18th August, 2015

Transition Tyalgum:
A Plan for Energy Self Sufficiency

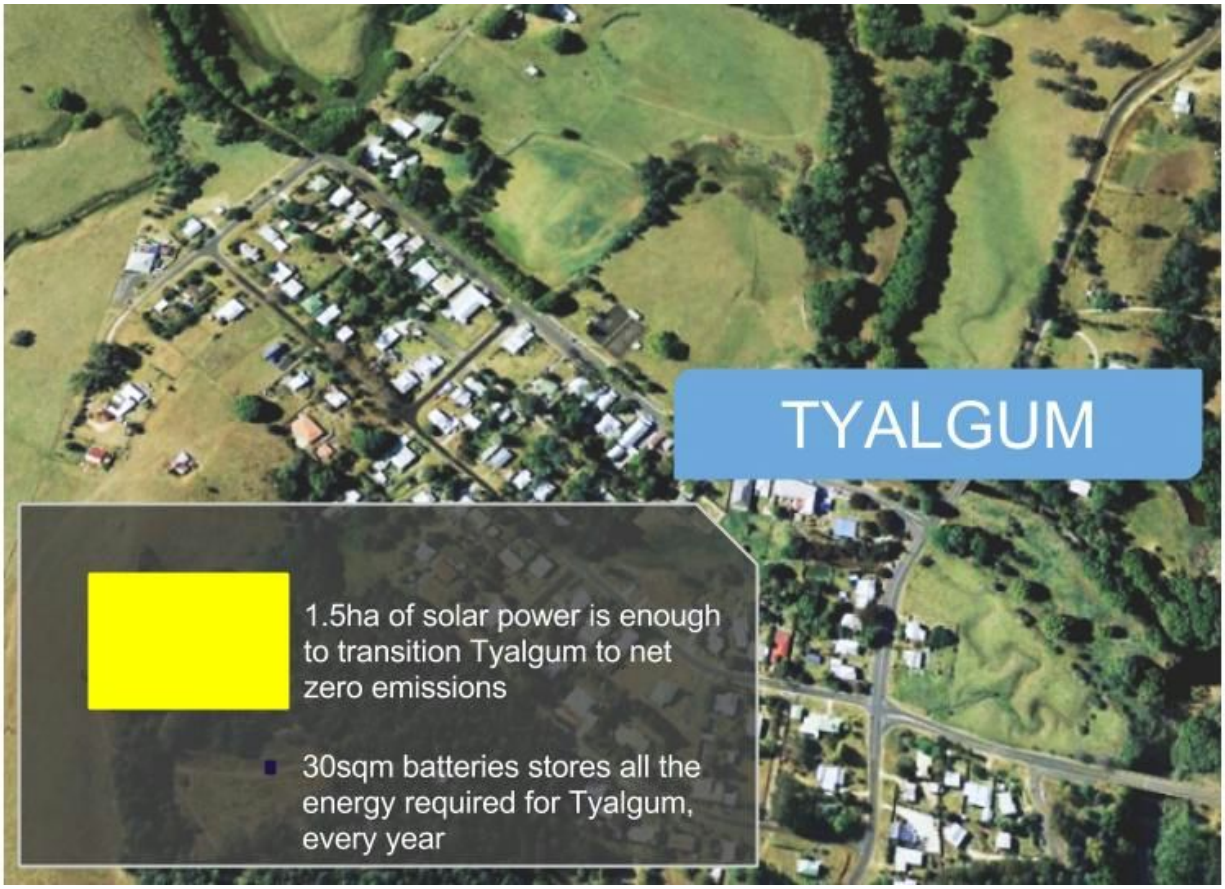
Developed with funding from the Office of Environment and Heritage

In partnership with the community of Tyalgum and The Alternative Technology Association, with in-kind support from Australian Radio Towers.

Contact the lead author:

Tosh Szatow, Director, Energy for the People, tosh@energyforthepeople.com.au

Transition Tyalgum in a Picture



Contents

About this document

This document is a living resource for the Tyalgum Community and its stakeholders.

It explores and assesses options for developing and implementing a community energy project in Tyalgum, with a view to generating 100% renewable energy for the town locally, and, if favoured by the community, transitioning to independent energy supply (disconnecting the town from mains grid energy supply).

It makes recommendations on how to proceed, including how the community and other project stakeholders can be engaged in order to build project support. This includes feedback from workshops and community consultation during the period May 18-22 and some links to useful reference material.

Background

The Tyalgum community, with support from The Office of Environment and Heritage and local business Australian Radio Towers, is exploring pathways to zero emission energy supply, including the potential to become self sufficient by generating and storing all of the Tyalgum's energy requirements locally.

Energy for the People was tasked with delivering a workshop in the Tyalgum community that would help attendees build an understanding of what energy solutions are available to them, and how to go about developing viable energy initiatives locally with an emphasis on ensuring the needs of the community and vulnerable energy customers are understood and managed.

In addition to the workshop, Energy for the People was engaged to explore the financial viability of the project, including ownership and management models and their regulatory implications. This included developing a project plan for the community of Tyalgum to implement.

To provide a rounded perspective on the risks and opportunities associated with this unique project, the Alternative Technology Association (ATA) explored the broader regulatory and policy environment, and assessed key aspects in detail. ATA also assessed some technical elements of the project to identify and address any significant practical barriers to the project

Executive Summary

Transitioning the Town of Tyalgum to 100% renewable energy requires a social solution for exciting, uniting and empowering the community around a project vision, shared values and tangible outcomes. For the project to succeed, the community of Tyalgum must develop and "own" this social solution.

Energy for the People recommends the project be implemented incrementally to build support, while managing project risks. We recommend a three phase process, with phase 1 focused on building strong social foundations for the project, before more detailed technical and commercial dimensions to the project are worked through in Phase 2 and 3.

Importantly, we find that engineering, financial and regulatory dimensions of the project have known solutions in both "off grid" and "on grid" scenarios considered. This makes the social solution the critical enabler of project success.

It is worth briefly summarising here the project by numbers, and broadly describing the viability of scenarios considered in this report.

Tyalgum currently spends approximately $700,000 - $750,000 a year on electricity, based on a net consumption of approximately 2.4GWh and a review of residential and business tariffs being paid by Tyalgum locals - with daytime energy prices of $0.3/kWh, off peak controlled loads of $0.18/kWh and supply charges of $1.26 a day[1]. Based on published tariffs by local network business Essential Energy, it is reasonable to assume approximately 55% of this spend, or $385,000, is paid to Essential Energy for network services.

With an approximate four peak sun hours a day after losses, 1.7MW of solar power would be needed to make the town "net zero emissions" based on current energy demand, assuming no energy efficiency measures are undertaken. Up to 2.7MW of solar power and 2.7MWh of battery storage (complemented by a backup generator) would be appropriate, based on best practice off grid system design to maximise use of renewable energy, if the town was to become energy self-sufficient by going "off grid"[2].

At this stage of the project, we can not provide a clear recommendation on whether it is best in the long run to install solar and storage assets centrally, or "behind the meter" of residential and commercial customers. This is due to project risk caused by uncertainty regarding future network tariff structures.

Based on current tariff structures, clearly the incentive is to focus on deploying behind the meter solar and storage infrastructure. We estimate that for a net cost of approximately $3.5m-$4m, Tyalgum could become net zero emissions[3] and largely energy self-sufficient, saving as much as $580,000 per annum, with every home and business having their own battery storage system[4], and with most customers have their own solar system, noting some households will not have suitable roof space due to roof condition or overshadowing.

