Briefing paper: Rates-based financing

Overview

One of the key barriers to uptake of new energy technologies by low-income customers is the high up-front cost. To overcome this issue a range of organisations are developing finance products and mechanisms that enable the customer to pay back the cost over a period of time. One of these finance mechanisms is rates-based financing, whereby a council enables finance for clean energy measures on a property and then levies a special rate on said property to payback the cost of finance over time.

Rates-financing can be coupled with local government or other clean energy programs targeting particular customer segments, such as low-income households that overcome additional information and trust barriers that can hinder clean energy uptake.

This briefing paper outlines the role that rates-based financing can play in increasing clean energy accessibility and affordability in Australia and what state and local governments need to do to enable it. Specific policy measures proposed include:

- State government legislative change to allow local governments to levy special charges (rates) for clean energy or undertake EUAs on residential buildings.
- Support for the aggregation of finance at sufficiently low cost of capital that low-income participants are better off from day one.
- Accompanying measures that make rates-financing programs easy for councils, clean energy businesses and households.

Description of rates-based financing

Repayment through rates or *rates-based financing* for clean energy is where finance for new energy technologies is mediated through the Local Government, with the repayment occurring through a special charge or rate levied on the property and paid by the occupant through normal rate repayments. Usually (though not always), the finance is not local government money, but is sourced through an external financer. Rates-financing can theoretically be used to support any property undertake clean energy or environmental upgrades. However, given the growing number of finance products available through more traditional sources e.g. banks, we suggest that rates-financing is most useful for households that face significant barriers (market failures) to accessing clean energy i.e. low-income households and potentially renters and their landlords.

Status of rates-based financing in Australia

The main form of rates-based financing currently being pursued in Australia is Environmental Upgrade Agreements (EUAs) for commercial buildings. EUAs are allowed under special amendments to the Local Government Act in both NSW, South Australia and Victoria. However, so far there have only been a few uses of the mechanism (seven in Victoria and five in NSW).

Internationally, rates-based financing for both commercial and residential properties is the basis for a number of successful clean energy programs, with schemes in the US - Property

Assessed Clean Energy (PACE), Canada and New Zealand - Voluntary Targeted Rates (VTR). Currently, rates-based financing for residential clean energy is allowed in Victoria under the special charges provision of the Local Government Act, but not allowed under NSW legislation and is unlikely to be allowed in other states either. Further, the special charges provision in the Victorian Act is not necessarily the best legal mechanism, as unlike EUA provisions, it does not allow councils to simply act as intermediaries for finance between a provider and a household/property. Thus, any finance for a clean energy rates-financing program, will set on a council's books, which in turn becomes a barrier to uptake for most councils.

One of the benefits of EUAs in the commercial sector is that it helps address the landlord-tenant split incentive issue. This is not the case at the residential level. Indeed, rates-financing is generally most appropriate currently for owner-occupiers, as state residential tenancy legislation generally prohibits landlords passing on rates to tenants. Changes could be made to the Residential Tenancy Acts to allow an opt-in clean energy rate pass-through, however careful consideration must be given to consumer protection issues before embarking on such changes.

The NSW Office of Environment and Heritage (OEH) are currently investigating residential rates-based financing for clean energy and Queensland is investigating commercial EUAs.

Examples

Darebin Solar Savers, Victoria is a program developed by Darebin City Council. The program in its first year saw the installation of solar PV on 300 low-income households in the City of Darebin. The cost to these households as free up-front, with repayment occurring over 10 years through a special rate/charge; the solar PV system was scaled to ensure households were better-off (through lower electricity bills) from day one. The Council partnered with Moreland Energy Foundation and Energy Matters (now Sun Edison) to deliver the program.

Only pensioners who owned their home and were eligible for the existing rates discount were eligible for the scheme. Darebin Council used its own capital reserves to finance the project at a 0% interest rate due to the fact that it was both a climate and social justice program.

Voluntary Targeted Rates, New Zealand is a program that was first developed by Wellington Council at the request of the New Zealand Government. The NZ Government was running an energy efficiency and health program, with 50% capital grants for clean thermal upgrades, however the program wasn't reaching the most vulnerable households. Wellington Council filled the gap and were able to use a rates mechanism to finance the remaining 50%, at zero cost to the household upfront. Now rates-based financing has been used for residential clean energy (solar, clean heating and other energy efficiency measures) upgrades in over 24,000 homes, with councils covering 60% of the population offering the scheme. Councils are supported by the National Government's Energy Efficiency and Conservation Authority, who provide a toolkit and training, as well as quality assurance audits of 5% of installations completed under rates-financing.

Why rates-based financing?

One of the benefits of a rates-financing approach is that because the repayment it tied to

a local government rate, it becomes a statutory requirement for the property against which it is leveraged. As local government debt gets first recall at point of sale, it becomes a much lower risk venture for financiers, thus lowering the cost of capital. Furthermore, because the rate is tied to the property it overcomes longer payback periods associated with more capital-intensive clean energy technologies and upgrades. However, one of the challenges is setting up the scheme by local government – it is not core business and thus requires determination and support to work through the complexity of setting up a rates-based finance scheme.

To summarise, the key benefits for rates-financing particularly compared to conventional commercial solar leases, PPAs and loans are:

- Debt is tied to the property not to the owner, which reduces the payback period risk for the borrower and as such this allows the council to recover debt with accrued interest when the property is sold or it can be passed on to the new property owner;
- Security of the financing attached to the property and statutory rate repayment mechanism, thus it makes it simple for the customer, reduces the risk of default, the enabling a lower cost of capital, due to security of the loan.
- Consumer confidence due to council involvement.
- Can easily be coupled with other clean energy programs including bulk-buys, panel tenders, grants etc as a financing option that makes clean energy more accessible, affordable and easy for consumers.
- Helps make clean energy accessible to low-income households, particularly owner-occupiers.
- Helps meet council environmental, climate and social objectives.
- Can be made cost-neutral for councils.
- The purchase and installation of the solar systems and energy efficiency measures are not subject to GST, because the rates charge is GST exempt, translating to greater savings for householders; and

Making rates-based financing work – specific policy asks

State governments should proactively develop a rates-financing program for residential clean energy targeted at low-income households. This program should encompass:

- State government **legislative change** (typically the Local Government Act) to allow local governments to levy special charges (rates) for clean energy or undertake EUAs on residential buildings. This legislation should allow finance for the program to be off-book for councils.
- Support for the **aggregation of finance at sufficiently low cost of capital** that low-income participants are better-off from day one,
- Accompanying measures that **make it easy for councils, clean energy businesses and households** to be able use the rates-finance mechanism. Such measures should include:
    - Supporting promotion, including information provision and special site-assessments for the target audience that is tailored to said audience
    - Clarifying the scope of clean energy products and services enabled under rates financing
    - A toolkit to help streamline the council administration

- Matching grants
- Working with councils to clarify all of the risk and consumer protection issues
- Underwriting of the finance by state government for rates-finance provided to the most vulnerable customers.
- A quality assurance process similar to the New Zealand Voluntary Targeted Rates scheme.

