A partially balanced firewood supply - meaning an improvement in local firewood collection and land management practices and a commencement of local reforestation efforts.

Electricity Network:

Increasing the use of rooftop solar PV and changing over to more efficient hot water heating has a significant impact not only on the annual use of energy but the demand on the energy network. These actions remove an overnight peak associated with hot water heating and allow significant generation during the day. This means that during the day Uralla could be generating 100% of its electricity needs for a large part of the year and using the grid to import electricity at night.

Economic impact

Financial

Energy efficiency and rooftop PV solar takes on the 'heavy lifting' for the electricity component of Z-NET for Stage 1. The overall uptake of these actions by households and business is made up of individual ‘private investment’ decisions. The electricity cost curve shows that there is a strong business case for each of these actions: the total value of energy saved (or generated) over the lifetime of each action will exceed the cost of investment.

Achieving the Stage 1 ambition of reducing total energy use by nearly 16% and increasing the proportion of clean energy used to 44% will involve 90% of households investing in one or more actions. The cost to a household could range from as little as $200 for a smart meter to almost $5,000 for solar panels. A household investing in all actions could spend up to around $10,000, while a business could spend up to $20,000.

Achieving the target uptake of these technologies over the period to 2025, this would result in:

» Savings in electricity costs for Uralla of $2.2mil p.a. (on average to 2025).

» Savings in electricity cost for participating households could be up to $1,000 p.a., and participating businesses of up to $2,900 p.a.

» A real (discounted) payback on investment for households (on average) of 6.0 years, and 4.0 years for businesses.

To achieve the transition in firewood, community investment in improved firewood resource management and reforestation will be required. This may potentially require a modest donation or a premium on the current cost of firewood.

There are significant overall benefits to undertaking those actions planned for Stage 1. Not all households can, or are expected to invest in all available actions. There is however, a compelling business case for energy efficiency and solar PV actions, and a growing imperative to better understand and improve firewood resource management.

Local economy

While there is significant activity involved in Stage 1, the scale and nature of the actions means that economic impact is difficult to model or quantify. Most of the potential local economic benefit is associated with installation and maintenance of small scale equipment, i.e. there is no manufacturing or large generation industry that would be located in the Shire and the capital costs for equipment would be absorbed outside the Shire. However there is opportunity to derive local benefit by considering the role of allied industries such as local trades and retail that may be able to partner in the rollout of small scale equipment.

In addition, the profile of Uralla as a national leader has the opportunity to increase awareness and be an incentive for visitors in the region to spend additional time within the Shire. A high level analysis indicated that Uralla's current tourism spend inclusive of day trippers is between $15mil and $25mil per annum. A modest increase in visitor numbers as a result of increased exposure of Uralla through Z-NET could provide an additional benefit.

Employment

The actions in Stage 1 do not present a measurable increase in permanent employment for the region, given the nature of the actions is largely installation. The community and Council should consider their capacity to encourage and train local trades to participate in programs (as outlined above) to capture some benefit locally.

Social impact

Low income benefit

Energy efficiency is an important opportunity to support low income households to reduce and control utility costs and increase comfort. The actions set out in Stage 1 present a practical and meaningful way for low income households to directly participate and benefit from pursuing the Z-NET vision.

Financial models may need to be developed to assist low income households to participate in programs where an upfront cost could otherwise present a barrier.

Community building

Uralla already has a great spirit of cooperation. By taking on Stage 1, the community will be building greater connections across the community and furthering its ability to face an uncertain future. The actions are inherently collaborative, encouraging activity and communication between a range of stakeholders and avoiding conflict often associated with larger centralised investments.

Environmental impact

Greenhouse pollution

The combined actions from Stage 1 should make a big impact in reducing Uralla's contribution to climate change. Stage 1 actions would result in greenhouse pollution reduction of 11,152 tonnes CO_2 for electricity and gas combined.

Land use impacts

Due to the nature of demand-side actions there is minimal or no local impact associated with energy efficiency or solar PV actions. Any actions to improve firewood resource management inherently have a land use benefit.

Air pollution

Particulate pollution from firewood is a key issue in the broader Northern Tablelands area due to the high use for heating and temperature inversion. In Armidale this continues to be a key health issue that has been the focus of efforts in the last decade. Reducing firewood consumption due to insulation results in a significant benefit from reduced particulate pollution. This action in Uralla has the potential to lead the way across the region in tackling this issue.

Biodiversity, habitat and ecological value

Improved firewood collection, better management of existing local grazed and commercial woodlands and reforestation of under-utlised farming land provides for a significant improvement in the ecological value within the Shire. Successful improvement to firewood resource management and local reforestation would see habitat value restored to existing woodlands and the area of Uralla under a commercial level density improve significantly. For a Shire which has been extensively cleared over the last 150 years, this is a significant driver to invest in reforestation despite the lack of a business case to do so.

Stage 2

Stage 2 seeks to resolve the balance of energy generation from renewable sources. This involves increasing the amount of renewable energy which is imported or pursuing utility-scale generation of electricity if and when it is comparable with importing renewable energy.