---

[1] Note: we believe these energy load figures pertain to the geographic boundaries of Tyalgum, which may extend beyond a single, isolatable distribution network. The commercial centre of Tyalgum and surrounding properties constitute the majority of Tyalgum residents and businesses, and do share a single, isolatable distribution network.

[2] We note an hourly energy load profile for Tyalgum was not available, however based on seasonal aggregate data, summer demand appears to be 50% greater than winter demand, and so aligns well with solar output, and off-grid system design more broadly.

[3] Note: net zero emissions simply means that in an typical year, Tyalgum would genberate as much, or more energy than it uses, from zero emission generation sources.

[4] Note: power reliability is a concern for Tyalgum, making individual battery storage appealing beyond direct financial benefits

However with high-to-full penetration of solar and storage assets installed “behind the meter” on customer premises across Tyalgum, Essential Energy revenue is substantially eroded to $70,000, from $385,000. If electricity tariffs were re-balanced by Essential energy to recover these losses, for example by increasing fixed charges, this would naturally impact on financial savings to Tyalgum residents with solar and storage assets. While this outcome is very unlikely to arise directly from the Tyalgum project due to the absence of locational pricing in NSW, there is a risk that broader tariff reforms slated for NSW that introduce declining block tariffs will have a similar impact in the economics of batteries and solar in Tyalgum.

If solar and storage assets were to be installed centrally, under current pricing arrangements there would be no direct reduction in network charges for the Tyalgum community. However without renegotiating network tariffs, and/or establishing an alternative model for energy supply for Tyalgum (for example, establishing the town as a private or embedded network with location-specific tariffs, it is unlikely that solar and storage assets can be viably deployed centrally.

To be completely energy self sufficient, using at least 90-95% solar power with no electricity being consumed from the mains power grid, we estimate the net cost would range from $6.5m - $7.2m based on current technology costs, which could drop to approximately $4.7m by 2020.

In all scenarios, the key variable influencing project viability in the long run, and the primary project risk, is the ability to negotiate network access, tariffs, and potentially the transfer of ownership of a portion of the network with Essential Energy.

The efficient cost incurred by Essential Energy in operating the network could be substantially - if not fully recovered, if Essential Energy shows a willingness to collaborate in the project at an early stage. For example, if they reduced network tariffs to Tyalgum residents that purchase electricity from a centralised solar farm, this would leave sufficient margin to generate and retail electricity locally, while utilising the distribution network. If tariffs remain as they are however, the community will have a strong incentive to prioritise “behind the meter” infrastructure, and so substantially erode network revenue.

This starkly highlights the tension in Australia’s energy market between the private incentive to invest in “behind the meter” energy infrastructure, and the public imperative to optimise the transition of Australia’s energy infrastructure to ensure consumers benefit from new and emerging technologies.

We note this problem cannot simply be resolved by refining network tariffs, and tariff structures, to reflect true network costs. This choice facing the local network business is more stark - reduce network tariffs and accept lower revenue to give customers an incentive to stay on the grid, or respond to declining demand by increasing tariffs to recover lost revenue, and risk customers leaving the grid.

Because of this risk, we recommend the community of Tyalgum focus its effort on building social support for the project in the short-term, while implementing some limited demonstrations of community owned energy infrastructure consisting of solar power, battery storage and energy efficiency solutions. These demonstrations will help build support for the broader ambition, and lay the foundations for subsequent phases of the project including negotiations with Essential Energy over network access, and network value.

This report details Energy for the People’s recommended three phase implementation plan, for the community of Tyalgum, including analysis and resources to assist decision making. We note this plan will naturally be subject to dialogue, debate and change within the community, and so should be considered a “living document”.

Workshop Findings

A workshop was held with community members and project stakeholders at the outset of Energy for the People's engagement on this project. Conducted over two hours, the workshop consisted of two primary goals:

1. Work towards a common understanding within the Tyalgum community of how zero emission energy supply could be feasibly delivered, including the potential for the community to disconnect from mains grid energy supply; and
2. Identify any latent community concerns about the project, ensuring they are addressed in the project plan.

To achieve these, the workshop was structured over two hours in order to:

- Share individual insights into Tyalgum as a community, including how it works together, and how it could work better together to achieve commonly held goals;
- Provide knowledge and context around the energy market transition we are experiencing, including how the economics of energy supply is changing, and the emerging role of battery storage technology; and
- Build shared understanding of the different ways zero emission energy and energy independence can be delivered for the community, including how to ensure the community benefits and any vulnerable members of the community are protected and supported

An interactive, community-led component of the workshop, and the majority of the workshop time, was allocated to address two of the fundamental challenges facing the project:

1. How can energy infrastructure design for Tyalgum be future proofed?
2. How can an entity responsible for owning and managing energy assets, be kept accountable to the community?

Conversations were facilitated and documented by individuals on each table (6 tables of approximately 6-7 individuals to each table).

What the Tyalgum community is saying

Responses to individual questionnaires, and notes taken by facilitators of community-led discussions were analysed to identify key themes around the two focusing questions.

1. how can an entity responsible for owning and managing energy assets, be kept accountable to the community?
2. how can energy infrastructure design be future proofed?

In response to the question of maintaining accountability, the discussion was organised around three key issues, which were:

1. What systems could be used for maintaining accountability between the entity owning/managing energy assets and the community; and

2. What structures for owning and managing energy infrastructure can help with maintaining accountability to the community;
3. What outcomes are desired by the community.

Themes arising from the discussion are summarised in the image below:

Discussions appeared less focused on the structure used for enabling community owned infrastructure, and more focused on the desired outcomes, and the systems that would enable those outcomes such as participatory decision making and transparent measurement and reporting on financial, social and environmental metrics. There was an emphasis on the need for transparency in decision making and accountability to the community, but also a recognition that overly consultative decision making could become burdensome, highlighting the need to find a middle-ground.

There was also a recognition that good systems would be needed for managing the arrival of new members to the community. At a practical level, this would include the need to ensure new homes were designed and built to a high standard of sustainability, as well ensuring new arrivals understood who their energy supplier was, and how to engage with them.

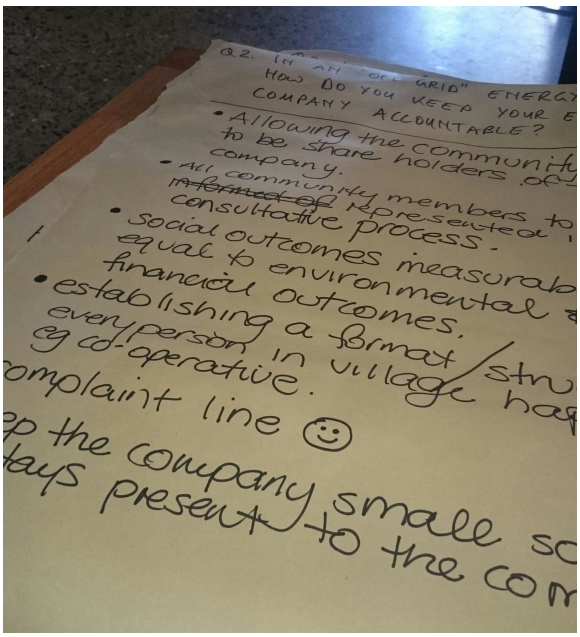


Image: notes from community workshop i Tyalgum

In response to the question of future proofing energy infrastructure, the discussion was organised around three key issues, which were:

1. strategies for future proofing energy infrastructure;
2. processes for future proofing energy infrastructure; and
3. risks to future proofing energy infrastructure.