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Briefing paper: Community-owned Renewable Energy

Overview

In Australia many energy consumers through no fault of their own are unable to put solar on their roof and in turn, fully participate in the clean energy transition. This may be because they rent, live in apartments, have shaded roofs, or simply can't afford the full cost of a solar system. One of the most exciting ways to address this equity issue is through the development of community-owned renewable energy (CORE). CORE projects are where households and businesses can own shares, or a number of panels on a solar or other renewable energy system outside of the bounds of their own home, and receive a financial return on their investment. These projects also have many non-financial benefits including increased energy literacy, local economic development and resilience and more.

This briefing paper outlines the wide-ranging benefits that CORE projects typically deliver and the exciting role they could play in the Australian energy system, particularly with respect to increasing clean energy accessibility and affordability. To make CORE viable in Australia the following policy support is needed:

- Establishment of ongoing **grant funding programmes**,
- the formation of a dedicated team within government to support community energy projects, including helping to deliver elements of the National Community Energy Strategy and ensuring **regulatory barriers across all areas of government are removed,**
- funding and policy support for **capacity building training and support structures,**
- introduce supporting policies to ensure a **fair price is paid for community-owned renewable energy**, and
- help CORE projects gain **access to host sites,** particularly through **making public buildings available**.

This briefing paper has been developed as part of the Renewables for All project.

Description of Community-owned Renewable Energy

The greatest challenges facing Australian society are highly complex, and will require our best innovation to address. Adapting our economy to a rapidly changing world, rising to the challenge of action on climate change, addressing energy affordability: these all require more than just a 'business as usual' approach.

Community-owned renewable energy is a highly beneficial and innovative solution for people who would like to invest in renewable energy but can't do so on their own property due to renting, unsuitable roof or living in an apartment.

CORE, also known as 'community energy', refers to projects where a community group initiates, develops, operates and benefits from a renewable energy resource or energy efficiency initiative (NCES, 2015). Community groups are formed based on a common interest or geographical region such as a town or a suburb.

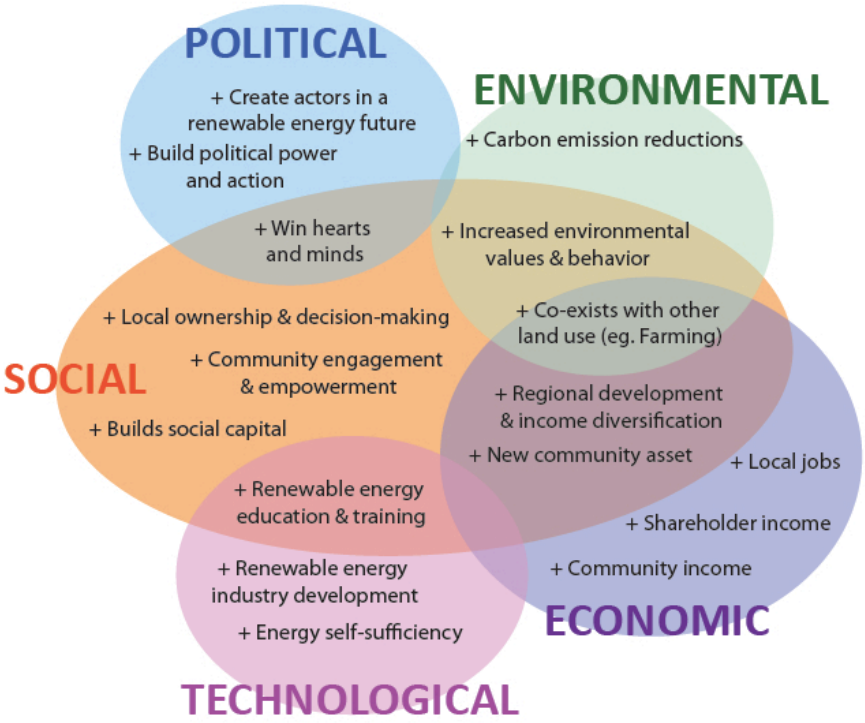
CORE projects have been developed across a range of technologies (e.g. solar PV, wind power, bioenergy), and are usually initiated by a small group of locals and offer community members but also the wider public the opportunity to engage and invest typically between $100 to $20,000 (though in some cases more) in a renewable energy project. As an ethical investment opportunity the projects typically yield a 4-10% dividend and as such can be quite attractive.

In Australia, CORE is the most common approach for community participation in new energy technologies beyond household scale with more than 20 CORE projects currently operating. Hosts for such projects are usually community halls, leisure centres, commercial buildings as well as farmland or other unused plots of land.

What are the benefits?

It is now possible to support clean energy so that thousands of local people have a financial stake in each project, thus becoming vocal champions for new energy.

CORE projects offer a range of economic, environmental and social benefits. Every project is different, being tailored to each community's specific needs. From local job generation, strengthening of 'community connectedness', local ownership of energy production, to action on climate change, CORE delivers a wide range of benefits back to the community where it needs it most. People can invest into medium-scale renewable energy projects and receive a return on investment from favourable interest rates. Furthermore those projects offer an option to participate in community activities and help to increase energy literacy and knowledge about renewable energy. Being community-owned, or part community-owned, increases the social licence to operate, especially for large-scale developments. As shown in the diagram below, CORE provides a wide range of tangible benefits across many aspects of society:



J Hicks & N Ison (2012) "Community Energy Generation", in Shepherd, A., Allen, P. and Harper, P. *The Home Energy Handbook:* Powys, Centre for Alternative Energy.