Stage 2 will need to resolve the best combination of imported and locally-generated renewable energy to meet the Z-NET goal. There are several paths to achieving the goal:

» Save, offset and/or generate enough total net energy to power Uralla—this could be any combination of using less, generating on-site, generating nearby or importing at a community scale

» Save and generate renewable energy to power Uralla at any time of the day—this would involve generation scheduling and energy storage to meet fluctuating demand

» Save and generate enough energy to power Uralla and nearby regions—this could be where utility-scale generation is commercially viable

The current operating environment is not conducive to commercial- or community-scale renewable generation in Uralla, however technology and policy developments may see this change. Given this:

» It is recommended that the community stay connected with these developments and align with advocacy and collaboration efforts towards overcoming financial, regulatory and governance challenges

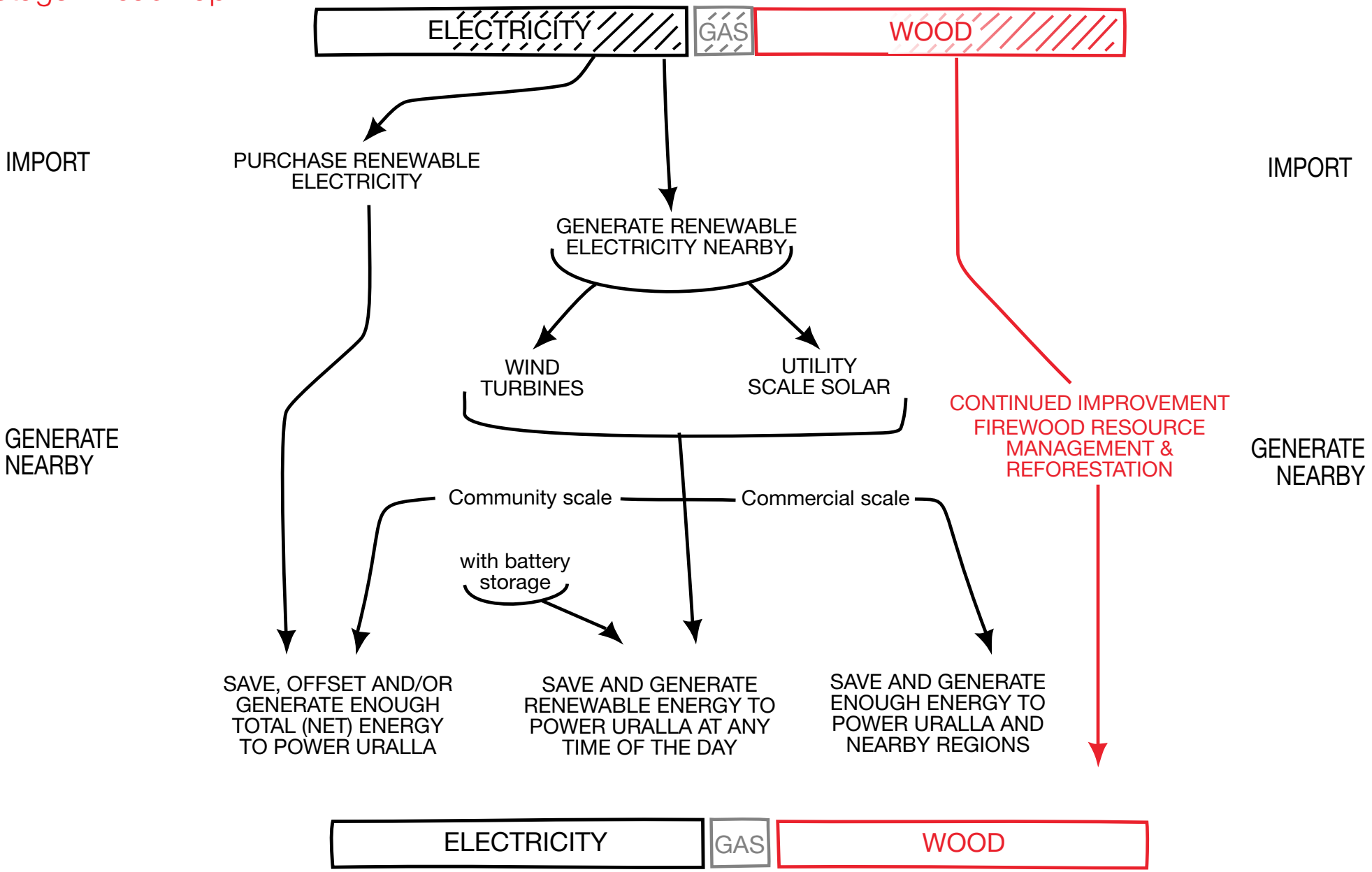
» Investigate specific opportunities for commercial- or community-scale renewables in Uralla that may be viable should conditions change

The following actions lay the groundwork for Stage 2:

1. Monitor and advocate for improvement in operating environment—legislative, regulatory, policy and economics of renewables compared to fossil fuels
2. Establish collaboration with organisations investigating local generation opportunities such as New England Wind to ensure that opportunities for commercial-scale wind are aligned
3. Undertake regular knowledge sharing with other regional towns who are developing community energy projects or via alliances such as the Coalition for Community Energy (C4CE) and support organisations Embark Australia and the Community Power Agency (CPA)
4. Develop interest in a community investor model building on community participation in Stage 1 delivery (the model for firewood may provide a useful foundation)

The following diagram presents the roadmap for Stage 2.

Stage 2 roadmap



How might it work?

Progressing the Z-NET goal in Uralla is achievable, but requires coordinated effort, practical projects and active participation.

Most might expect there needs to be a single party or entity that is responsible for implementing Z-NET, however the model proposed here is one of shared responsibility. This creates opportunity for stakeholders acting either independently or in partnership on individual programs and projects and more strategically to further the Z-NET goal.