Notes from the discuss are summarised in the image below:

It was recognised that the key to future proofing Tyalgum's energy infrastructure, would be ensuring a compelling value proposition to customers - for example, if energy costs were too high, or the benefits to the community were not clear, customers may not opt in. Community members were also very conscious of the practical need to ensure funds were set aside year to year for the maintenance and replacement of any shared energy assets, and that ongoing research would be needed to keep abreast of changing energy technologies, and how they could be applied in Tyalgum.

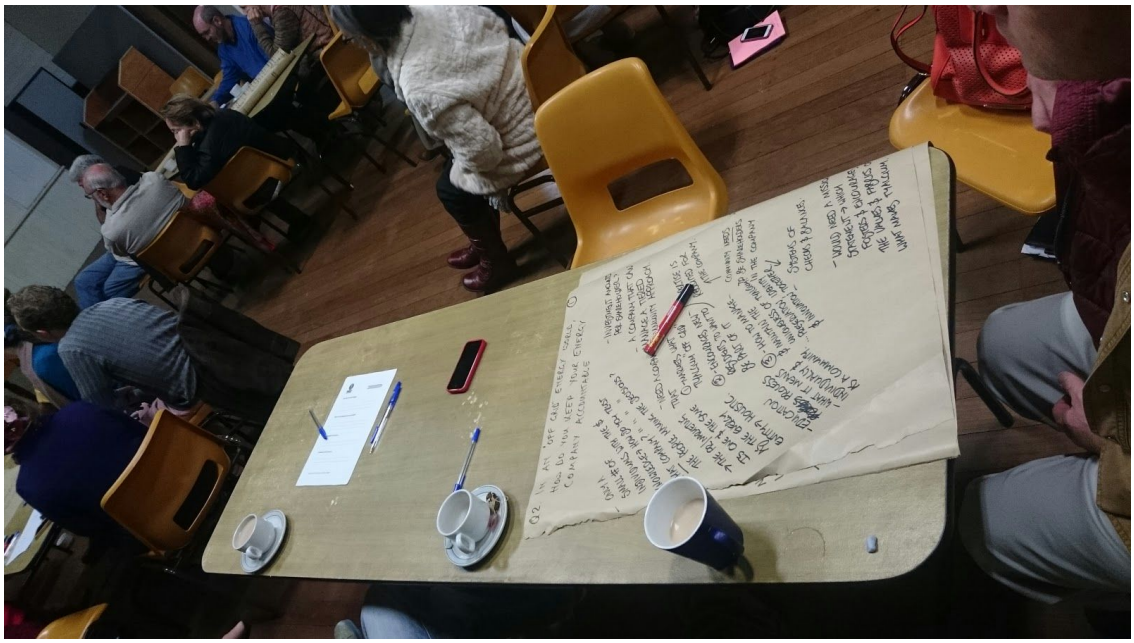


Image: Tyalgum community members at work

It was recognised that 100% opt-in to a project of any kind would be difficult to achieve, but a worthwhile aim, and that some flexibility may be required to ensure different members of the community could be catered for should they choose not to opt in.

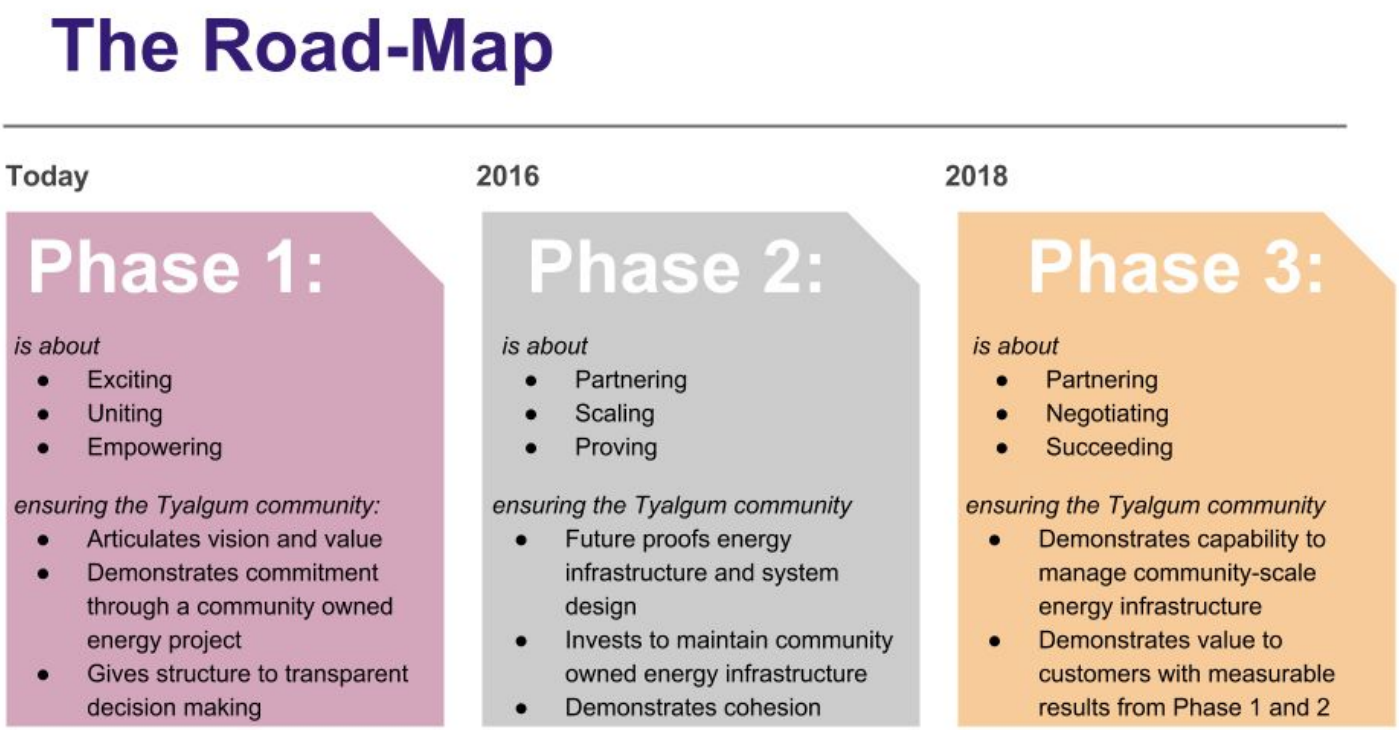
The primary risks were seen to be the potential for social division, should winners and losers be created by the project, and managing the risk of customers opting out of the proposed solution(s). There was recognition that a staged implementation of solutions could be a good way of managing this risk, as well as "stress testing" scenarios to ensure investment decisions made by the community would be viable in a range of possible future scenarios.

Lastly, there was also the recognition that different members of the community would react to the project in different ways, and that communication would need to be tailored to ensure a broad base of the community understood, and engaged with the project from an early stage.

The plan developed by Energy for the People addresses and builds upon the input provided by the Tyalgum community, to ensure risks and concerns are managed. It can be seen that our recommendations in this report and three phase implementation plan, directly reflect the input provided by the community at the beginning of our engagement.

The Project Plan

Based on consultation with Tyalgum residents and project stakeholders, Energy for the People created a three phase plan - The Road Map - that incrementally builds support for the project, while managing project risks. The figure below summarises key elements of the plan and an indicative timeline for its implementation.