Over the last five years various models of community energy have emerged in Australia as primary enablers for diverse segments of our communities to come together to access clean energy solutions by reaching beyond the bounds of a property.

Status

The community energy sector in Australia is large in both potential and ambition. With the right policy support at all levels of government, the sector has the potential to engage millions of Australians in future energy issues, bringing the benefits of the clean energy transition to as many Australians as possible.

- There are currently over 70 community energy groups in Australia, having grown from just one group in 2010 (Hepburn Wind).
- Similar levels of growth have been observed in countries such as Scotland and Germany.
    - Germany's energy transition of the last 15 years has resulted in 33% of their energy production capacity being based on Clean Energy (Bundesverband Erneuerbare Energien,2015). 46% of Germany's clean energy capacity is owned by citizens and communities (Renewable Energy Agency, 2013).
    - Scotland has over 290 community energy groups (Community Energy Scotland, 2015), starting from a base of close to zero just 11 years ago.

At present, CORE is supported by State government policy in New South Wales, and most recently in Victoria. At the time of writing, details of Victoria's New Energy Jobs Fund have been announced, including priority support criteria for community-based new energy

initiatives like CORE.

In NSW, supporting CORE projects was identified as a key action in the State's Renewable Energy Action Plan. As a result there are eleven operating CORE projects within NSW and more than 28 groups developing projects. To date, the NSW Government has provided over $1.2million in funding for CORE pre-feasibility and feasibility studies spread over 25 groups. While the NSW Government has been very supportive of community-owned renewable energy, there remains a number of significant barriers, and the same can be said and magnified when examining conditions for community energy in other States.

Barriers to CORE

Despite the significant cultural and regulatory barriers facing CORE projects, strong momentum from a vibrant and growing CORE sector continues. However, several significant regulatory and other barriers still exist, including issues around CORE projects gaining access to host sites, achieving affordable grid-connection, lack of start-up funding, a fair price for the energy they generate, access to 'host sites' and investor limits and disclosure issues associated with ASIC regulations.

Many community energy groups also suffer from capacity constraints and would benefit strongly from access to capacity building training and mentoring, and standardised legal documents, financial modelling tools and shared administrative services. The provision of funding and policy support to increase the capacity of the sector will enable CORE groups to harness the best expertise and experience available and share this knowledge and insight with communities developing new projects. The community energy sector is an extremely collaborative, meaning any capacity building will have significant reach across the sector. Specifically, capacity building programs would aid existing groups to:

- minimise duplication of effort, share information, build capacity and grow the community energy sector as efficiently and effectively as possible; and
- leverage public, private and community finance and funding for the sector; and ensure that the community energy sector does not stall due to shifting Federal policy environments

Examples of CORE in Australia

Repower Shoalhaven One – is a small-scale community-owned solar array on the Shoalhaven Heads bowling club on the South Coast of NSW. The Repower Shoalhaven model uses a proprietary limited company Special Purpose Vehicle (SPV) legal structure to enable up to 50 community members to co-invest in a project (though no more than 20 per year). For the first project 20% of the system was financed and owned by Shoalhaven Heads Bowling and Recreation Club, with the remaining 80% financed and owned by community members/shareholders.

Hepburn Wind - Australia's first CORE project Hepburn Wind is co-operatively owned by 2000 members, the majority of whom are local. With 2 x 2.05 MW turbines on Leonards Hill, near Daylesford, Central Victoria, it produces approximately 11,000 MWh per year; equivalent to 2000 homes. Its 'Benefit Sharing Model' includes a Community Fund, focused on sustainability with more than $1m over 25 years pledged to go back in to the local

community.

Specific asks

- Establishment of an ongoing **grant funding programme** including the formation of a dedicated team to support community energy projects, help deliver elements of the National Community Energy Strategy, and ensure that **regulatory barriers across all areas of government are removed**

- Funding and policy support for **capacity building training and support structures**

- Introduce supporting policies to ensure a **fair price is paid for community-owned renewable energy** (see Renewables for All Solar Gardens Policy Briefing),

- Help CORE projects gain **access to host sites,** particularly through **making public buildings available**. The potential for public buildings local to community solar projects to be utilised by these iconic projects is significant and remains an exciting untapped opportunity**.**

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Briefing paper: Rent-based Finance

Overview

One of the key barriers to uptake of new energy technologies by low-income customers and renters is the high up-front cost. To overcome this issue a range of organisations are developing finance products that enable the customer to pay back the cost over a period of time. One of them is the rent based mechanism which allows community/social housing providers to introduce renewable energy or energy efficiency upgrades for which tenants pay for via their rent over time.

Repayment mechanisms are important in making new energy technologies easy for customers. Further, some of these repayment mechanisms address additional barriers such as landlord-tenant split incentives.

To enable rent-based financing for clean energy the following policy measures are needed:

- Facilitating and supporting the development of pilot projects with community housing providers (CHPs)
- Co-funding capital costs of renewable energy or energy efficiency technologies
- Help broker relationships between community energy groups and other key stakeholders working in the field and CHPs

Description

Repayment through rent refers to a model that specifically applies to community/social housing providers that would allow them to collect repayment for renewable energy or energy efficiency upgrades through their tenants' rent. As such CHPs as landlords are in a great position to help their low-income tenants to access new clean energy technologies and enable cost savings through reduced electricity bills. The advantage of this model is that CHPs have well-established processes and administrative procedures (e.g. rent collection) that would allow for efficiently collecting of repayments from tenants. Additionally they have a good understanding of the needs of their tenants which will help to tailor and communicate programs effectively.

