Case Study: 26 Aroha Sandringham

A customer owned network with solar hot water and solar PV

26 Aroha started with a vision: Create hubs of people that can live in a sustainable, affordable and friendly way with minimal impact on the planet and be positive to the neighbourhood.

Founders Jules and Blair MacKinnon achieved this with a 13-unit apartment building in Sandringham, a suburb close to the Auckland CBD. The building, which has received a Homestar rating of 10, features a thermally optimised building envelope, solar PV, central solar hot water and a shared EV on a customer owned network along with a worm farm for composting, a community garden and water saving systems. They use about half the water and half the electricity as the average Auckland household while generating only half the waste.

One of the intentions is to provide people who are renting with similar quality of features as owners. They do this with a suite of amenities from roof top BBQ, kitchenette and laundry and a rentable guest room.

Governance

Jules and Blair own the building through a trust. They manage the building operations and all the utilities (energy, water and waste.) This governance structure has enabled effective decision making and savings allocation during the construction and operations phase. It has enabled them to take advantage of scale on systems such as PV and solar hot water and contract relationships with utility companies. Savings are returned to residents through lower utility bills and, in the case of waste management, a slush fund for general use. They hold regular huis with the residents to solicit input and there is an online chat group.

People and skills

Jules' mother had built up a rental business over decades. When the business passed to Jules, this property was developed under an existing business framework along with Jules' experience as a health care professional and family history of property management. 26 Aroha hired architects, builders and consultants such as Revolve Energy for the energy systems design and enablement.

Project steps

Land acquisition: The land was already part of the property portfolio so it was a matter of disassembling and upcycling the 1920's bungalow materials into a 13-unit complex managing to meet their 90% recycling target for the old house.

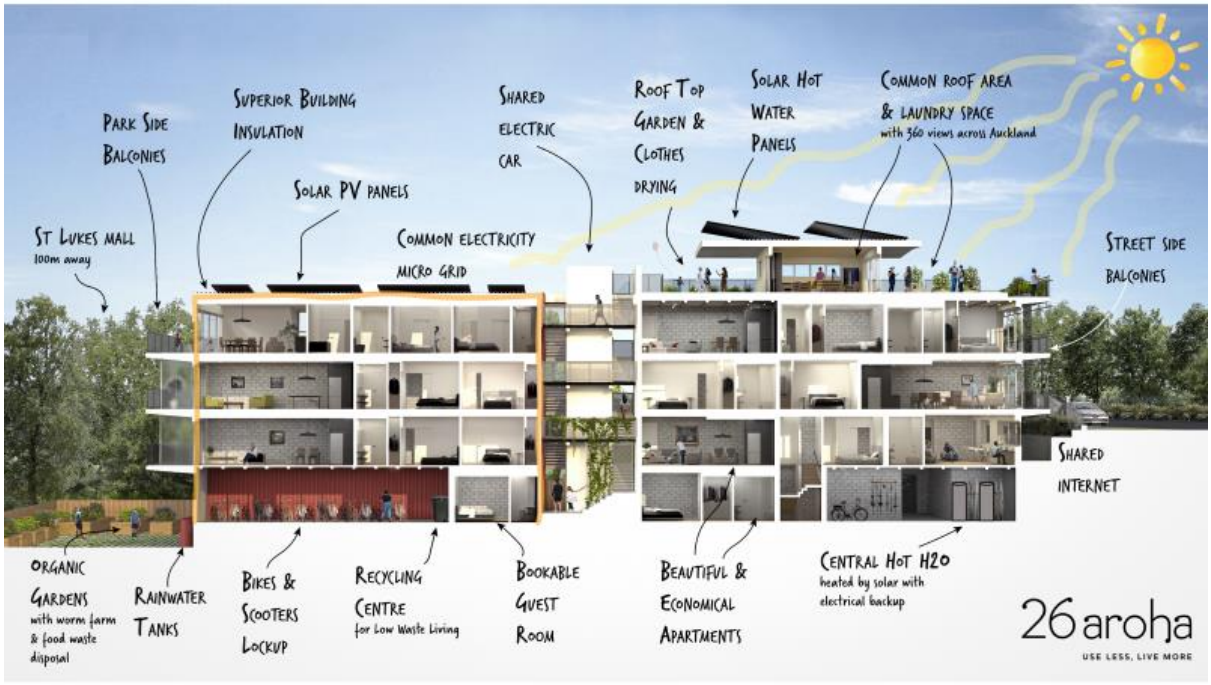
The design: The design was intended to offer long-term, quality rentals in a sustainable, low-carbon building. Parking was reduced to the absolute minimum of two rentable spaces and the one shared EV. The rentable carparks were prioritised for young families. Communal living is optional with the design allowing for shared space and private living.

Sound financial decision making

As this building is a livelihood for Jules and Blair, they had to make sure that the capital expenditures made commercial sense over the long term. The savings had to be realized and shared by both the residents and the owners. One example is the hot water system.