It starts with a "community contract"

Prior to implementing the three phase plan, or an alternative plan developed subsequently by the community, we recommend a set of core commitments be adopted by the community and project stakeholders to anchor project intentions. These commitments will constitute a form of "community contract" and help guide decision making at every stage of the project.

We make this recommendation based on feedback provided during workshops and community consultation, that suggests the primary risk to project success would be the risk of community division, and implicitly, uncertainty about whether anyone in the community may be worse off as a result of the project. Specifically, we recommend adopting the following commitments, which will act as checks and balances during every stage of the project:

- The unit cost of energy will not be higher , and nobody in the community will be worse off financially, as a result of the project/plan;
- 100% renewable energy will be supplied;
- A portion of financial value arising from the project will be returned to the community; and

- Power supply will be more reliable than at present (i.e. mid-2015) - not less.

The commitments (herein referred to as "The Community Contract") will provide a foundation for communicating project intentions. They also build confidence within the community that the project will benefit all Tyalgum residents, garnering support for the project plan as it is developed and communicated in more detail. The commitments have been developed following the community consultation process, which explored project intentions and barriers to success.

From the outset, we suggest the full details of the plan be communicated, considered and debated by the community and project stakeholders, so that its logic can be tested and refined as necessary. However we caution against waiting for all details of the plan to be fully documented, understood and accepted before commencing with Phase 1.

We advise this caution for two reasons:

1. Some of the project details, such as who might manage the "poles and wires" in the event Tyalgum becomes completely self-sufficient, or what energy prices will be, simply can't be resolved in sufficient detail at this stage of the project. The community will need to demonstrate commitment to the project and its capability for managing energy infrastructure at a small scale first, before contemplating more complex elements of the project;

2. Based on community consultation undertaken, we believe there is broad support for Tyalgum becoming energy self-sufficient, assuming no-one will be worse off, and at a minimum there is broad support transitioning to 100% renewable energy. The primary risk to the project appears to be the potential for social division, and the perception that this is project is "just another idea" without the potential to be implemented. Addressing these risks will require demonstrable results that unite the community, arising from projects the community implements together.

Phase 1 - Excite, Unite, Empower

Phase 1 is focused on exciting, uniting and empowering the community of Tyalgum.

This is done by building informal networks, and the community coming together around small, low-risk projects that bring life to the project. It also creates structures that will ensure transparent decision making as the project evolves, while building local capability for managing the project. These will be important foundations for Phase 2.

Specifically, Phase 1 involves six key tasks described below, including why these tasks are important, and how they contribute to the long term success of the project:

1. *Establishing an informal network:*

    - This will be open to all members of the community, and is likely to consist of a core group of at least 5-10 community members that start to meet regularly (monthly initially) to make sense of recommendations in this report, and to plan and execute Phase 1 recommendations;

    - These informal meetings are likely to lead to working groups and structures that begin to manage the project in a more formal way within the community.

2. *Planning and executing a simple community energy project*

- This will provide a platform for creating, discussing and sharing the project vision and values, helping them take shape and come to life;
- We recommend doing this around a tangible project, as opposed to a more conventional workshop and consultation approach, to avoid the risk of stagnation in the group - this is a very real risk for community energy groups that are unable to translate a vision into action. Given this project has a relatively long history in Tyalgum, we believe it is the right time to start delivering outcomes;
- We recommend crowd funding an integrated solar power, energy efficiency, and energy storage solution for a neutral venue in Tyalgum - such as the school - with energy savings to be invested to enhance learning opportunities for students. This project will informally engage the community in the project's financial and social value, while tangibly, demonstrating the value of local energy solutions.
- The crowd funding process will create opportunities for the project vision and values to emerge from a diverse group of community stakeholders. By locating the first project at a neutral venue in the community - the school - any risk of social division will be minimised.

3. *Developing communication material that explains the project and excites Tyalgum*[5]
    - This material will articulate the project vision, value proposition to the community, and project plan to community stakeholders, using four-to-five "touch points" for communication across town that engage the diverse social groups of Tyalgum;
    - The touch points could include a visual display highlighting project facts and figures[6], with more detailed flyers to take away explaining the project and "social markers", such as stickers for shop windows, cars and letterboxes, that help identify commitment to the project;
    - It will be important to ensure the project is communicated in sufficient detail to give stakeholders confidence in the project plan. However some details of the project plan will only be resolved in subsequent phases. For this reason, we recommend focusing communication on the core value proposition to Tyalgum, which is the potential for more reliable electricity and lower bills, as well as some of the key facts and figures, such as how much solar power would be needed, how battery storage could make power more reliable for everyone, and who to contact with questions about the project such as how to get involved (see pg xxx for more detail)
4. *Identifying and train a core group of locals to conduct energy assessments, and establish an energy efficiency retrofit service*
    - This will serve an important capacity building function and improve energy literacy within the community. The group can work towards developing an energy efficiency and load shifting solution hierarchy, with approved products and supply chain partners;

[5] During the crowdfunding process, students of the school could be involved in creating communication material, such as imagery and language, that helps to articulate the project vision and values from a neutral perspective

[6] For key facts and figures, see "Tyalgum, By the Numbers" chapter of this report on pg 20

- At a minimum, this service should target measures that reduce winter energy demand, such as ceiling and roof insulation, draft sealing, fixed appliances and white goods (fridge, freezer, TVs, air conditioning and washing machines), and hot water services, with established "products of choice" that are known to have efficiency benefits and can be recommended to households. Where possible, products of choice will ideally be "smart grid ready", with the ability to be programmed and controlled remotely, or at least have manually settable timers.

- This group will also form the base for an important, community-led service that reduces winter energy demand and shifts discretionary energy demand into the daytime. These discretionary loads can be integrated with smart energy management systems that ensure the vale of solar power out is maximised, and the need for energy storgage and/or backup generation is minimised, reducing overall project costs. This will be essential to achieving the project goals efficiently;

5. *Creating an investment vehicle, that will enable the community to invest*

    - The investment vehicle will be needed to raise money for, and manage, community owned energy assets. It could take a number of forms, from a member owned co-operative, a unit trust, or a company with local shareholders.

    - Based on workshops and consultation with the community, we find there is concern that a solely for profit company owning and managing local infrastructure would not meet important social goals, while at the other end of the spectrum, a member based co-operative could be at risk of operating inefficiently, and getting bogged down in decision making. The other consideration is how much money this vehicle would need to raise, and any constraints to that inherent in the structure

    - We recommend pursuing a unit trust as the investment vehicle, to be managed by an independent Trustee company, with a representatives from the community on the board for governance functions, and processes to ensure the community is consulted and engaged in decision making, without compromising the ability to operate efficiently, and in the interests of all community stakeholders. The unit trust will be able to attract investment from within the community, or from outside the community should additional capital be required. It also aligns well with traditional funds management structures, meaning that should a larger financial institution be needed as a partner to mitigate project risks, they can be easily integrated as a partner investor

    - Establishing this vehicle, and appropriate management structures around it, is arguably the greatest risk, and greatest enabler of success, for the project. The process for establishing this vehicle, and the processes put in place to manage accountability, will need to accommodate diverse interests and goals.

    - Prior to establishing this vehicle, the informal networking, crowd funding demonstration project, and communication about the project using four-to-five "touch points" across the community should enable any latent community concerns to be identified and addressed.