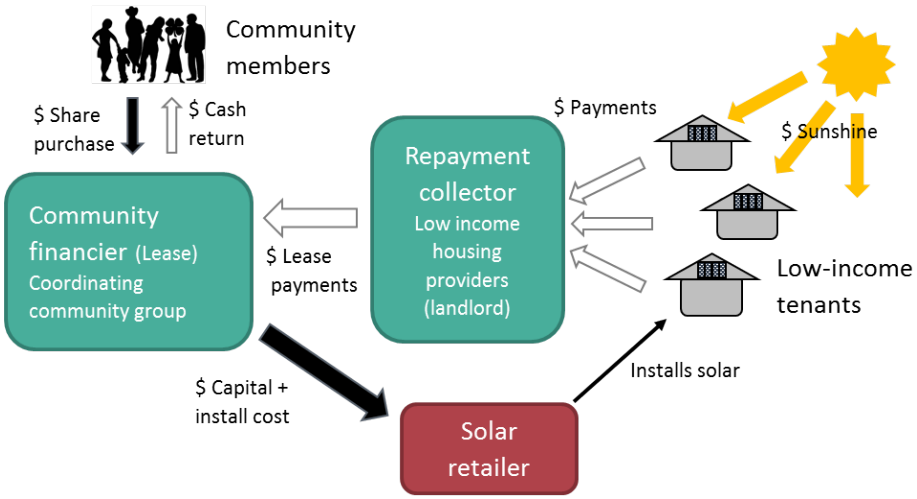
CHPs that are willing to go the extra mile for their tenants have different options to finance and thus increase access to renewable energy or energy efficiency upgrades:

- Self-funded, all costs are covered by the CHP, which collects the repayments from the tenants;
- Third party financing, hereby the CHP receives finance for the installation of the solar and other clean energy assets from a third party. Example third parties include traditional finance institution e.g. a bank, charity lenders, community investors etc.
- Another option is financing provided through solar retailers

Figure 1 shows an example of how rent-based financing could work. In this case when a CHP collaborates with a community energy group, a CHP takes out a solar lease with a

community energy organisation. The community energy organisation installs and manages the solar assets on the low-income households' roofs. The landlord is responsible for paying the lease until the end of the contract period. The community group will raise the funds for capital, installation program costs via an equity crowdfunding approach and manage the returns to investors over the contract period.

Figure 1: Rent-based finance mechanism via a community housing provider and a community financier.
Source: Cooper et al (2015): Low-income Community Solar – Options Assessment for South Coast Solar Saver Project. Report.



In order to implement a rent-based program that benefits low income households, it is important to ensure that

- independent and trusted information are provided and assistance is offered to the households
- the capital cost of a solar power system or energy efficiency upgrades are spread over a sufficiently long time period to ensure that the ongoing benefits through electricity bill savings exceed the repayment costs
- the program contributes to a better understanding of the benefits of a solar powered system and thus may help to educate the beneficiaries
- the business model of the program is foremost designed to benefit the participating low income households by reducing their electricity bills over time

Why Rent-Based Finance?

In recent years, the reduction in capital costs of distributed generation technologies has allowed more and more households in Australia to counterbalance the soaring electricity costs through the installation of for example solar PV systems. Clean energy systems greatly contribute to better manage electricity bills and help to reduce costs of living.
However, many low income households are not able to access renewable energy or energy efficiency measures due to a number of barriers. For example they often do not have

disposal income available to fund a capital intensive new technologies, nor are they able to access debt finance due to their income level and, if renting, lack collateral in the form of property. Furthermore tenants are exposed to the split incentive issue or landlord-tenant problem, which refers to a situation where the landlord is reluctant to invest in e.g. solar, because the benefit would accrue to the tenants over time through lower energy bills. Meanwhile the tenant is reluctant to pay for investment in solar if they may not remain a tenant long enough to reap the benefits

Yet, rent-based finance addresses these barriers and helps low income households to access renewable energy or energy efficiency technologies because:

- It provides certainty for the landlord or CHP and reduces the risk for financiers
- Rent carries a low risk of default
- No ongoing adjustments to legal documentation, and therefore no complications when the tenant moves out.
- Less stakeholders involved with this model than with other repayment models.
- Helps to overcome the landlord/tenant problem to an extent as the cost pass-through can be agreed upon mutually by landlord and tenant

According to a study by Cooper et al (2015) households participating in a rent-based solar program (assuming 60% self-consumption) could benefit between $60 and $231 each year. Over the lifetime of the technology, the tenants could be $8,744 to $10,792 better off relative to the same household who did not install solar. The total savings are forecast to be at least three-times as much as the cost of participating.

Status

The authors are not aware of any operating examples of rent-based repayment projects in Australia. However in NSW different community groups (e.g. Solar Suburbs, Clean Energy of Newcastle and Surrounds, South Coast Health and Sustainability Alliance in Eurobodalla, Repower Coffs) have started to collaborate with a number of CHPs to explore the options of the repayment which include rent-based models.

Currently, many low-income housing providers are not able to pass on rent increases. This may be due to government funding conditions or rent increase restrictions. In such cases, a separate ‘utility charge’ similar to a water charge could be recovered by the landlord. Such a charge is expected to be permitted under funding and regulatory rules; however, it is less preferable (relative to rent) as it is an additional bill and therefore higher administrative costs and higher default rates are expected.

It should be noted that as with many of these repayment options, solar and energy efficiency provision is not core-business for social housing providers and as such there may be other cultural and institutional barriers to implementation that need to be overcome.

It should further be noted that both the NSW Government and Clean Energy Finance Corporation have both released clean energy programs targeting community housing

providers.

Example

Rent-based finance is an innovative solution to enabling tenants' access to new technologies. While it is new to Australia, a number of different international examples indicate how it can be applied.

In Germany landlords can pass along the costs of a building upgrade (e.g. solar heating or insulation) to their tenants through the "Modernisierungsumlage", which is basically a leasing rate or modernisation allocation. This leasing rate is regulated in the civil code law §559 BGB and represents a special form of rental increase, which should incentivise the landlords to modernise their building stock and reclaim some of the costs in the form of a rental repayment. In order to protect the tenant, the regulation only allows for an annual rental increase of 11% of the costs associated with the refurbishment (that means for refurbishment costs a rental increase of € 9.17/ month is permitted). As such modernisation upgrades apply to a single house but also to multiple apartments, in the latter case the landlord has to distribute the costs equally across all tenants. The landlord is furthermore obligated to disclose (in writing) the rental increase including a detailed calculation of the costs and the new rent.

Modernisations or building upgrades usually comprise measures such as solar PV, heating system improvements, façade insulation, solar water heating, double-glazing windows and water or energy meters. However these measures can only justify a rental increase if they provide primary energy or water cost savings for the tenant.

There are other international examples that are designed on Grant or Feed in Tariff mechanisms.