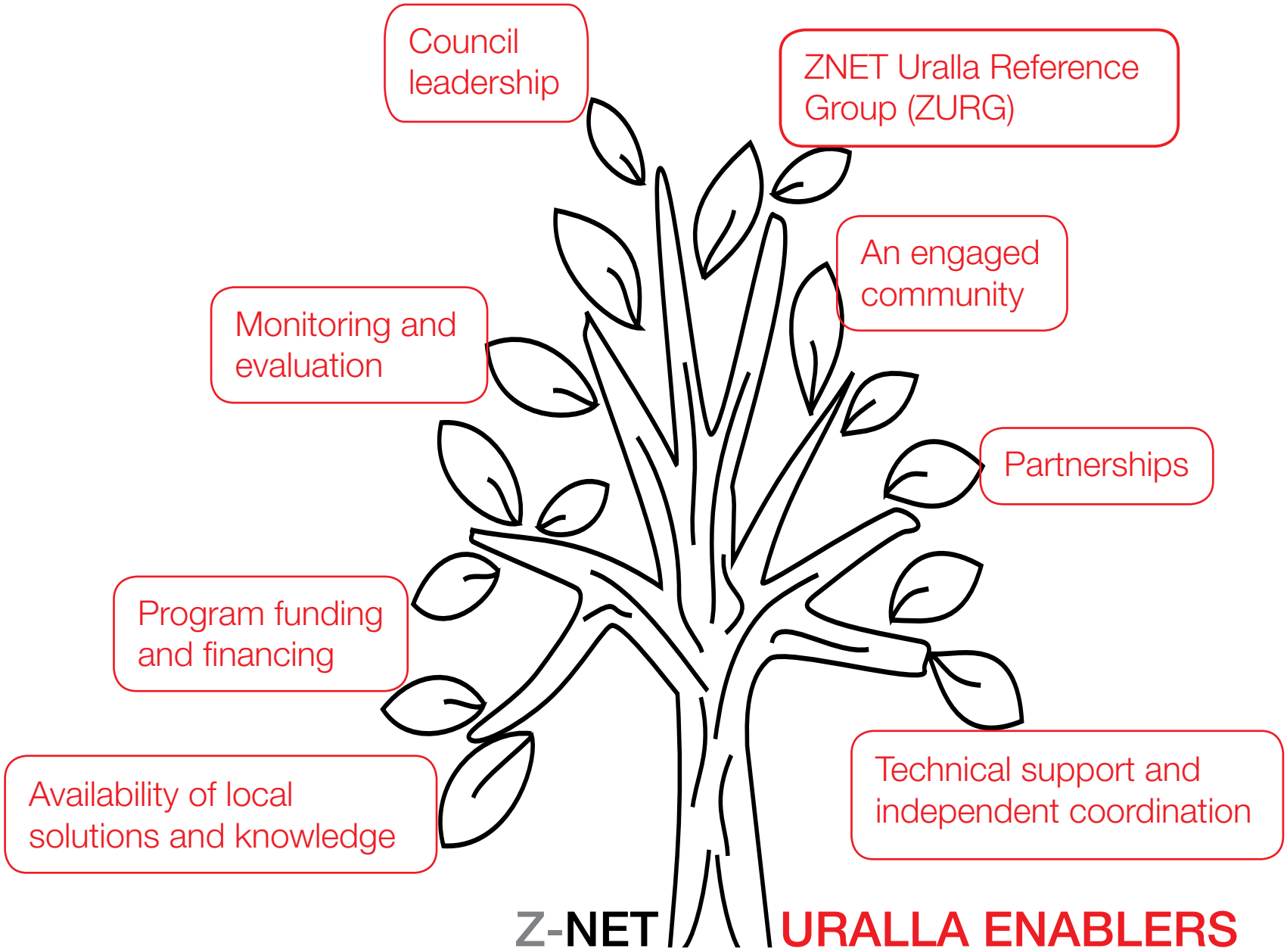
There is no single organisation who has authority or control over the energy use and decisions of Uralla. The community of Uralla comprises thousands of individuals, families, households, businesses and organisations. This of course does not preclude individual organisations from developing their own governance frameworks.

If a large portion of the members of the Uralla community took concerted action on renewable energy then the shared goal of becoming Australia's first Z-NET could be solidly progressed. The Case Study outlines a range of viable actions that community members can consider taking right now, and could be assisted to do so through campaigns and programs.

This kind of 'self-organising' is more likely to happen with some level of coordination, support and leadership. Further, there are particular projects, like group purchasing, and opportunities, such as seeking funding or negotiating partnerships, that require management by organisations or collaborations of organisations.

The intent is to create the conditions for energy leadership across the community, both independently and collaboratively.

Stakeholders will obviously need a forum for collaboration. Following the launch of the Case Study, it is recommended that all parties with an interest in helping to deliver the Uralla agenda meet and discuss the first steps of the implementation phase (including communications). This could form the basis of a periodic forum focusing on reviewing progress, effort alignment (and avoidance of duplication) and further ideas generation.


Council leadership
ZNET Uralla Reference Group (ZURG)
An engaged community
Monitoring and evaluation
Partnerships
Program funding and financing
Technical support and independent coordination
Availability of local solutions and knowledge
Z-NET URALLA ENABLERS

Enablers

The Z-NET Blueprint acknowledges the importance of enablers in the delivery of any project. The enablers in the Uralla context are discussed folllowing.

1. Council leadership

Uralla Shire led the expression of interest to become the successful Z-NET case study and has the opportunity to demonstrate leadership in delivering the target. As a small regional Shire, Uralla does not have the resources to coordinate or fund significant program and project delivery, although selected input into ZURG and smaller aspects of program delivery are likely achievable. Councillors and the Council do however have a significant role in providing leadership to the community. Examples of leadership would include:

- Communicating the project and the Z-NET Blueprint process to others
- Assisting communications around specific programs (e.g. bulk buys)
- Lending coordination support
- Visible actions to use less energy and generate on-site with its own facilities
- Active involvement and support for town branding and tourism activity which promotes Uralla as a Z-NET
- Developing planning policies which promote energy efficiency and renewable energy to guide new development within the Shire
- Advocating for relevant state and federal policy and regulatory reforms.