6. *Executing four-to-five community owned solar projects*

- these projects will be executed through the investment vehicle, to demonstrate financial and social viability of community owned energy infrastructure, including the ability to deliver a financial and social return that unites the community.
- Once the investment vehicle is established, an exemption from requiring an electricity retail licence for the purpose of selling electricity, or an approved licence, will be required before these projects can be implemented. The investment vehicle will need to be established before this application can be made, as the application needs to be made in the name of the entity that intends to sell energy. The application will be made to the Australian Energy Regulator.

Some important elements of Phase 1 are that:

- Diverse community stakeholders and interests are represented in decision making from the outset. However it is likely a core group of between five and ten community members will drive Phase 1, and provide the necessary balance between consultation and action;
- All elements of Phase 1 have been demonstrated in community projects across Australia, providing reference points for project stakeholders to replicate or improve on;
- The quantum of community investment in solar and storage projects will be significant enough to be meaningful in Phase 1, but not so great as to put a strain on the local distribution network physically or financially. It is likely that up to 200kW of solar may be deployed in Phase 1;
- The performance and value of all community energy assets deployed in Phase 1 will need to be monitored and measured. This will help test whether "The Community Contract" is being kept, and provide a foundation for positive stories that can be shared across the community;
- Energy efficiency measures in particular can be targeted at households that are identified as vulnerable or disadvantaged, where they are likely to have most value. This will help reinforce the message that the project, done well, can enhance energy affordability for Tyalgum residents

Phase 1 Resources:

Here we provide some links to publicly available resources, to assist the Tyalgum community in implementing Phase 1 recommendations:

Examples of crowd funding

There are currently two models in Australia for crowd funding solar projects. Note: crowd funding differs from community investment, in that crowd funding typically involves a financial donation to a project only, without an expectation of financial return

1. The People's Solar (www.thepeoplessolar.com) is a crowd funding platform, where tax deductible donations are raised (via a partnership with The Alternative Technology Association), to pay for solar panels. Energy savings are then invested by the project host to

support community needs, such as funding training for the unemployed, or sustainability education for school communities.

2. CORENA (www.corenafund.org.au) raises money from donors, and establishes a loan agreement with a solar project host, so that the loan repayments are less than savings from the solar panels. These loan repayments are reinvested by CORENA to fund additional solar projects. CORENA is also crowd funding for a larger solar thermal demonstration project

There are also a range of crowd funding platforms, such as http://startsomegood.com/ and https://www.chuffed.org/ that help users raise funds for projects of almost any kind, but with a focus on projects that have a social or environmental benefit.

Examples of good communication and engagement

Good community engagement and communication, at its simplest, requires involving your community in developing a shared vision, and then clearly articulating that vision, including how it will be achieved, with your community. Along the way, you will need to define and celebrate success to build support and momentum towards your goal.

The Community Power Agency have developed a guide to best practice community engagement. While focused on Wind farm projects, the guide is applicable more broadly, and is available at this link:

http://cpagency.org.au/wp-content/uploads/2014/03/Attachment-E-Best-practice-community-engagement-in-wind-development-FINAL-V1.0.pdf

Examples of investment structures

A number of projects across Australia have used various legal structures for raising funds and managing community owned energy assets. A good summary of options is available on the Embark wiki - see http://www.embark.com.au/display/public/content/Review+of+legal+structures. A brief summary of project examples, and the structures they have used, appears below.

- *Co-operatives*

Australia's first community owned wind farm, Hepburn Wind[7], used a co-operative structure to raise funds and manage the community investment. Hepburn Wind is the owner and operator of Australia's first community owned wind farm, at Leonards Hill, just south of Daylesford Victoria. The 4.1 MW wind farm comprises two turbines and is located at Leonards Hill, in Central Victoria, just south of Daylesford and approximately 100 km north-west of Melbourne.

Hepburn Wind is the trading name of Hepburn Community Wind Park Co-operative Ltd, a co-operative registered in Victoria, Australia. The co-operative structure, with each member having one vote, ensures democratic control however members will receive dividends proportional to their investment. The co-operative is managed by a board of nine volunteer directors who are elected at Annual General Meetings of the co-operative. Operational support is provided by a local executive team.

- *Public Company*

One of Australia's early pioneers of community-based investment in renewable energy has been RePower Shoalhaven. Repower Shoalhaven is a member based, not for profit association. To raise

[7] read a more detailed account at http://hepburnwind.com.au/about/

funds for its solar projects, it creates and sells shares in a public company. The company is effectively managed by the not for profit association, and establishes a legal relationship with solar customers for the supply of energy. More information about the project is available at http://www.repower.net.au/about.html

- *Unit Trust*

An alternative to raising funds through a public company is to use a unit trust. Many of the legal constraints and governance requirements are comparable to a public company, however a unit trust is more compatible with the wealth management industry, and so in the event external capital is required, is likely to be a more effective options.

How to get an exemption from a retail licence

Before an entity can sell power to an energy customer, in this case from a community owned solar asset on a rooftop, a retail licence to sell electricity, or an exemption from requiring a retail licence, is necessary. Generally, selling energy 'from the grid' to a customer requires a full retail licence, and selling 'behind the meter' only requires an exemption. The process of obtaining an exemption from the Australian Energy Regulator, is relatively straight forward - a list of individual exemptions granted in NSW by the Australian Energy Regulator is available at this link

http://www.aer.gov.au/node/11037?sector=4&region=14&status=7&exemption=1355

Alternatively, the application for exemption made by Repower Shoalhaven is available at this link -

https://www.aer.gov.au/sites/default/files/REPOWER%20Shoalhaven%20application%20for%20an%20individual%20retailer%20exemption_0.PDF

Refer to ATA's report titled "Energy regulation and the Tyalgum community energy project" for more detailed information regarding electricity retail licencing arrangements.

Phase 2 - Partner, Scale, Prove

Phase 2 involves refining supply chain partnerships (such as solar power suppliers, energy storage suppliers, technicians and financial partners) and technology choices, in preparation to scale up provision of community energy solutions across Tyalgum.

Community investment in energy infrastructure (solar power, energy efficiency, energy storage) will be done with a view to monitoring performance and maintaining systems, and demonstrating cohesion as a community - principally growing the proportion of the community that willingly opts in to the solution offered. A competitive tender process, with transparent criteria, can be used to build trust and confidence across the community with supply chain partners, and managed by the trustee company established in Phase 1.

The key options to be considered in Phase 2 will be whether to deploy solar and storage assets "behind the meter" on rooftops of homes and businesses, or to build a centralised solar farm for the purpose of selling energy locally through a partner retailer. Both of these options can be implemented incrementally, that is to say, without all members of the town requiring participation. Key considerations will include the likely response of the local distribution network, Essential Energy, to the community plan, and specifically any indication that tariff structures and metering arrangements can

be modified to minimise financial risk for all project stakeholders. During Phase 1, the community of Tyalgum should begin to form a view on these risks, with Phase 2 entailing a more rigorous assessment, and plan for managing these risks.

In the table below, we briefly assess the options to be considered in Phase 2, noting that costs and revenue are approximations at this early stage of the project, and that more detailed and rigorous assessment will be required at a later stage of the project, before committing any capital investment.