Specific policy asks

- **Facilitating and supporting the development of pilot projects** with community housing providers (CHPs), to ensure greatest likelihood of success of the model. Realising that early pilot projects with CHPs is important to demonstrate the feasibility of the business model and encourage other community groups to initiate their own projects and/or collaborate with existing projects.
- **Co-funding for capital costs** of renewable energy or energy efficiency technologies to ensure that low-income households benefit from installations through reduced bills.
- **Help broker relationships** between community energy groups working in the field and CHPs. This includes facilitated information sharing between community energy groups to ensure a greater distribution of lessons learned.
- **Support stronger collaborations** between existing initiatives of community energy projects that investigate rent-based finance options in partnership with CHPs. To that purpose we believe it is worth exploring whether the establishment of a joint entity of community energy groups, which is responsible for administrative tasks and book keeping, would help to support community energy groups to overcome the

financial barriers of implementing such projects.

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Briefing paper – Mini Grids

Overview

The rise of increasingly cost competitive clean distributed energy resources, from local renewables generation technologies to demand management tools, means that in many places it now makes economic sense to meet most, if not all of a community's energy needs locally. Mini-grids (also known as 'micro-grids') are one way to go about this.

The Renewables for All project is proactively supportive of the development of renewable powered mini-grids in appropriate locations in Australia, as they:

- Can reduce grid costs for all Australians
- Leverage community engagement and to permit more people to participate in renewable energy deployment,
- Are sites of innovation in new clean energy technologies, business models, ownership structures and benefit sharing approaches,
- Can reduce remote community's reliance on diesel generators, which is particularly pertinent as remote communities have a disproportionate number of low-income households.

Policy measure needed to support the uptake of mini-grids in Australia include:

- Funding for pilot projects
- Feasibility studies and technical assessments for interested communities
- Improve and upgrade mini-grids in remote locations to ensure they are powered by renewable energy not diesel
- Investigating the benefits of ownership transfer of centralised network assets where there is an interested community, particularly in edge-of grid locations.
- Assessing grid upgrades more stringently in areas where mini-grid solutions are possible
- Supporting a cultural shift in network operators and energy retailers

Description

The term mini-grids refers to a combination of energy generation and distribution that typically operate as isolated systems in a range of 10 kW to 10 MW, serving tens to several hundred customers. Mini-grids mostly exist in remote areas that are separated from the national grid or on islands. However, there is also a growing interest in grid-connected or embedded mini-grids because it allows for greater control of the electricity generation e.g. from renewables and reduce network costs.

Since the 1980s mini-grids have internationally been seen as a way of improving access to energy services in rural and remote areas and are considered a great opportunity for community participation and ownership. Although many countries continue to pursue large-scale and centralised grid programs, the interest in decentralized generation and distribution through mini-grids is growing. This applies in particular to developing country contexts'

where constraints such as an isolated population, low purchasing power and limited potential for load growth hinders larger scale ambitions. But mini-grids also play an important role in developed countries for remote communities or edge of grid locations and increasingly as embedded systems.

There are a number of different approaches to the development of mini-grids which comprise technological, institutional and financial elements. Mini-grids can operate with single generation technologies such as diesel, solar PV, wind, hydropower or biomass or with a hybrid system that combines one or more of those technologies. Hybrid models are of particular interest due to their ability to mix non-interruptible (e.g. diesel, biomass) and intermittent and variable power sources (e.g. solar) to increase reliability and load matching.

The flexibility of a system can be also secured through the application of thermal and battery storage technologies. The institutional and financial arrangements to set up a mini-grid are more diverse. Private or public actors can own and operate the system or parts of it such as generation, distribution and demand management. They may also incentivise additional actors such as community members to engage and invest into the system.

The World Bank and US Aid have identified four main types of mini-grids:

- ***Community based model***. Here, the community becomes the owner and operator of the system and provides maintenance, tariff collection, and management services. For example a community group sets up a cooperative or trust that invests in and operates renewable resources of hydro, wind or solar energy systems, and makes the electricity available to all households in the community via a local distribution grid. For example, the Isle of Eigg, Scotland.

- ***Private sector operator:*** In this case, a private actor establishes and owns the mini-grid system. These initiatives can be driven by local entrepreneurs that take ownership e.g. of existing systems by setting up contracts with the utility or end users to run the system.

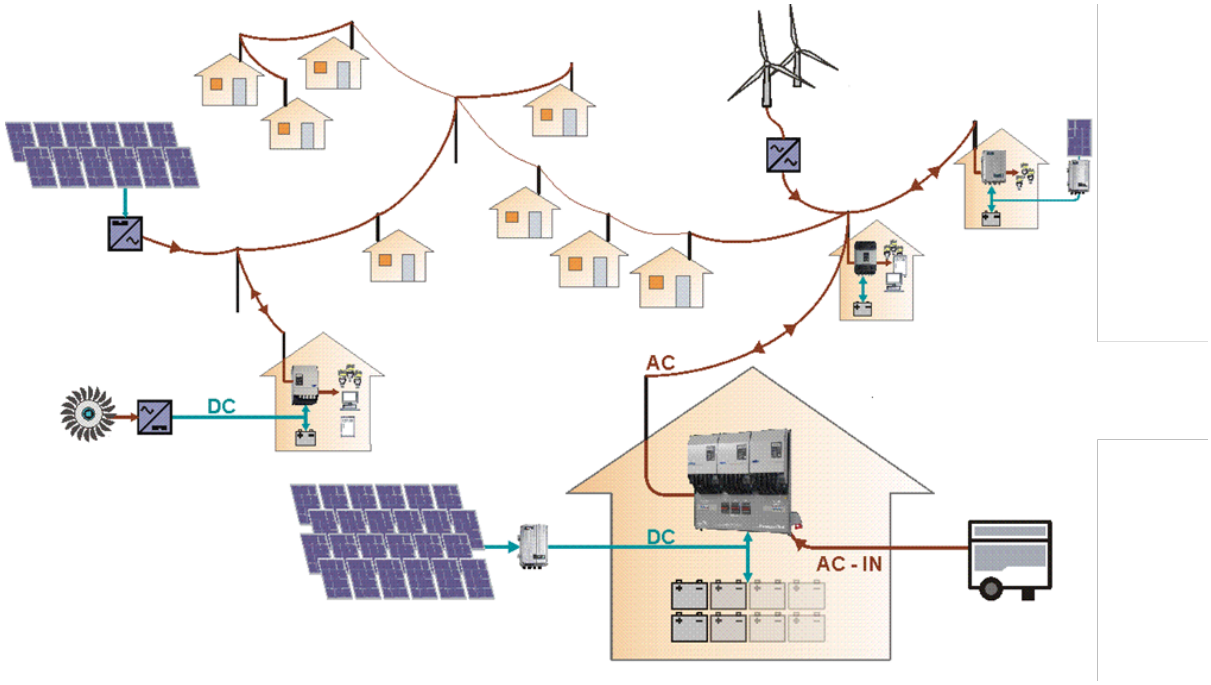
- ***Utility-based approach***: In this case the existing electricity utility owns and operates a mini-grid in a location that does not make sense to service centrally through the national grid (or at least service to the same degree. Typically, utilities already have the capacity, knowledge and staff to run a mini-grid system.