2. Z-NET Uralla Reference Group (ZURG)

The capacity and commitment of the existing ZNET Uralla Reference Group (ZURG) is quite extraordinary. Their ongoing role will be crucial to the implementation of Z-NET; without this pivotal support the project will not succeed. The ZURG's primary focus will be in maintaining community engagement over the duration of the plan, however this does not preclude undertaking other activities. Where technical knowledge and capacity exists, this should be used to contribute to research, program design and implementation. Depending on the number and capacity of members, ZURG may designate specific roles within the group as:

- Community engagement—Grow and develop a large network of Uralla residents and businesses who are interested in being part of the ZNET journey
- Grants—seeking grants and funding streams that may be able to support ZURG activities and project delivery
- Partnerships—managing relationships with other towns who are working on similar goals, and organisations such as Council, NISBN and RDA who will all be actively working to support Uralla to become a Z-NET
- Advocacy—keeping a watching brief on the operating environment to identify new opportunities or manage risks that might affect the ability of Uralla to become a Z-NET
- Research—using existing technical capacity to commission or contribute to follow up investigations required to inform action
- Program design and implementation–provide input according to expertise into the design and implementation of programs and projects.

3. Availability of local solutions and knowledge

The availability of local solutions and knowledge will be crucial to Uralla becoming a Z-NET. This includes three main elements:

- The availability of local tradespeople such as electricians who have the technical knowledge to deliver solutions
- The main project proponents (ZURG, key Council representatives and others) could benefit from improving their technical knowledge of energy efficiency, renewable energy and firewood resource management in order that the questions of the community can be addressed and that programs can be ‘sold’ to the community effectively. Should paid or volunteer capacity exist, this could extend to undertaking household or small business energy opportunity assessments
- Local availability of products—key outlets such as the hardware store need to stock DIY energy

efficiency products (LEDs, insulation, draught roofing,water pipe lagging) to ensure good access to solutions. Over time, community members could be taught to undertake these activities themselves.

4. Program funding and financing

Each and every stakeholder who is part of Uralla's journey to becoming a Z-NET will need to think creatively to identify and actively seek funding streams for Z-NET programs and projects, particularly to support their design, coordination and communication. These efforts can be both strategic and opportunistic. They may involve:

» Aligning projects and programs with existing government program support e.g. existing OEH programs targeting insulation and other upgrades for low income households

» Specific grants or program allocations—these can be government or non-government funded and should not be restricted to environmental grants. The health sector, for example, has in the past offered grants to vulnerable households or upgrades to accommodation for the elderly

» Local fundraising – the power of fundraising (particularly in a regional community) may be able to provide a supplementary source for communications, program delivery or iconic local projects.

Allocated roles within various stakeholder groups who have responsibility for keeping a watch on grants and program changes, can, if targeted, be a worthy time investment. The key will be to develop a track record with some 'quick wins' such that becoming a Z-NET can be shown to be a good target for funding. This may involve 'pitching' Uralla as a pilot to trial programs or technologies.

There are also members of the community which will need specific assistance to be part of local solutions. Specifically there are low income earners which will not be able to fund capital investments up front and tenants of both residential dwellings and commercial premises who may not be in control of some aspects of their building.

Work has recently commenced in NSW for policy work to be undertaken to examine and recommend policy options to overcome this split incentive barrier between tenant and landlord.

To effectively participate low income earners need access to financial models such as solar leases or green loans where the savings from the activity outweigh the repayments or leasing costs. Some commercial providers of renewable energy and energy efficiency products already offer these services, others partnerships could be developed over time.

For tenants to effectively participate requires further consideration of landlord incentives to invest or at least partner in energy efficiency and renewable energy upgrades with their tenants. Potential exists through changes to taxation policy and increased standards at the point of lease, however these will remain under the control of State and Federal governments. A further opportunity is through Environmental Upgrade Agreements (EUA's) which allow a long-term loan to be paid off through a Council rates mechanism. Current arrangements are more suitable to larger Councils as there is considerable administration costs involved in setup, however this may improve over time through legislative changes.

Both these vulnerable groups are periodically targeted through State and Federal programs. The Energy Efficient Homes Program provided more than $25 million in funding in 2015 for a low income program. The key for the Uralla community will be to ensure alignment with the programs of the day and market itself as an attractive destination for piloting or trialling new programs given its Z-NET background and goals.

5. Technical support and independent coordination

There is a variety of technical and program delivery skills required to drive the sorts of projects which will help Uralla achieve its Z-NET goal. One of the key requirements is for independent coordination of programs (for example that involve procurement of bulk purchases such as solar panels and day to day management of customer registrations or referrals). Given the commercial nature of the programs, these roles are not generally suited to local or State government and are best handled by independent organisations or operators.

Similarly the community will at times need technical assistance to support on the ground activity - this could include due diligence processes for procurement, feasibility investigations and other types of support.

6. Partnerships

Active partnerships will improve the chances of Uralla becoming a Z-NET. They are important because they enable:

» Efficiency—there are practitioners and community members all over the world who are trying to achieve similar goals in their local community. It is valuable to use their learnings to better target Uralla's own efforts. Uralla are leaders but they are not the only Australian community on this journey, it will be important to talk to members of the Moreland, Yackandandah, Byron and other communities on a similar path. Opportunities for sister town or city relationships could be explored nationally and internationally.

» Leveraging private and public sector investment—often a program may lend itself to corporate sponsorship or align with work others are already doing, working together can help reduce duplication of effort and maximise results

» Focus for other local organisations who may have different day-to-day priorities, but can be key allies if they are taken on the journey. Can a local club hold a collaboration event or put solar on their roof, can a charity organisation target some fundraising towards a local Z-NET project?

