



Photo credit: Rachel Dulson

West Pittwater Home Energy Assessments

Report prepared for Ausgrid by Ecologic and Your Energy Friend

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Company profile

Ecologic is an energy analysis business combining big data analytics, energy simulation science, and the latest web and mobile technology. Ecologic's core product is a set of apps and a cloud-based platform to help households, businesses and communities assess and deploy energy efficiency, solar and batteries at scale.

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Your Energy Friend is an energy advisory business founded in 2006 with a vision of providing truly independent energy, carbon and water efficiency assessment services. To date YEF have conducted over 5000 assessments for homeowners, councils, schools, electricity network and retail companies, state and federal governments and NGO's.

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Disclaimer

The authors have used all due care and skill to ensure the material is accurate as at the date of this report, however, Ecologic and the authors do not accept any responsibility for any losses that may arise by anyone relying upon its contents.

1 Introduction

Your Energy Friend and Ecologic were commissioned by Ausgrid to undertake home energy audits within the West Pittwater area. The result of these audits will contribute to the assessment of options included in the West Pittwater Energy Reliability Project.

This document reports on the key findings and recommendations arising from a set of 84¹ property energy assessments undertaken in the target supply area in January and February 2018. The report includes:

- a brief background on the supply area (Section 2)
- an overview of the property assessment methodology (Section 3)
- findings of the property energy assessments in terms of key property features (Section 5)
- an analysis of metered energy consumption (Section 6)
- conclusions and recommendations (Section 7).

2 Background

Ausgrid has been exploring options to improve the reliability of electricity supply to Scotland Island and West Pittwater, following several extended power outages.

The West Pittwater local power supply area comprises a string of relatively isolated communities including McCarrs Creek, Elvina Bay, Lovett Bay and Morning Bay.

The supply area is currently served by an overhead aerial bundled cable in a single line, connected to the mainland by a submarine cable. The area has experienced a relatively high frequency of extended outages reflecting the uniquely challenging local conditions, with two extended outages attributed to failures in the submarine cable in 2013 and 2015, and 7 outages since 2015 attributable to other causes, largely storms and vegetation impacting overhead power lines.

Several options have been pursued to mitigate and reduce the incidence of these outages, including improved vegetation management and improvements to the network; however a longer term response is also being assessed.

Feasibility studies have looked at a number of options including a new cable via Scotland Island, but have been rejected based on geotechnical constraints and environmental risks along with the limited benefit they would produce.

The purpose of the home energy audits was to understand local conditions and household energy use to assist in assessing alternative options. These options may include demand management, energy efficiencies, generation or storage options such as solar, household/community batteries and diesel generation.

¹ Note the total number of audits was 91, as it includes multiple dwellings on seven properties

3 Property energy survey method

Property energy assessments were offered to the approximately 160 resident households living in the West Pittwater local supply area, of which 84 properties responded and 91 audits were undertaken. Seven of these properties had mixed use or dual occupancy.

Property energy assessments involved a 1.5 hour consultation and included an assessment and identification of the following:

- Building shell
- Heating and cooling systems
- Hot water systems and usage
- Lighting systems and usage
- Appliance ownership and usage
- Possible energy saving opportunities
- Identification of properties with solar generation potential.

The inclusion of solar energy potential in this assessment was bespoke, and considered key factors such as shading, orientation, access and area size.

Data was collected manually and used the Ecologic audit and retrofit platform to analyse and produce reports.

Note the participating households were self-selected so some biases can be assumed. For instance, those properties primarily used for holiday accommodation are anticipated to be less likely to participate in the survey.