- ***Hybrid model***: This case is where a combination of the above approaches are applied. There are numerous variations of business models for hybrid mini-grid system, which can involve separate entities owning and operating different parts of the system.

To set up a mini-grid is a complex task. There are mainly two options for a mini-grid operations: as islanded networks or connected to the main grid as back up option (if available).

In both systems households are interconnected with a local distribution network whereby the power is generated locally. Single households can also produce power for example through solar PV panels and feed their excess electricity back to system.

Figure 2: Example of an islanded mini-grid system powered by renewable energy sources - Xtender. Source Studer Innotec SA



Why Mini-grids?

In Australia there are good reasons to consider both islanded and grid-embedded mini-grid systems.

Grid-embedded mini-grids

Australia's energy system has the longest distribution network in the world and regulation sees network owners compelled to service all customers within reach. As a result there are massive cross-subsidies between urban and regional areas, for example in Queensland the Community Service Obligation is a cross-subsidy of approximate $0.5billion each year. Towns that are sometimes more than 1,000 km away from the source of generation have to be cross-subsidised by up to $600 per household (REneweconomy, Oct 2015). That is not to say that regional communities shouldn't have access to affordable electricity – they absolutely should, but now there are smarter, cleaner and cheaper ways to do this.

In the recent years grid upgrades, maintenance and extensions have contributed to rising electricity prices across Australia. But with the reduction in costs for distributed generation technologies such as Solar PV, studies suggest that one third of the customers could be go off the grid by 2050, if not sooner (CSIRO, 2012). In this scenario renewable mini-grid

solutions could help to reduce the risk of stranded assets and the Death Spiral. This has already led a number of the network operators to consider taking whole towns off the grid, or at least making their connection skinnier.

Furthermore, mini-grids that employ new ownership structures which help communities to take control of their own electricity supply and to create a local energy market that captures the value of both the generation of electricity and the network savings achieved by local generation. Such mini-grids are likely to be economically efficient and effective solution at the edge-of-grid locations. This is particularly the case where communities are interested in renewable energy generation in order to reduce their members' electricity bills. At edge-of-grid locations mini-grids can increase reliability and quality of the local electricity supply and prevent power fluctuations.

Already there are a range of actors looking at mini-grids in edge of grid locations. For example, network operators in both Western Australia and Queensland are doing tender processes to take a number of edge-of-grid communities off the grid through mini-grids (REneweconomy, Oct 2015).

Other communities are also interested in a mini-grid approach for example:

- Newstead, has funding from the Victorian State Government to create an embedded mini-grid for their town in a project called Newstead Behind the Meter;
- Tyalgum, has NSW state government funding to investigate going off-grid and to be powered entirely by renewable energy. In a recently finalised feasibility study two scenarios were proposed: first option to completely become self-sufficiency with 100% renewable energy, second option still using the grid for backup with a 100% renewable energy power generation.

Islanded mini-grids

Islanded mini-grid systems already exist in a number of communities in very remote locations across Australia. Disadvantaged people are over-represented in remote communities (ABS, 2012). Yet, they depend on mini-grid systems that use diesel to generate electricity and ultimately face finite fossil sources and a steady increase in fuel prices.

The availability of cost effective renewable energy technologies provides alternatives for such communities. An upgrade of mini-grids with solar PV or wind power systems would allow for the displacement of expensive diesel-based generation to help them to become independent from fossil fuels and thereby reduce their costs of electricity. The new technologies offer the opportunity to diversify such community's energy supply and allow for the most appropriate energy sources to be deployed e.g. solar, wind, bioenergy etc. Hence, they help to increase the community's energy security and resilience in times of diesel price volatility and when remote communities are inaccessible for a certain amount of time during severe weather events (or e.g. wet season in Queensland).

In Australia many remote communities depend on off-grid solutions particularly in the Northern Territory. A very successful program in remote locations in Australia was Bushlight that ran from 2002 to 2012 with the aim of increasing livelihood opportunities for people

living in small remote indigenous communities through the provision of renewable energy services. Bushlight was a project of the Centre of Appropriate Technology (CAT) that was jointly funded by the Department of Families, Community Services and Indigenous Affairs (FaCSIA) and the Australian Greenhouse Office (AGO). Bushlight installed over 100 renewable energy systems ranging from household stand-alone systems to large scale community systems and community hybrid systems. The two latter were designed to meet the electrical needs of a small community and involved the application of mini-grid technologies. In these cases, power is generated centrally and then distributed out to individual households or buildings. Each household or building has its own Bushlight supplied switchboard that provides energy management on the household level (Rodden, 2008; CAT archive, 2012).

Further benefits of renewables powered mini-grids specifically include: emission reductions, local economic development and electricity costs savings of the broader customer base.

Policy asks

While mini-grid solutions in NSW are quite new it is necessary to better understanding some of the technical and institutional requirements for such projects and identify the barriers and challenges in the current market environment.