» Research value—A community project such as this has immense research value to both universities and other research organisations (the interest already is significant).There are real opportunities to collaborate with research organisations that might 'trade' research value for investment in a pilot project or a behaviour change program for example. High profile research can also point the spotlight on Uralla in a way that might attract other funding.

Independent sustainability organisations are expert in facilitating these types of connections often using existing networks, however in an un-funded environment this becomes a resourcing challenge.

7. An engaged community

The task of reaching the Z-NET goal is reliant on building community momentum and action towards a common goal.

Aside from individual programs and projects which will have their own communications requirements, there is a recognition that the community as a whole will need to go on a journey.

This will include engagement focused on raising awareness and achieving behaviour change. Engaging with the community is a requirement across all phases of becoming a Z-NET, and there will be periods where communication activity is intensive. There are opportunities to utilise local stakeholders and partners, however a dedicated and qualified community engagement resource may be required, over and above program allocations noted in the next section.

Fundamentally a level of behaviour change within the community is required, i.e. once aware of the Z-NET goal and the potential to contribute, what will motivate the community to undertake individual change which will aggregate to the Z-NET goal?

Community engagement

Communications planning needs to ensure that simple, regular and targeted communication, within the town and to other communities, is possible.

A variety of engagement methods will be required to reach diverse members of the community, including the elderly, low-income, renters and children (through schools). According to the 2011 census, 30% of Uralla households did not have access to the internet at home. Further, other members of the community make infrequent visits to Uralla township.

Uralla needs to consider:

» What it needs to communicate

» Who it needs to communicate to

» How best to reach each target audience.

As part of the communications process, buy-in is required from a broad group of stakeholders who have an interest. Stakeholders should collaborate on the high level communications objectives, but then take ownership of individual elements according to their relative strengths, for example ZURG may be in the best position to maintain a strong social media presence, Council or Uralla Arts may be in the best position to lead on a town signage project and an organisation such as Northern Inland Sustainable Business Network might be best placed to engage with business.

Each project or program outlined in this section will have its own communications requirements which run alongside well-coordinated overall communications activities. This starts with a deeper understanding of the broader community as a target audience. This conversation

could commence as part of the local forum recommended to kick-start the implementation phase of the project.

Direct engagement with local residents and businesses is going to be required over a long time frame. Communications planning should seek to look at the roles of stakeholder organisations to avoid duplication of limited resources and to ensure alignment of effort.

Professional support in developing a communications strategy would be valuable, but obviously comes at a cost.

One of the key outputs from early communications planning should be some simple communications materials – tools, such as logos, brochures and signage, that can be used to help communicate the concept within Uralla and market the town to other communities. The economic benefit of town branding of Uralla as a Z-NET will be enduring and worthy of coordinated investment.

Behaviour change

There are many theories which attempt to explain the reasons why individuals and groups change their behaviour. Ultimately, there is no single theoretical or practical answer - it is an extremely challenging area of practice. It is important to understand individuals' motivations as these are the primary drivers of decision-making both on energy and more broadly. Whilst the project was able to develop some understanding of residents' energy and environmental motivations through a survey, this process will continue to evolve throughout the implementation phase and be expanded more holistically to business and the wider community in order to be able to tailor program and project delivery.

There are two stages to the local behaviour change equation. Stage 1 focuses on the first, which is facilitating investment in energy products and services. While there is the initial behaviour of the financial investment, which presents its own challenges (see financing in this section), ongoing changes in energy behaviour (such as closing internal doors to limit heating required) to realise the full benefits, also need to be a focus.

An increased level of energy literacy is fundamental. This is best achieved through visual in-home and in-business energy monitoring devices (see appliances and energy monitoring analysis).

The majority of people learn and contemplate action through seeing and doing. With the redevelopment of the Visitor Information Centre in the short term, the opportunity may exist to provide a small amount of space to an exhibition of the Z-NET project. This could 'go on the road' at major events and festivals such as the Seasons of New England market.

A second area of early focus is through the communication of local change examples. While static communications techniques, such as brochures and articles, can be used, change champions (local people willing to share their success) are likely to be highly effective. The Case Study has provided some profiles of individuals and organisations making change, but it will be important to tap into a wide variety of local motivations to mainstream positive energy behaviour and to facilitate investment by the community.

As stakeholders improve their understanding of the local community motivations these leadership examples will change and evolve.

8. Monitoring and evaluation

Good monitoring and evaluation is important to measure success and identify the most effective approaches for reaching the goal. It is necessary to monitor and evaluate the performance of individual programs or projects, as well as the combined action towards the Z-NET goal.

Each program and project should develop a number of key performance indicators (KPIs) which relate to the effectiveness of the particular program, for example in the case of a bulk buy for solar panels, KPIs would need to include number of installed systems and total capacity installed.

It is also important to measure progress at the whole-of-community level. This whole of community monitoring may benefit from utilising a structured framework such as a Monitoring, Evaluation, Reporting and Improvement (MERI) plan. This could be part of preliminary discussions at the collaborative implementation kick-off forum as outlined.

The modelling undertaken for the project can be used as a guide to help monitor progress over time. The spreadsheet has used several metrics to inform the model baseline.

These are:

» For electricity—substation demand figure supplied by Essential Energy (extrapolated to

town and shire)

» For gas—the household survey and business sustainability opportunity assessments (no aggregate data set exists)

» For wood—the total amount of wood consumed in Uralla in any one year (based on household survey and NSW regional data)

For electricity, an arrangement with Essential Energy needs to be developed to obtain substation data.

Home or business level monitoring can be achieved by linking to the planned smart meter rollout program in NSW. Uralla may be able to position itself as a first-mover in this rollout.