Summary assessment: transitioning Tyalgum to zero emissions

	Centralised solar farm - net zero emission	**Behind the meter solar and storage - 80% self sufficiency**	**Energy self sufficient - "off grid"**
Solar system size (kW)	1644	2192	2630
Energy storage size (kWh)	0	1120	2630
Approximate capital cost (2015) - upper estimate	$3,287,671	$4,127,671	$7,232,877
Approximate capital cost (2015) - lower estimate	$2,794,521	$3,465,315	$6,312,329
Approximate capital cost (2020)	$2,432,877	$2,847,370	$4,740,822
Approximate revenue	$240,000	$580,000	$725,000
Cost Assumptions	- $1700-$2000/kW in 2015 - Potential for a further 20% reduction by 2020	- $1300-$1500/kW in 2015 - $550-$750/kWh in 2015 Potential for a further 25% reduction by 2020	- $1600-$1750/kW in 2015 - $800-$1000/kWh in 2015 Potential for a further 30% reduction by 2020
Revenue model assumptions	Assumes a favourable PPA can be achieved by selling power directly to residents, through a partner retailer or via a retail exemption. Electricity is sold from the solar farm @ 10c/kWh, plus a retail margin and network costs directly to local customers	Assumes network tariffs do not change, and that solar + storage systems deployed behind the meter of homes and businesses, makes customers largely energy self-sufficient	Assumes Tyalgum is able to establish a vertically integrated generator, distributor and retailer, capturing the full electricity value chain.
Risk	Future changes to network tariffs would erode the financial value of the solar farm, by impacting on the margin at which a partner retailer can sell the power locally to residents of Tyalgum. Certainty over network tariffs	Future changes in network tariffs, to recover lose revenue, may erode the financial value of these solar + storage systems. Operation and maintenance costs need to be considered, however given these are hybrid systems, it won't be as	Operating cost, including compliance costs, will erode the business case for this solution with stand alone power infrastructure management being more onerous. Strategic partnerships may help mitigate this risk. There is currently ncertainty about the future regulatory environment.

		onerous as stand alone power infrastructure	
Note	The unit cost of solar in this scenario is higher than for small scale solar, due to the lack of rebates for systems at this scale, and additional cost of land acquisition, planning and approvals	The overall cost, and the unit cost, of solar and storage in this scenario is the lowest of all scenarios considered due to the simplicity of installation and system integration	The overall cost of solar and storage in this scenario is higher, to accommodate additional costs of back up power generation, system integration and purchase of poles and wires

Note: figures above are approximate only, and do not account for the role energy efficiency can play in reducing electricity demand. The role of energy efficiency is likely to be critically important to ensuring the ultimate goal of energy self sufficiency can be reached cost-effectively.

Phase 3 - Partner, Negotiate, Succeed

Phase 3 is an extension of phase 2, and entails completion of the project.

During Phase 3, partnerships and approaches continue to be refined. In this phase, Tyalgum will seek to supply the town with 100% renewable energy. If near-100% opt in can be achieved, this may include transitioning to stand alone power infrastructure, and effectively disconnecting from mains grid energy supply.

Again, a competitive tender process can be used, managed by the Trustee Company, to engage and select partners in the detailed design, supply and management of infrastructure.

Any assets deployed “behind the meter” in Phase 2 would be integrated into the management of community-scale energy infrastructure, such as additional centralised solar power, battery storage and back up power generation.

If near 100% opt in cannot be achieved, a mains grid connection can be retained, without compromising the goal of achieving 100% renewable energy for Tyalgum.

Key considerations will include the likely response of the local distribution network, Essential Energy, to the community plan, and specifically any indication that tariff structures can be amended to minimise financial risk for all project stakeholders, or whether local “poles and wires” can be sold to the community at a fair price. The nature of future regulatory and legal arrangements for the sale and distribution of energy will also need careful consideration, and in all likelihood, legal advice.

With Phase 3 so dependant on outcomes of Phase 2 negotiations, we do not contemplate phase 3 in more detail here. However put simply, if Phase 1 and Phase 2 are successful, Phase 3 is likely to be an extension of Phase 2, to complete the project.

Tyalgum, By the Numbers

In this chapter, we assess project viability in more detail than outlined in the three phase plan, using the energy data available for Tyalgum.

The assessment is necessarily high level due to the limited energy data, however there is sufficient information to make some broad judgements on project viability, and the best way to progress the project.

In brief, we find that Tyalgum becoming energy self sufficient is likely to be viable over the next three-to-five years, and that the key project risk lies with negotiating network access and value with Essential Energy.

Tyalgum Energy demand

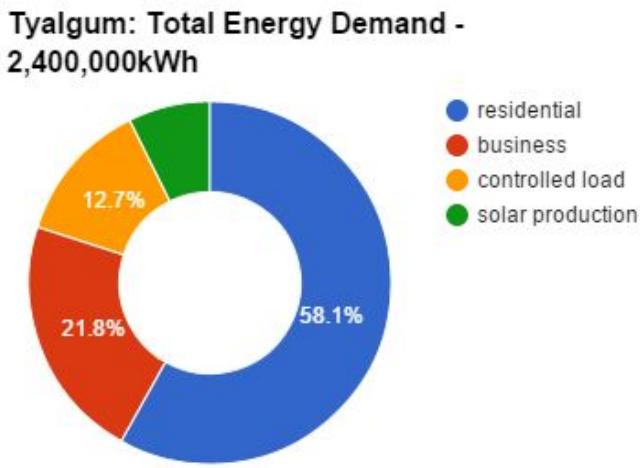
Tyalgum currently spends approximately $700,000 to $750,000 a year on energy, based on a net consumption of approximately 2.4GWh (2,400,000kWh) and a review of residential and business tariffs being paid by Tyalgum locals - with daytime energy prices @$0.3/kWh, off peak controlled loads @$0.18/kWh and supply charges of $1.26 a day.

Energy demand is approximately 60% residential and 20% business, with “controlled loads”, largely off peak hot water across business and residential customers, being 14% of energy demand. Solar energy appears to supply approximately 7% of energy demand.

Based on a review of Essential Energy tariff structures, and retail prices being paid by residents and businesses in Tyalgum, we estimate approximately 55% of that $700,000 ($385,000 per annum) is being paid to Essential Energy for network services.

While detailed hourly load profiles were not available, based on a review of seasonal energy data for Tyalgum at an aggregate level, and a review of bills from residential and business customers, it appears summer demand exceeds winter demand by approximately 50%. This demand profile aligns well with solar power, and reinforces solar power as the generation technology of choice to supply renewable energy to Tyalgum. Ideally, more detailed load profile data would be made available by Essential Energy, but if not available, this can be gathered with independent energy monitoring systems.

A visual breakdown of total energy demand is provided below.



In order to assess project viability at this early stage, we have considered two scenarios in more detail for transitioning Tyalgum to zero emission energy supply. Both scenarios assume a successful Phase 1 is completed, with an investment vehicle established by the community, demonstration projects and broad community support behind the project.

Scenario 1 - Complete Self Sufficiency (or "going off grid)

In this scenario, we assume that there is 100% community opt-in, and that a turn-key solution is provided including detailed design, supply, installation and maintenance of all infrastructure required to generate and store all energy needs for Tyalgum locally.

Infrastructure finance may be provided by community members, or external investors, with net energy costs no higher than they are today for Tyalgum residents. An exemption from requiring a retail licence for the purpose of selling energy is secured, and either a partnership with a distribution network licence holder, or an exemption from requiring a distribution network licence is also secured. A charter of customer obligations are developed and adhered to, ensuring protections for Tyalgum residents experiencing energy hardship.