4 Survey findings

4.1 Summary

The audits identified that:

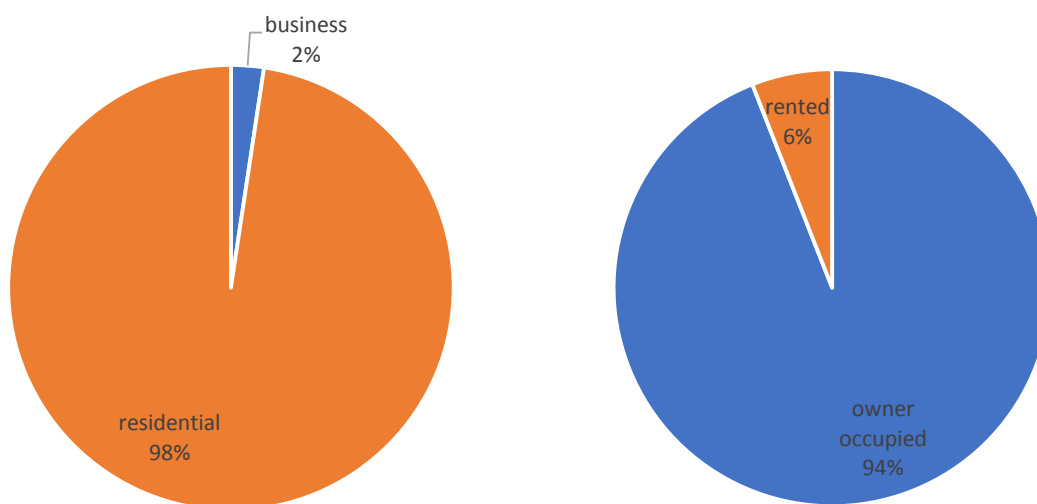
- Based on the opinion of the auditor and home occupier, approximately 80% of the surveyed properties have some level of solar access or generation potential with less than 10% of properties with solar PV currently installed. This opportunity assumes generation greater than 2-3 hours per day as a minimum, but will need to be qualified with a solar specialist. Areas assessed included the building, but also yard, jetty and infrastructure space.
- Almost all households audited indicated a support for or an interest in installing household battery storage systems.
- Small appliance ownership was high overall, with an unusually high ownership of heated towel racks and bathroom floor heating, with some systems set to operate 24 hours year-round leading to considerable electricity consumption
- An opportunity exists to reduce power usage with remote controlled power eliminators to switch off small appliances that are using high levels of stand-by power.
- Water heater replacement/thermal setpoint tuning appears to be a prospective opportunity in the supply area, with such a large number of inefficient electric

hot water systems, many of which were observed to have inappropriately high temperature thermal setpoints.

- The dominant driver of electricity consumption appears to be water heating, with a significant number of electric hot water systems in use.

4.2 Household features

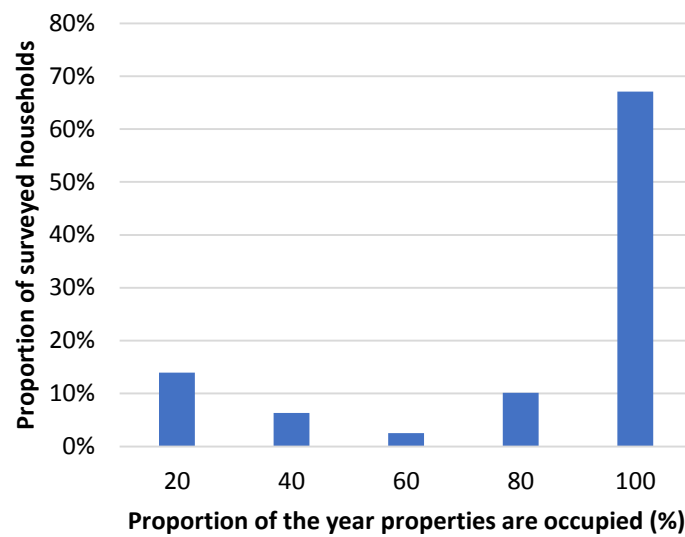
The surveyed properties are largely residential, with three non-residential businesses included.



The three businesses audited all provided a form of boat repair/shipwright or servicing which are able to absorb short-term supply interruptions through the use of a generator, but longer outages (beyond 1-3 days), could force a shut-down. This is mainly due to their inability to use electronic winches to move the boats up and down slipways. The shut-downs come at a considerable cost to these businesses.

Whilst there were only three businesses audited, it should be noted that many residential properties have home offices and holiday accommodation (in addition to the main house) in place so they could be considered mixed use properties.