Victoria has now almost completed a rollout of smart meters. This has allowed some households to access half-hourly tracking of electricity data across the day. Existing studies have indicated that smart meters, accompanied by real time 'in-home energy displays', can assist with energy literacy in the community and allow residents and businesses to manage their electricity better, leading to an up to 10% saving. Aggregated use of this data may provide a source of town-based monitoring.

For gas, no representative surveying of the business community was undertaken given the small amount of gas use in comparison to other energy sources. It would be useful to develop a more accurate baseline in order to track the changes in gas usage over time. A longitudinal survey (of both business and households) would help verify the assumptions, and provide a comparison over time.

For wood, monitoring is unfortunately very complex, and needs to be underpinned by further research on what sort of firewood collection and land management practices can be regarded as renewable under a local definition. Subject to resolving this and establishing a baseline for what is already renewable, monitoring should be based on:

» The total amount (tonnes/yearly) of certified firewood purchased by the Uralla community from outside the Shire

» The amount (tonnes) of 'renewable' firewood sourced in Uralla and used either locally or in the wider region

» The area of existing woodlands being restored under a forestry management plan

» The area of vacant farmland being reforested.

In addition to verifying the assumptions in the model over time (growth rates etc), these four metrics above will provide an indication of progress towards zero net wood energy.

Evaluation should take place during and at the conclusion of the project and program. Monitoring and evaluation through the life of the program will identify success factors and barriers, and where required, enable changes to be made while the program is still live.

At a community scale, evaluation timeframes should be driven largely by data availability but occur at least once a year, with some elements being considered in a forum where all stakeholders in the project can provide input. Additional monitoring and evaluation methods, other than those highlighted here, may be useful to individual stakeholders or to the implementation framework.

Action plan

The tables below set out an Action Plan for Stage 1 which translates the options which have proved to be desirable, feasible and viable into projects and programs.

While a plan is important, it is also vital for programs and projects to be flexible enough to respond to changing circumstances and emerging opportunities.

The key programs for Stage 1 include:

» Hot water system replacement program

» Solar PV bulk buy program

» GreenPower changeover program

» Thermal fabric (insulation program)

» Firewood resource management and reforestation program

Area of influence	Hot water (using less energy)
Description of project or program	A dedicated group or bulk-buy changeover program that seeks to swap inefficient electric storage hot water systems for electric heat pumps
Target and impact	3.1% contribution to ZNET over 10 years
Timeframe	2016–2019

Key challenges and considerations

- Low winter temperatures may effect efficiency and performance of heat pumps
- Ability to promote landlord investment is crucial
- Business case not as attractive as other options
- Trial required to test the efficacy of heat pump solutions in Uralla climate

Key delivery steps

- Seek expressions of interest to be part of a Uralla heat pump trial
- Trial 3 to 5 different heat pump systems over winter 2016 and summer 2016-17 in up to 15 homes (potential for sponsorship from companies keen to test their systems in cold climates)
- If outcomes are poor consider re-orientating program towards solar hot water (electric boosted)
- Engage Essential Energy to test the value to the grid of reducing Uralla's peak load (at 2am)
- Investigate funding alternatives for program design, communications / engagement, coordination and program management
- Undertake program design and establish incentives and program alignment to ensure low income and rentals can benefit from program
- Appoint preferred supplier based on trials and other due diligence processes
- Develop case studies using results of trial
- Promote the program locally through community networks and other channels
- Intensive program delivery over 3 year period, but with staged changeover through entire project period
- Monitor benefits in residents' homes to promote action and broader Z-NET objective

Resources

- Majority of cost borne by private sector
- Support for low income and renters made available through subsidues or innovative financial models
- Funds required for project design, coordination, communications / engagement and procurement (at least. 0.4 FTE for two years, reducing to 0.2 FTE for final two years of project)

Potential roles

- **ZURG** – input into engagement and promotion and potentially other program aspects
- **OEH** – low income program alignment
- **Experienced independent coordinator** – heat pump trial communications / engagement, program design, coordination and management and due diligence of preferred provider

Area of influence	Solar PV bulk buy (generating on-site)
Description of project or program	A dedicated group or bulk-buy program that seeks to dramatically increase the take up of solar PV in Uralla
Target impact	12.6% contribution to Z-NET over 10 years
Timeframe	2015–2017

Key challenges and considerations

- Feed-in tariff is likely to be removed completely over the next several years so worthwhile considering as high priority
- Variability in quality of solar panels and inverter but good certainty in generation outcomes
- Excellent business case should assist in driving uptake
- Ability to promote landlord and tenant investment is crucial for rentals – financial models such as leasing and payback mechanisms through rates are worth considering

Key delivery steps

- Seek funding or investigate funding alternatives for program design, communications/engagement and program management
- Undertake program design and establish incentives and financial models to ensure low income and rentals can benefit from program
- Appoint preferred supplier/s based on due diligence processes
- Promote the program locally through community networks and other channels
- Initial rollout program over six month intensive period
- Monitor benefits in residents homes to promote action and broader Z-NET objective

Resources

- Majority of cost borne by private sector i.e. households and businesses
- Support for low income and renters made available through innovative financial models
- Funds required for project design, coordination, communications / engagement and procurement (at least 0.4 FTE for six months, reducing thereafter)

Potential roles

- **ZURG** – input into engagement and promotion, and potentially other program aspects
- **OEH** – low income program alignment
- **Experienced independent coordinator** – program design, communications / engagement, program coordination and management and due diligence of preferred provider
- **Uralla Council** - Assistance with communications outputs.