Without implementing energy efficiency measures, such as upgrading appliances and installing insulation, the cost of transitioning to complete energy self-sufficiency, where all energy required in Tyalgum is generated and stored locally using 100% renewable energy, and no energy is consumed from the mains grid, is likely to be approximately $6.5m - to $7m based on current technology costs.

Note: this is based on aggregate energy demand data only, and so can be considered a reasonable approximation only. We have assumed the off grid system would include at a minimum up to 2.7MW (approximately $4m) of solar power, 2.7MWh (approximately $2.5m) of battery storage, the cost of a back-up generator, system integration and controls (approximately $0.5m), and an estimated cost of "buying the poles and wires" ($0.2m).

Note: we have assumed the grid would be priced fairly, given it is an old asset, paid for many times over by customers since it was originally built, even factoring in the costs of recent work to re-conduct the lines. We have not assumed the grid would be priced according to its future revenue potential.

The Table below summarises key information, noting we have assumed a premium on solar power and storage assets, to accommodate balance of system costs including back up generation, system integration and purchase of the "poles and wires" themselves.

We note again that with a cost-effective, targeted energy efficiency program to reduce energy loads, and shift discretionary loads to between 10am and 2pm, where solar output is at its highest, the cost of infrastructure is likely to be further reduced. While a more detailed assessment would be required to determine a robust business case, we can see that by 2020 a simple payback on infrastructure, excluding operation and maintenance costs, could be approximately seven-to-eight years.

	Energy self sufficient - "off grid"
Solar system size (kW)	2630
Energy storage size (kWh)	2630
Approximate capital cost (2015) - upper estimate	$7,232,877
Approximate capital cost (2015) - lower estimate	$6,312,329
Approximate capital cost (2020)	$4,740,822
Approximate revenue (note: figures exclude operating costs)	$725,000
Cost Assumptions	- $1600-$1750/kW in 2015 - $800-$1000/kWh in 2015 Potential for a further 30% reduction by 2020
Revenue model assumptions	Assumes Tyalgum is able to establish a vertically integrated generator, distributor and retailer, capturing the full electricity value chain.
Risk	Operating cost, including compliance costs, will erode the business case for this solution with stand alone power infrastructure management being more onerous. Strategic partnerships may help mitigate this risk. There is currently uncertainty about the future regulatory environment
Note	The unit cost of solar and storage in this scenario has been increased, to accommodate additional costs of back up power generation, system integration and purchase of poles and wires

Scenario 2 - 100% Renewable, Using the Grid for Backup

In this scenario, we assume that 100% community opt-in could not be achieved, and/or that access to the network proved an insurmountable barrier to complete energy self-sufficiency. A compromise was reached with Essential Energy, enabling a large roll out of solar and storage assets, and a restructuring of tariffs to balance the need for revenue required for network asset maintenance, and investment confidence in rolling out behind the meter solar and storage infrastructure.

Infrastructure finance may be provided by community members, or external investors, with net energy costs to customers no higher than they are today for Tyalgum residents. An exemption from requiring a retail licence for the purpose of selling energy is secured, for the purpose of rolling out solar and storage assets behind the meter and potentially a bespoke metering and licencing arrangement allows for energy trading within the community. A charter of customer obligations are developed and adhered to, ensuring protections for Tyalgum residents experiencing energy hardship.

To transition to 100% renewable energy using solar power, by producing as much clean energy as the town consumes on average over the course of a year, while providing every home and business with battery storage in order to improve power reliability and minimise reliance on the grid, costs approximately $3.5m-$4m. This consists of 1.7MW of solar power, and approximately 1.2MWh of battery storage, with each home receiving 7kWh of storage, and each business approximately 30kWh of storage. In this scenario, the town is likely to export clean energy to the mains grid in summer, and consume small amounts of energy from the grid through shoulder seasons and winter.

In this scenario, if solar power was deployed on rooftops of most homes and businesses, those customers would become largely self-sufficient for energy, and would be likely to produce and store approximately 80% of their energy needs, reducing revenue to the local distribution business Essential Energy. However if only a small portion of solar power was deployed on rooftops, with the balance of solar power installed in a central location, the revenue of the local distribution business would be preserved as locally produced energy would still be sold over existing “poles and wires”. In the latter case, the owner of the centralised solar asset would need a commercial arrangement for selling energy to local residents, that enables them to capture more value from their generation than simply selling to the wholesale market. The project is unlikely to be viable if a centralised solar farm simply sold energy to the wholesale market.

The following table summarises key facts and figures for this scenarios.

	Behind the meter solar and storage - 80% self sufficiency, 100% renewable
Solar system size (kW)	2192
Energy storage size (kWh)	1120
Approximate capital cost (2015) - upper estimate	$4,127,671
Approximate capital cost (2015) - lower estimate	$3,465,315
Approximate capital cost (2020)	$2,847,370
Approximate revenue (note: figures exclude operating costs)	$580,000
Cost Assumptions	- $1300-$1500/kW in 2015 - $550-$750/kWh in 2015 Potential for a further 25% reduction by 2020
Revenue model assumptions	Assumes network tariffs do not change, and that solar + storage systems deployed behind the meter of homes and businesses, makes customers largely energy self-sufficient
Risk	Future changes in network tariffs, to recover lose revenue, may erode the financial value of these solar + storage systems. Operation and maintenance costs need to be considered, however given these are hybrid systems, it will be substantially less than stand alone power infrastructure
Note	The unit cost of solar and storage in this scenario is the lowest of all scenarios considered due to the simplicity of installation and system integration

What do the scenarios reveal, and why are they important?

These scenarios are estimates of cost only, but provide important insights. The cost of transitioning to 100% renewable energy, with approximately 80% energy self sufficiency (**Scenario 2**), is almost half as much as transitioning to complete energy self-sufficiency (**Scenario 1**) however entails only 80% less revenue and significant less operation and maintenance costs.

On paper, scenario 2, in which Tyalgum becomes largely energy self sufficient and powered by net zero emission energy, appears far more attractive financially than scenario 1.

However in scenario 2, if there is a high uptake of solar power and use of energy storage in homes and businesses, the volume of energy consumed from the grid drops substantially. In practice, this would reduce revenue for the local distribution business, Essential Energy, and may force them to re-price their services in order to recover lost revenue. For example, the fixed cost of energy supply (the standing charge on a customer's energy bill) may increase, and erode the financial value of those solar + storage systems deployed in the community.

Indicatively, we estimate that revenue to Essential Energy could drop from $385,000 per annum, to $70,000 per annum, if all solar and storage assets were deployed behind the meter on customer premises. If Essential Energy responded to this by re-balancing tariffs to maintain all its current $385,000, the value of solar and storage assets would drop from approximately $580,000 per annum, to $265,000 per annum.

However a compromise could be reached to preserve network revenue, while accommodating the communities ambition for 100% renewable energy supplied locally.

For example, if network tariffs were reduced in response to a roll out of solar and storage assets across Tyalgum, reflecting Tyalgum would be largely self-sufficient for energy supply and a diminished role for the network provider, residents would have an incentive to retain a grid connection for back-up power supply. Indicatively, network revenue of $250,000 could be retained, with residents still saving approximately $400,000 per annum, in addition to improving power reliability - a reasonable return on approximately $3.5m-$4m investment in solar and storage assets. Certainly at 2020 prices for solar and storage assets, a $400,000 saving on approximately $2.8m investment, would be attractive.