The surveyed properties were largely owner-occupied, with a small minority (6%) being rental properties. This is positive when considering the process and potential for energy efficiency and solar improvements that may be part of an efficiency or response program.

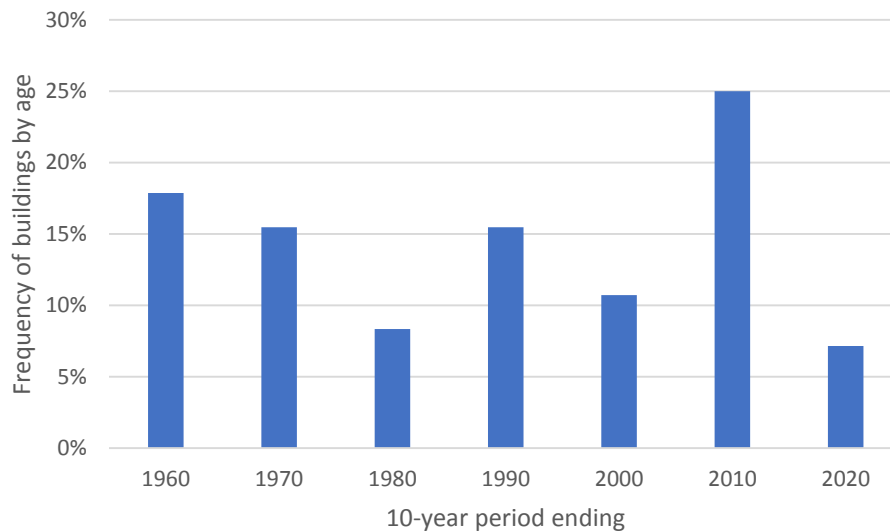


Of the properties surveyed, a relatively small proportion of dwellings (13%) were unoccupied during weekdays and used as ‘weekenders’ only. It should be noted, however, that the surveyed households likely to represent a biased sample in this regard as unoccupied households are less likely to participate in the survey.

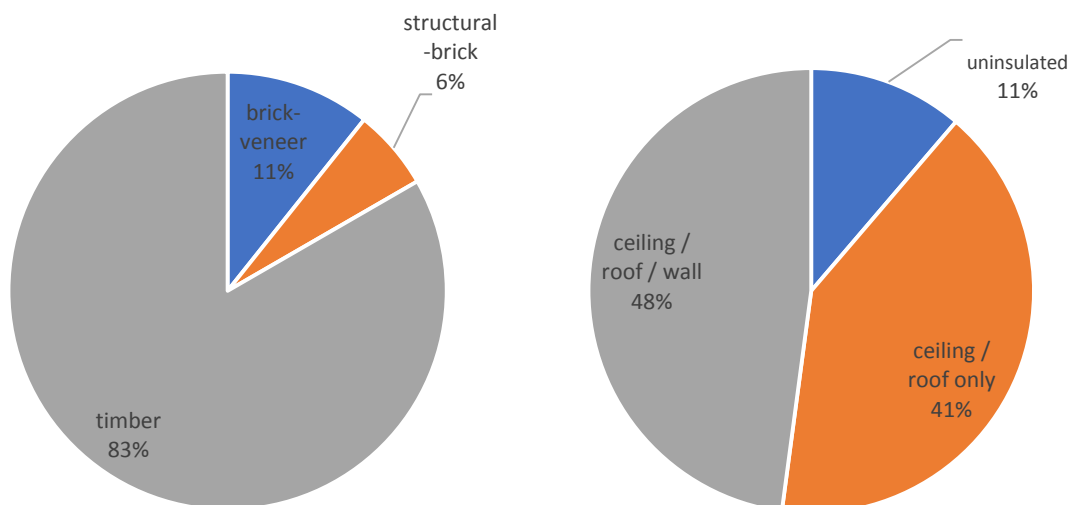
The surveyed properties were also largely occupied throughout the entire year rather than seasonally. Again, the surveyed households are likely to represent a biased sample in this regard as unoccupied households are less likely to participate in the survey.