Area of influence	GreenPower changeover program
Description of project or program	A partnership campaign with a retailer to sign up residents and businesses to an accredited GreenPower source
Target and impact	1.4% contribution to Z-NET to 2020 (conservative estimate, can be more significant with higher participation)
Timeframe	2017

Key challenges and considerations	Key delivery steps	Resources	Potential roles
» A GreenPower changeover program tests the market in Uralla to see if local residents and businesses are willing to pay a premium for renewably sourced electricity » Community-based retailer models are currently being established in NSW	» Establish broader program parameters and seek funding or investigate funding alternatives for communications and program management » Investigate partnerships with potential retailers to deliver a GreenPower product to the Uralla community (or broader) which trades an aggregated customer base for a reduced price for Greenpower electricity » Align changeover program with energy efficiency and solar rooftop PV campaigns for efficiency	» Cost borne by private sector » Investment in partnership development with suitable retailer required	**ZURG** – engagement and promotion of GreenPower offer to Uralla community **Experienced independent coordinator** – coordination of partnerships with suitable retailer/s **Retailers** – remain open to a partnership approach of this type

Area of influence	Thermal fabric (using less energy)
Description of project or program	A dedicated ceiling insulation program which seeks to address the low levels of ceiling insulation in Uralla
Target impact	7% contribution to Z-NET over 10 years
Timeframe	2015–17

Key challenges and considerations

- Reaching low income households that often have the lowest rate of insulation
- Ability to promote landlord investment is crucial
- Alignment with existing OEH low income insulation programs (policy development around reducing the split incentive barrier has recently been commissioned)
- Strong due diligence process required for any preferred provider endorsement
- Need to avoid issues associated with delivery of Federal Government insulation program
- Potential asbestos in ceiling cavities

Key delivery steps

- Investigate funding alternatives for program design, communications/ engagement, coordination and program management
- Undertake program design including establishing incentives and program alignment to ensure low-income and rental households can participate
- Expression of interest process for provider/s
- Promote the program locally through community networks and other channels
- Intensive program delivery over 2 years
- Monitor benefits in residents homes to promote action and broader ZNET objective
- Potential opportunity to fund cost of coordination, communications or project management within insulation price

Resources

- Majority of cost borne by private sector i.e. households and businesses
- Support for low income and renters made available through subsidies or innovative financial models
- Funds required for program design, communications / engagement, project coordination and procurement (at least 0.6 FTE for two years)

Potential roles

- **ZURG** – input into engagement, promotion and potentially other program aspects
- **OEH** – low income program alignment
- **Experienced independent coordinator** – program design, communications/engagement, program coordination and management, and due diligence of preferred provider/s

Area of influence	Firewood resource management and reforestation
Description of project or program	A long-term coordinated program of research and subsequent improvement of firewood resource management and reforestation of under-utilised farmland
Target and impact	Up to 40% contribution to Z-NET over 10 plus years (depending on definition and quantification of current practices)
Timeframe	2016–2025 and beyond

Key challenges and considerations

- Research time and funding required
- Land-owner/ firewood collectors/ community buy-in required
- No certainty that Uralla and regional market would pay more for a defined renewable supply
- Potential to look at environmental trust grant or simiilar to fund research
- The long-term nature of reforestation demands that an early investment be made despite the lack of an economic business case

Key delivery steps

- Commence a local dialogue on firewood between potential partner organisations such as ZURG, Landcare, OEH, Regional Development Australia, CSIRO, Forest Stewardship Council, Council, land managers, firewood collectors and ecological experts
- Develop a research agenda to better understand existing firewood resource management practices, ecological sensitivities and a locally appropriate definition of a renewable wood supply. This would include direct engagement through community forums which seek to raise awareness, gather data on current sourcing and test demand for an investment model (donation/price premium) for practice change and potentially reforestation
- Seek funding for and develop partnerships to undertake required research activities
- Based on the results of research:
  - confirm a baseline (of what is already renewable)
  - design a support system for the community, for firewood collectors and for land managers
  - design and implement a monitoring approach
- Implement support system
- Develop a fundraising model that can contribute to supporting improved firewood resource management and reforestation
- Once the support system is established, actively market the approach regionally through community networks and other channels

Resources

- Funds required for research phase initially
- Funds required for coordination, communications / engagement (at least 0.4 FTE or greater for at least four years) - note this does not include the actual research or implementation of a support system
- Governance model for any donation/ accreditation model may require some legal or administrative resources

Potential roles

Experienced program coordinator / community education officer – coordination of local dialogue and research program, design and implementation of any support system and associated activities.

Other roles would be determined from initial local dialogue

Further energy reduction

Not all options lend themselves to a dedicated project or program. Several options which were evaluated will be delivered through ongoing improvement in product efficiency and standards over time with limited additional investment from the community. These ongoing improvements can be supported through more general information and awareness programs and through the existing market.

Lighting

Residential lighting improvements are driven by several factors: the availability of the government programs which make replacement more cost-effective, and increases in lighting standards and availability of more efficient and cost-effective new lighting products. This will continue to occur alongside the delivery of the above programs and projects. The benefit of the lighting improvements has been factored into the business model.

Appliances

Appliance improvements are driven largely by increases in the Minimum Energy Performance Standards (MEPS). A fridge purchased today is approximately 30% to 40% more efficient than one purchased 10 years ago. The model assumes a changeover in fridges and televisions for 70% of households over a ten year period. These reductions could be accelerated through specific campaigns around retiring seldom used second fridges, information campaigns which assist in choosing efficient appliances and the rollout of home energy displays and smart meters which increase energy management and literacy.

Heating and cooling

Similar to appliances, improvements to electric heating and cooling will be largely driven by increases in the Minimum Energy Performance Standards (MEPS). The model takes into account the very low usage of electric heating and cooling in Uralla (approximately 70% use wood as their primary heating source). This means that the impact is low overall despite a reasonable business case for replacing inefficient systems with high efficiency systems.