To support the development of mini-grid in NSW, the following measures are needed:

- Provide funding for research and implement **pilot projects** to enable accelerated learning by energy market participants and regulatory authorities;
- Support communities with funding to conduct feasibility studies and technical assessments as well as the system design processes for interested communities
- **Improve and upgrade mini-grids in remote locations** to ensure that they are powered by renewable energy not diesel
- Investigating the benefits of ownership transfer of centralised network assets where there is an interested community, particularly in edge-of grid locations.
- **Assessing grid upgrades more stringently** in areas where renewable mini-grid solutions are likely to be viable
- **Support a cultural shift** of network operators and energy retailers to conduct such projects

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Briefing paper – Solar Gardens

Overview

In Australia many energy customers through no fault of their own are unable to put solar on their own roof. This may be because they rent, live in apartments, have shaded roofs etc. One of the most exciting ways to address this equality issue is through the establishment of central solar facilities known as solar gardens, where households and businesses own shares or a number of panels and the energy generated is credited on those customers' energy bills.

This briefing paper outlines the exciting role that solar gardens could play in the Australian energy system, particularly with respect to increasing clean energy accessibility and affordability. To make solar gardens viable in Australia requires changes to:

1. The economics of local generation e.g. through a Local Network Credit,
2. Enable new billing structures e.g. through Local Energy Trading, and
3. Compel or incentivise networks and retailers to participate.

The briefing paper has been developed as part of the Renewables for All project.

Description of Solar Gardens

For energy customers that own a sunny roof, solar PV works by installing solar, using the energy at the time its produced and reducing the amount of electricity imported from the grid. This in turn reduces the amount the customer pays for electricity, with excess generation exported back to the grid. It's called a behind-the-meter model, because the Solar PV is installed on the customer side of an electricity meter (rather than the grid side).

This behind the meter solar model makes economic sense for millions of Australian energy consumers. It's a win-win because it helps a customer reduce and manage power bills while also helping to address climate change. The economics stack up because the cost of grid (or retail) electricity is for most customers greater than the cost of electricity from solar. With the savings on electricity bills solar customers should pay-back the cost of the system in 4-6 years, depending on how much of the electricity a customer uses, the retail price they pay and how good the solar resource is.

However, not everyone is in a position to put solar on their roof – this is a problem. This is where solar gardens come in. 'Solar gardens' work by installing a central solar array, generally in close proximity to a population centre – think a field at the edge of town, perhaps next to the town landfill or a big warehouse roof. The typical grid-integrated solar model is where a private company sells the electricity from a renewable energy generator (wind, solar PV, bioenergy) to a retailer through a power purchase agreement (PPA). In a solar garden:

1. The customer owns (or leases) a share or a number of panels in the central solar array and
2. The electricity generated by their share/panels is credited on the customer's electricity bill (see Figure 3).

In the solar garden model any energy customer can participate in and benefit from solar energy. It should be noted that this model could be used for other renewable electricity generating technologies, not just solar.

Figure 3

Solar Gardens Internationally

Solar gardens have become the most prevalent community solar program in the US in the last four years. According to the Solar Electric Power Association (SEPA, 2014) they represented 96% of all active and planned community solar capacity with a cumulative capacity of 40 MW. As of August 2014, SEPA listed 57 community solar programmes spanning 22 states (other sources provide even higher numbers). While this is still relatively small sector, solar gardens in the US are predicted to increase in capacity seven-fold by 2020 (Honeyman, 2015).

Why Australia needs Solar Gardens

There are three compelling reasons that Australian governments and regulators need to enable solar gardens:

1. Clean energy accessibility and equality
2. Avoiding the Death Spiral
3. Increased economic and technical efficiency and associated business model benefits

Clean Energy Accessibility

Solar Gardens enable a significant number of customer segments who face market barriers, to participate in and benefit from clean energy technologies.

- Renters – solar gardens bypass the landlord-tenant split incentive issue by enabling renters to buy in to a solar garden and get a credit on their electricity bill. For

tenants, this is a much more viable alternative than putting solar on the roof of a rental property.

- Apartment dwellers – solar gardens bypass the issues around space, roof access and the split incentive between strata bodies and apartment owners by giving apartment dwellers an alternative way of participating in solar ownership.
- Low income households – in the US, policy that supports solar gardens requires that Solar Garden providers offer a certain proportion of the solar gardens capacity for free or at a discount to low income customers. Solar gardens are also a less capital intensive and simpler approach for some customers than rooftop solar, which can appeal to low-income households.
- Households without solar access – there are a range of households that cannot put solar on their roof due to roof orientation, shading, heritage listing, space or structural issues. Solar gardens enable these households to participate and benefit from clean energy.

Essentially solar gardens represent an elegant and simple solution to key market failures particularly split incentives, solar access and complexity.

Avoiding the Death Spiral

Australia is going through a period of unprecedented change in our energy system, with a combination of factors leading to potentially unbeneficial outcomes for most actors within the Australian energy system – customers, distribution companies, retailers and generators.

Key factors include:

- High electricity prices and specifically high network costs, resulting from $47billion being invested in network infrastructure, at least a third of which was to meet peak demand growth that has not eventuated.
- The cost decline of distributed energy technologies – solar PV, energy efficiency and soon batteries, which has and will continue to reduce the usage of grid electricity.

The combination of these two factors lead to what is called the Death Spiral.

Solar gardens hold the potential to become a key strategy in the fight to prevent the Death Spiral. They create a win-win situation by enabling customers to benefit from distributed energy technologies, while maintaining some degree of grid utilisation. This in-turn could reduce grid defection by energy customers, thus maintaining network revenue and avoiding a situation where charges have to be increased so that sunk infrastructure costs can be recouped from the small group of customers who remain connected, including the most vulnerable.

Economic and technical efficiencies

Solar gardens and the policies that underpin them (Local Network Credits and Local Energy Trading – explained below) have significant technical and economic benefits over alternative clean energy business models. Specifically:

- Enabling electricity prosumers to use the grid at reduced cost through a Solar Garden and Local Network Credit will reduce the likely duplication of infrastructure – innovators will no longer look to install private wires (an alternative business model).
- The size of a solar array is no longer dependent on a host-site's energy use, as is the

case with the behind-the-meter models of community solar being implemented in Australia – thus unlocking additional roof space for solar.

- The increased size of the solar array in a solar garden compared to both commercial and residential behind the meter business models allows for greater cost reduction through capturing the benefits of economies of scale.
- For community investors in solar gardens the fact that the return on investment is returned as a credit against an electricity bill potentially means that participants are not taxed, just like people who put solar on their own roof, but unlike other models of community renewable energy.