Note: we do not consider the detail of how lower network revenue could be achieved as a compromise in practice by changing tariff structures. However we advise this is done simply and equitably, which could be as simple as re-pricing network tariffs for all customers. We estimate that reducing network tariffs by approximately 35% would be sufficient to maintain an incentive for investing in local supply and storage assets, improving reliability and delivering net zero emissions while retaining the majority of network revenue required for maintaining and upgrading local network infrastructure.

We caution against tariff structures that reward solar customers at the expense of others in the community that may simply not have suitable roof-space for solar power, for example favourable feed in tariffs for solar customers that re-allocate network revenue paid by customers without solar power, to those with solar power, without reducing total network revenue. We also caution against tariff structures that simply reward more solar production for its own sake, as this could lead to oversizing solar assets without commensurate benefits, for example, virtual net metering that enables a solar customer to sell excess energy directly to nearby customers, without paying the cost of the distribution network service.

This assessment hints at the complexity of managing the transition of Tyalgum to 100% renewable energy, and the importance of an incremental approach to manage risk for all project stakeholders. It

also hints at the important role Essential Energy will play in this project, and the choice between a disruptive transition, and a collaborative one.

The tradeoffs between deploying solar power and battery storage assets “behind the meter” or centrally, will need to be worked through as the project evolves - in this report we recommend these options are resolved as part of phase 2 and phase 3. Definitive advice on the most viable solution cannot be provided at this stage.

Note:

- We are confident the cost of solar power, battery storage, integration and controls are conservative estimates, and those costs may come down over time. However sizing and designing these assets will require a more detailed understanding of the local electricity load profile
- The primary unknown is the cost of acquiring poles and wires in the “going off grid” scenario.
- An important part of reducing cost will be setting up a program for identifying and rolling out energy efficiency solutions in Tyalgum. A program targeting appliances, hot water systems, building fabric and active heating/cooling systems could reduce the capital cost of each scenario by approximately 25%.
- While detailed load profiles were not available, based on a review of seasonal a data for Tyalgum, and a review of bills from residential and business customers, it appears summer demand exceeds winter demand by approximately 50%. This demand profile aligns well with solar power, and reinforces solar power as the generation technology of choice to supply renewable energy to Tyalgum. Ideally, more detailed load profile data would be made available by Essential Energy, but if not available, this can be gathered with independent energy monitoring systems. Project stakeholders, Australian Radio Towers, has indicated they will be offering monitoring systems to households and businesses in the near future.

Ownership and management models

Here we consider ownership and management models for energy infrastructure in some more detail, including an assessment of why a unit trust, as an investment vehicle, appears most appropriate.

It is inevitable that some members of the Tyalgum community will purchase and install their own solar systems. We recommend that as far as possible, ownership and management of off grid energy infrastructure at any scale (from individual homes through to community scale) be with a professional, third party service provider, with a local service centre to ensure any impact arising from faults are minimised. This will help mitigate the risk of system failures, leading to an erosion of confidence in the community in the value of local energy generation and storage.

Owning Infrastructure

In considering models for owning energy infrastructure, we believe the key criteria for choosing an appropriate ownership model are:

- Ability to raise capital;
- Ability to effectively and efficiently make decisions that consider the interests of all stakeholders equitably;
- Risk management, specifically ensuring the model does not expose customers or asset owners to undue risk, in the event there is an engineering and/or financial management failure

Here we consider the two most common structures for owning energy assets - a unit trust, and co-operative:

- A unit trust is a commonly used vehicle for raising and managing investment funds as it maintains an independent manager and Trustee, both of which are appointed by the owners (unit holders) to act on their behalf. This structure helps provide governance functions and independent, specialist oversight of investment decisions. This is a widely adopted and flexible investment structure that is not limited by State -based legislation, and one with which most investors are familiar.
- Co-operatives are people-centred organisations that are owned, controlled and used by their members. A co-operative's main purpose is to benefit its members. A co-operative is a democratic organisation, owned and controlled by its members for a common benefit. Members of a co-operative can benefit from economies of scale through the combined purchasing, distribution or marketing power or influence of the group. They share in the group's investment and operational risks and losses, as well as its benefits. Unlike private companies, co-operatives do not have a limit on membership numbers. Their 'one member, one vote' system also differs from public companies, where voting rights are linked to share ownership.

With both structures, their strength is their weakness. A unit trust is a structure more compatible with, and more familiar with, the wealth management industry, making it suitable for raising substantial capital at relatively low cost. However, ensuring the unit trust maintains accountable to stakeholders, beyond investors, is more difficult and requires careful design of governance structures. A co-operative is a structure more compatible with, and more familiar to community-led initiatives and organisations. It creates a more democratic decision making framework, however there is a risk that member involvement delays or hinders effective decision making.

On balance, we consider a unit trust structure more compatible with the community of Tyalgum's long-term interests of becoming energy self-sufficient. As outlined in this report, there are substantial costs and risks associated with owning and managing community-scale, off-grid energy infrastructure. We believe the benefits of the unit trust structure, in being able to integrate with the wealth management industry, are likely to outweigh the risk of eroding the value placed on community interests.

Note: we believe the risks of external investors operating local energy infrastructure in a way that erodes value for the local community, are inherently reduced because without a clear, long-term value proposition to the local community, a self-sufficient energy grid serving Tyalgum will be extremely difficult to sell to the community, and maintain over time. This includes oversight that will be provided by the Australian Energy Regulator when assessing any investment proposals, and the level of consumer protections in place.

Managing Infrastructure

It will be critically important that any individuals purchasing off grid energy systems, independently, or as part of Tyalgum's community plan, have a good experience. Any negative experiences, such as failure of components, or incorrect sizing and management of battery systems leading to poor performance such as high reliance on back up generation, will have an impact on broader community perceptions of "going off grid".

As outlined above, third party ownership can be facilitated through an investment vehicle, such as a unit trust, that finances the infrastructure, and recovers cost based on structured finance re-payments (equivalent to a lease arrangement).

Importantly, the infrastructure provider is unlikely to charge customers based on how much energy they consume. A service contract would be required, stipulating response times in the event of equipment failure, and of course warranty conditions. This maintenance contract could also include sourcing a carbon neutral biofuel, such as biodiesel, and arranging for supply to customers. Such maintenance contracts, backed by local service capability, would provide the backbone of an asset management regime and will be critical to ensuring the long-term success of the project.

Regulatory and Policy Implications

The regulatory and policy implications of the different scenario's considered in this report have been considered here at a high level. For a more detailed consideration of regulatory and policy issues, please refer to a separate report provided by the Alternative Technology Association titled "Energy regulation and the Tyalgum community energy project".

Next Steps

The project plan outlined in this report details our recommended next steps for the community of Tyalgum. For the community and project stakeholders more broadly, a number of additional steps will be needed to bring this project to life. This includes:

1. Project stakeholders (Office of Environment and Heritage, Tweed Shire Council, community leaders), to review and refine the plan outlined in this report in consultation with the community;

2. Project stakeholders to assess the project resources required to implement the plan, and secure resources to enable next steps. This could financial or in-kind resources, to ensure a project officer, or volunteers from within the community, are empowered and supported to begin implementing the project plan outlined in this report. We note that given the strong business case for some of the scenarios outlined in this report, private investment may be available to support public investment; and

3. To address uncertainty caused by changes to future network revenue and pricing, it is essential that stakeholders engage the local distribution business, Essential Energy, on this project at an early stage. This could be done directly with Essential Energy through the Tariff Structures

Statement development process with recourse at a regulatory level through the Australian Energy Regulator's TSS approvals process, or at a political level through the NSW Minister for Energy and Resources.