Business energy efficiency

Business energy efficiency is a challenging area of engagement, and given the size of the business community relative to the residential community in Uralla, is a less obvious target for energy efficiency. Whilst not considered a program priority, if government programs exist which support upgrades then a dedicated program or specific awareness campaign may be beneficial. Ongoing improvements should be coordinated and aligned with organisations such as the Northern Inland Sustainable Business Network and Regional Development Australia.

In order to engage farmers (as part of the business network), specific engagement activities may be required which extend to targeted information programs around reducing energy use (e.g. solar pumping). Larger land owners will also be involved in improved firewood resource management and reforestation programs.

What are the risks?

What are the risks and how does the community best manage them?

Low uptake

While the first step is to have an idea on paper, the key test is whether the community embraces the program and participates. Critical to uptake is the capacity to present a clear vision and identify both community and individual participant benefit. The Blueprint principle of determining least cost actions reduces this risk. The focus on demand side action makes the Z-NET plan both tangible to households and businesses.

Care needs to be taken during implementation to ensure community engagement strategies are well considered and tested. Visibility of ‘quick wins’ and action from community leaders such as Council and local business identities will be important.

Target not achieved

Not meeting the target can be frustrating and demoralising for key participants, and could result in a loss of buy-in from the wider community and key stakeholders. Early ‘quick wins’ are important.

Opportunity cost

Any investment of money or time needs to consider the opportunity cost of not taking an alternative approach. The structure of the plan focussing on demand side action in Stage 1 is considered a ‘no-regrets’ approach that will serve the community well no matter how the world

around Uralla changes.

Complexity

Complexity of projects due to the combined factors of technology, regulation and multiple stakeholders can test the capacity of a community to implement what appears on paper to be a financially viable concept. Attention must continue during implementation to ensure program delivery does not become overly complicated. The Z-NET plan, set over two key stages, aims to reduce complexity and develop individual programs that share co-benefits but are not reliant on others.

Increased energy use

The Z-NET plan is based on the community taking actions to reduce current energy consumption and increase renewable generation. Care must be taken to avoid unexpected fuel switching or increase in consumption associated with changing business and lifestyle activities. Examples are shifting to gas for electric hot water heating, or an increase in the penetration and use of inefficient air-conditioning or other appliances.

Conclusion

The Z-NET project has brought the community of Uralla together to build a vision for a sustainable energy future. Along the way the concept has captured the imagination of many others across Australia. The challenge is to provide a feasible, viable and desirable path to deliver it.

The Case Study provides a clear roadmap to implement solutions that work today and sets out a framework for future action. The project started with lots of great ideas but along the way many of those proved impractical or not financially viable. The Z-NET least-cost approach identifies a set of practical actions that have both a measurable tangible impact and an acceptable payback period for participants. By undertaking Stage 1, Uralla is taking a significant step towards the Z-NET goal of reducing the Shire's current stationary energy use and significantly increasing local renewable generation.

In turn, Uralla will be positioning itself to adopt further actions as they become viable in the future. The energy sector is undergoing significant change though there remain significant economic and regulatory barriers to large-scale renewable energy projects. Stage 2 recognises the need for Uralla to join with many other voices seeking to accelerate this change.

The Z-NET Blueprint presents a simple logic for communities across Australia to invest in renewable energy over time. While the Blueprint highlights that many forms of large-scale generation are not yet financially viable, they are technically feasible in Uralla and clearly desired by the community. This should further strengthen the resolve of policy makers to develop policies that provide a stable environment for the long-term.

Acknowledgements

Z-NET Funding

NSW Office of Environment & Heritage

Z-NET Consortium

The Consortium provided strategic guidance for the initiative, providing input on project design, town selection and consultant.

- Institute for Rural Futures | University of New England
- Office of Adam Marshall |Member for Northern Tablelands
- NSW Office of Environment & Heritage
- NSW Trade & Investment
- Regional Development Australia Northern Inland
- Northern Inland Sustainable Business Network
- Starfish Initiatives
- John Wearne

Project Executive

The Executive were responsible for the day-to-day management of the project.

- Adam Blakester | Starfish Initiatives
- Liz Gardiner | Starfish Initiatives
- Lauren Zell | Regional Clean Energy Program of NSW Office of Environment & Heritage
- David Thompson | Regional Development Australia Northern Inland

Advisory Panel

The Advisory Panel supported the Consortium, providing specialist advice as required.

- Andy Cavanagh-Downs | Embark Australia
- Dr Christopher Blanksby | Entura
- Franziska Mey | Community Power Agency
- James Felton-Taylor | Australian Sustainable Timbers
- Alun Davies | Digital Economy Coordinator & Regional Communications Advocate
- Ken Davey (biogas)
- Kristian Handberg | Percepscion
- Mark Byrne | Total Environment Centre
- Michael Brennan | Clarence Consultants
- Murray Hogarth | Green Capital & Wattwatchers
- Tim Nelson | AGL & Future Grid Cluster

Z-NET Uralla Reference Group

ZURG supported community engagement during the development of the project and provided local advice as required.

- Sandra Eady (Coordinator)
- Andrew Parker
- David Ryan
- Isabel Strutt
- Maxine Ross
- Rachael Sowden
- Ray Pickford
- Stephanie McCaffrey
- Teresa French
- Alan McKenzie
- Terry DeLacy
- Peter Low
- Gordon Garradd

Key Stakeholders

Key stakeholders that provided advice to support the analysis

- Essential Energy
- Shire of Uralla
- Uralla businesses and residents

Technical Team

The Technical Team were responsible for preparing the Uralla Case Study and developing the Z-NET Blueprint.

- Moreland Energy Foundation Ltd.
- Little Sketches
- Enhar
- ClimateWorks Australia
- Rod Marsh

zeronet
energy town