Examples

Moira and Swan Hill, Victoria

As part of the ARENA funded project into Local Energy Trading, a virtual trial of a many-to-one local trading project or solar garden is being undertaken in collaboration with Moira and Swan Hill councils. This trial will look at the viability of solar gardens in the current market context and if the Local Generation Network Credit Rule Change was implemented.

More information: http://www.uts.edu.au/research-and-teaching/our-research/institute-sustainable-futures/news/building-level-playing-field

Mid-Valley Metro Solar Array, Colorado

The Mid-Valley Metro Solar Array was a pioneer solar garden project in the US. It was constructed prior to the introduction of Colorado's Virtual Net Metering legislation. Holy Cross – the local utility, voluntarily, supported the development of a 78kW ground mounted solar farm in its area by Clean Energy Collective. Clean Energy Collective (CEC) then supported community members (Holy Cross customers) to purchase an ownership stake in the project. The participating customers then receive a monthly bill credit using CEC's smart metering and bill calculation software and hardware system, which integrates directly with the utility's systems.

More information: http://www.nrel.gov/docs/fy12osti/54570.pdf, p22-24

Barriers to Solar Gardens in Australia

Solar gardens, while operating across Europe and the US, currently don't work in Australia. The two main barriers are:

- The economics of the business model – it doesn't stack up, and
- Institutional culture/appetite, particularly by network companies and retailers.

The economics of Solar Gardens

In Australia, solar gardens currently don't stack up economically. This is because currently the amount that would be credited on a participating customers bill is the wholesale price of electricity - just the "generation" part of the bill, which is typically 4-6c/kWh. If you put solar on your own roof you get to offset the full retail price of electricity – which for residential customers is approximately 18-30c/kWh and for business customers is typically 11-20c/kWh.

The reason for such a significant difference in price is that the cost of transporting electricity – the distribution and transmission infrastructure (aka poles and wires) accounts for approximately half of the retail price of electricity. Further, if you want to generate electricity

at one site and use it at another site, as is implicit in the solar gardens model even if the sites are next door or close to each other, the electricity user in this equation has to pay for the full cost of the network infrastructure, even though only a tiny proportion is actually being used.

Unfortunately, the cost of developing, installing, operating and administering a Solar Garden is greater than the revenue stream of 4-6c/kWh of electricity generated even when the additional revenue stream of Renewable Energy Certificates (large or small) are also factored in. As such, in Australia, solar garden projects would always run at a loss, so no one is doing them.

Bill crediting

The second challenge is that for solar gardens to work requires a retailer to be willing to pass on the bill credit to a customer. Setting up the administration systems – essentially software that integrate with existing retailer billing systems, is possible, but costly and retailers currently don't have any incentive to do so.

Policy Solutions

To address these challenges, requires three things:

1. New tariff structures that recognise the value of solar gardens – these can be done in a few ways and there are a few dimensions that need to be considered.
2. Bill-credit software platforms that helps streamline the relationships between the retailer, customer and solar garden administrator.
3. Regulation or legislation that compels or incentivises retailers and networks to participate or allows the establishment of 2nd tier retailers (solar garden developers) to facilitate the model.

New tariff structures

The solar gardens model is underpinned by the credit on participating customers' bills, this is essentially a new electricity tariff structure. The questions that then need to be addressed are:

- Who develops these new tariffs – how do they get established?
- What do these tariffs need to consider?

In establishing the new tariffs there are two possible and complimentary approaches:

1. A rule change through the Australian Energy Market Commission (AEMC). There is currently a rule change process underway on this topic entitled Local Generation Network Credit. The rule change is proposed by Total Environment Centre, City of Sydney and the NSW Property Council and AEMC consultation commenced in late 2015.

2. State legislation. State governments can legislate and require network companies to set a new tariff structure for certain customer classes, in a process not dissimilar (though on a smaller scale) to the Queensland Community Service Obligation (CSO).

In designing the new tariffs the following details must be considered:

- Amount/value – what is the value of the credit?
- Distance constraints – do the Solar Garden members need to be in the same

network distribution area e.g. zone substation area to be able to get the credit?

- Timing – does the energy generated in the solar garden have to be used by the customer at the same time?
- Who can participate – are all customers eligible to participate/benefit from the credit arrangement or just certain customer classes?

Currently, a consortium of different stakeholders including the Institute for Sustainable Futures and a number of Councils, Networks and retailers are funded by the Australian Renewable Energy Agency (ARENA) to investigate the opportunities of peer-to-peer electricity trading. They are conducting five virtual trials to inform the development of alternative charging methods for local energy projects and potential changes to electricity market rules. Additionally, the Local Generation Network Credit Rule Change process should help clarify the value of local energy generation and thus what the credit on a consumer's bill should be if such a business model were to be enabled.

Bill-credit software platforms

Internationally, there are a number of software platforms that enable solar gardens, however, they are currently not adapted to the Australian context. Solar garden trials could help streamline and reduce the cost of this software that might otherwise destroy the economics of a solar garden business model.

Ensuring the key actors participate

Solar gardens are dependent on both network and retail companies' participation. Incentives such as tax breaks or funding or requirements through regulation or legislation are the main policy levers to ensure they do so.

Specific policy asks

- **Support the Local Network Credit Rule Change**
- **Implement state-based legislation that supports renters, low income households and households without solar access** by one or more of the following methods:
    - Setting a higher bill credit value – close to retail rate for those customers that are unable to put solar on their roof or
    - Providing grants to low-income households and renters to be able to participate.
    - State governments can also put in place legislation to compel networks or retailers to credit certain eligible customers who participate in a solar gardens scheme at a certain rate. One option would be that customers who cannot put solar on their own roof could be eligible for full-retail electricity rate, while those customers who can put solar on their roof, would be credited at a lower rate, thereby increasing equity of access. There may be an opportunity to look at how these types of support could be aligned with low-income rebates for electricity costs such as the Family Energy Rebate' (FER) and 'Low-income Household Rebate' (LIHR).
- **Fund trials** or the development of open-source bill credit platforms' sof to ensure that the software necessary to implement Local Energy Trading (or bill credits) is accessible and affordable.
- Follow the outcomes of the ARENA/Institute for Sustainable Futures Local Network Credit and Local Energy

- If retailers are refusing to participate in Solar Garden projects, particularly those that benefit low income customers and renters, investigate legislative or regulatory options to compel or incentivise them to do so.

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