4.3 Building features



A large proportion of buildings (23%) were constructed or significantly renovated between 2000 and 2010. It should be considered that building code requirements for performance became significantly more stringent during this period, suggesting approximately 67% of buildings are 'pre-code' or poorly performing building stock. It should also be noted that due to the 1994 bushfires, many homes were rebuilt or renovated around this time.



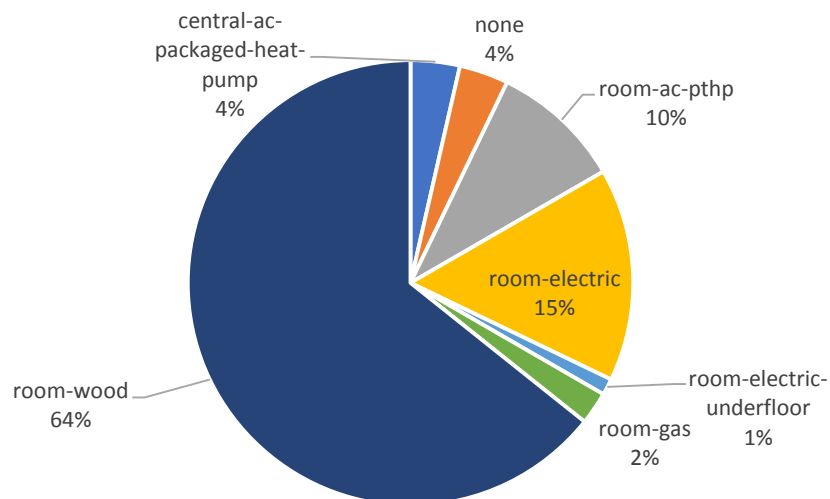
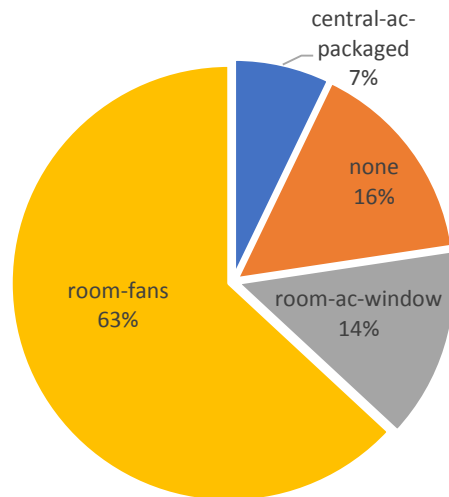
The structures are primarily lightweight timber construction (83%), with a small minority of brick veneer (11%) and structural brick (6%). It was suggested that residents in this area were very aware of the hazards of bushfires and properties are built to code.

The majority of the surveyed households had some form of insulation with 41% either ceiling or roof insulation, and 48% with roof and wall insulation. This figure is quite high by regional standards, and potentially a reflection of the low uptake of active cooling and heating systems (see below). Both factors mean the energy saving opportunities associated with insulation in the study area are likely to be limited.

4.4 Heating and cooling features

A large number of households use room fans only (63%) or no cooling equipment at all (16%). A small proportion of households have active cooling, either room air conditioning (14%) or central/ducted air conditioning (7%).

Cooling requirements for houses were low owing to the close proximity of Pittwater and prevailing ocean breezes.