The central hot water system gets about 70% of its heat from a 30 m^2 roof mounted solar hot water heater which cost about $80,000. This additional capital cost will be paid back over time in reduced energy use. The supplemental 30% of heating is from an electrical heater element powered by grid or solar electricity depending on the time of day.

The central hot water system freed up space in each apartment that allowed for additional storage room amounting to a collective savings of about $65,000 in alternate use floor space. While the $65K is not a direct one-for-one offset against the $80K, it certainly shifts the balance clearly in the direction of central solar hot water.



A pictorial representation of 26 Aroha and its features

The energy system

Consumer owned network

26 Aroha operates a consumer owned electricity network with a single grid connection to supply electricity to the 13 units and to all shared loads such as laundry, communal lighting, hot water and EV charging. Cold water is similarly distributed to apartments from a single Watercare connection. Hot water is completely internal to the site with a central on-site hot water plant delivering hot water via a circulating ring main.

The property has a single gate meter at the grid interconnection point. This means that Vector, the local lines company, only has one connection and one customer, and, Ecotricity, the energy retailer, only has one customer, rather than 13. This gives 26 Aroha buying power to get a cost-effective energy rate of about 12 cents per kWh fixed for 3 years and a lines charge of just over 5 cents per kWh.

Within the property there are check meters for each unit and for most of the key loads such as the central hot water system and the shared EV charger. This enables 26 Aroha to monitor and allocate the cost of services to each unit.

Internal billing is managed by the owners using a software billing system designed by Revolve Energy for customer owned networks. The owners also manage the relationship with the retailer Ecotricity. This enables the residents to enjoy the benefits of low cost and self-generated energy without having to spend time managing it.

Having a single gate meter and operating a consumer owned network enables 26 Aroha to take full advantage of their on-site generation and controllable and flexible loads to generate savings without compromising comfort and convenience.

Photovoltaics
The 10kWp (peak) roof mounted PV system feeds the customer network and therefore all loads on the property. Given that 75% of the solar is used on site, the payback on the $40,000 investment should be faster than a single home PV system which often can only consume 50% on site. Energy consumed on site offsets against a flat rate energy tariff of 12 cents whereas they would get about 9 cents for exported energy. However, they still need to pay about 5 cents per kWh consumed in lines charges. While both the lines charge and the energy tariff are significantly lower than they would be for an individual house, there is a net benefit of ~8 cents for every kWh (12+5-9 =8) that they can consume directly from solar versus exporting and buying back later.

In the future there might be ways to further optimize the use of the PV to be used on site. The owners did not want to compromise the lifestyle of the residents by actively managing the EV charging times.

Central solar hot water
The central hot water system is set to maximise the use of the 30m^2 solar heater using timers. A hot water system has to reach 60 degrees at least once per day to eliminate bacteria. This 60-degree peak is set to occur each day at 4pm which gives the solar heater as much time as possible to get the hot water up to temperature so as to minimize the supplemental heating needed. This also means that the water is hot for the residents evening activities. The temperature is then held at 55 degrees throughout the night until 9am, after which it is allowed to fall waiting for the solar heater to kick in and return the temperature back up toward the 4pm peak. This may be optimized further over time as usage patterns and solar PV self-consumption is optimized.

Space heating

Since the units are very well insulated, the space heating requirements are relatively modest and could be served by small 1.5kW to 2kW space heaters in each apartment. Some residents hardly ever use the space heater.

EV chargers
The shared electric vehicle is charged with a smart fast charger. At present there is no active management of this load or attempt to have charging occur during solar generation. Since the EV is a Nissan Leaf with a range of 150km, it is not worth the risk that residents might experience the inconvenience of a half-charged car.

There is likely a way to optimize all of this with a booking system integrated to the charger that can be set up in the future.

Allocating costs fairly

The data acquisition, metering & billing solution ensures that the operational costs and future upgrade/replacement costs of the system are recovered fairly from the residents.

Interactions with the lines company

Since the property was shifting from a single 1920's bungalow to a 13-unit building it was likely that a larger power supply would be needed. E-cubed, a services engineering company, developed an estimate of the capacity that would be needed and provided it to Vector, the local lines company. Vector concluded that the best way to supply the estimated power would be by connecting the property to a different distribution transformer 100 meters away. This did not require an upgrade to the transformer but did require a new conductor be laid at a cost of $100,000 to the project.

In retrospect, there might have been an opportunity for 26 Aroha to consider other mitigation strategies that might have reduced this cost but it could equally turn out that this was the most cost-effective solution. It also provides some degree of future proofing if more loads such as additional EVs or air conditioning is added.

Interactions with the retailer

Ecotricity provides energy to the property at a flat rate of 12 cents per kWh locked for a three-year period. Lines charges are separate and a pass through. This, in combination with solar, makes the middle of sunny days the best time to use electricity and hot water.

Special thanks

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