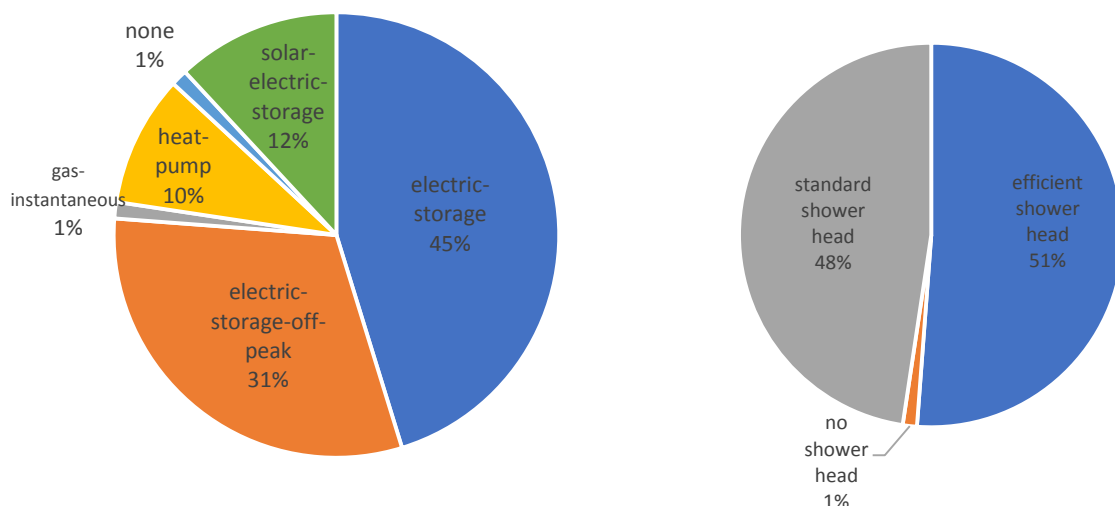


A considerable proportion (64%) of properties were heated with combustion wood heaters, and a much smaller proportion, electric room heating (15%) and reverse cycle air conditioning (10%). There were also several isolated instances of room gas heaters, central ducted reverse cycle air conditioning and underfloor electric underfloor heating.

While electric room heaters were not prevalent (15%), there was an indication that they were used regularly in children's bedrooms, suggesting an opportunity to reduce or substitute this heating with more efficient heating options.



4.5 Water heating system features



A significant majority of surveyed properties had an electric storage water heater installed, most of which were continuous/uncontrolled systems (45%) and off-peak/controlled systems (31%). The balance of hot water systems were electric heat pump (10%), solar with electric boosting (12%). Water heater replacement/thermal setpoint tuning appears to be a prospective opportunity in the supply area, with such a large number (76%) of inefficient

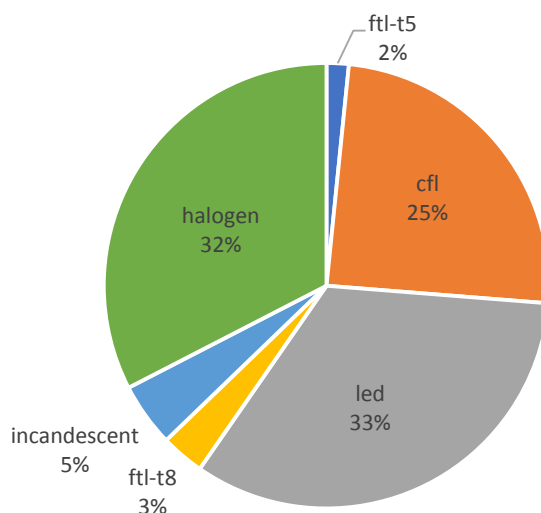
electric hot water systems, many of which were observed to have unnecessarily high temperature thermal setpoints.

There may also be a considerable opportunity associated with adding ripple or more advanced load control devices to these systems as hot water systems are thought to be a considerable driver of both overall consumption and peak demand in the supply area. It was also noted that very few properties had tempering valves.

Several households mentioned that during the previous outages, hot water systems created issues for back-up generators when they were switched back on. The opportunity associated with more efficient heat pump and solar hot water systems does need to consider the highly saline environment and that solar hot water systems may be constrained by solar access owing to the local vegetation.

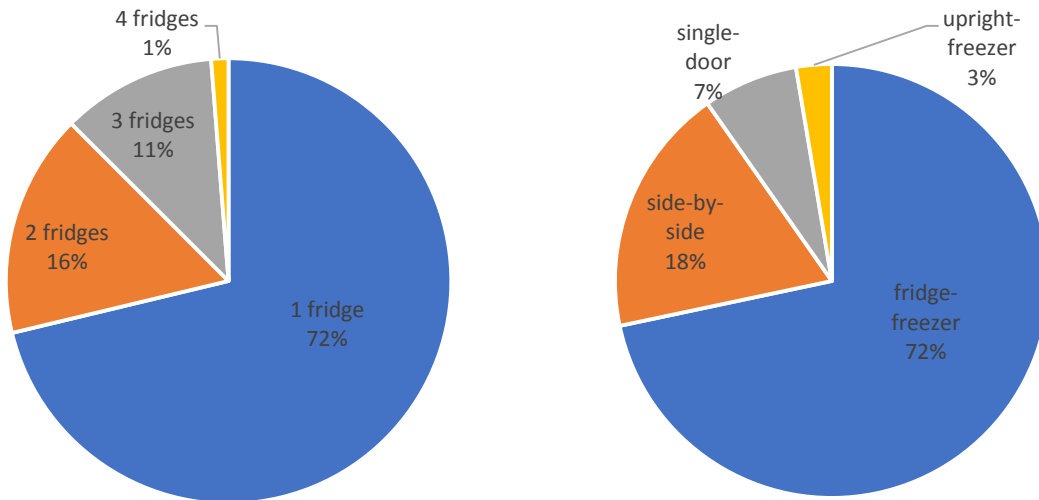
Approximately half of households had a standard inefficient showerhead installed, suggesting further water heating savings may be unlocked through a showerhead replacement program. This high number also relates to the number of households who were on gravity fed water supply, which impacts pressure and the opportunity for a WELS rated showerhead to be effective.

4.6 Lighting features

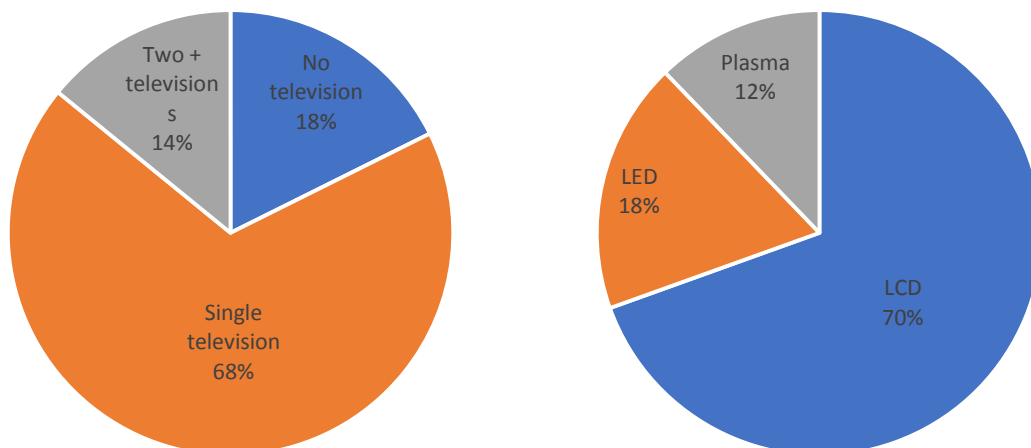


Lighting fixtures included halogen (32%), LED (33%) and CFL (25%). It appears that lighting usage is unusually low, with most properties estimating only 5-10% of lights on during night hours. Some caution should be exercised with self-reporting lighting usage estimates. It does appear a halogen replacement program maybe worthy of further investigation.

4.7 Appliance ownership and usage



A majority (72%) of households have a single fridge, with a much smaller number of dwellings having two (16%) or three fridges (11%). Most models were upright fridge-freezers (72%) or side-by-side fridges (18%), with a small number of single door fridges and upright freezers. This is consistent with regional norms. Many of the secondary fridges are not required for day-to-day needs, so there may be energy saving opportunities with a program to remove/switch off secondary fridges and freezers.



A majority (68%) of surveyed households had a single television. Consistent with regional norms, most televisions were more modern LCD or LED models.

Small appliance ownership was high overall, with an unusually high incident of heated towel racks and bathroom floor heating, with some systems set to operate 24 hours a day, year-round, leading to considerable electricity consumption. A targeted program comprising behavioral change, timers and/or standby power boards could reduce demand in several instances.

4.8 Pools and spas

Only one property had a spa/jacuzzi and no properties with pools installed so there is unlikely to be any benefit to programs targeting this end use.



4.9 Rainwater and wastewater systems

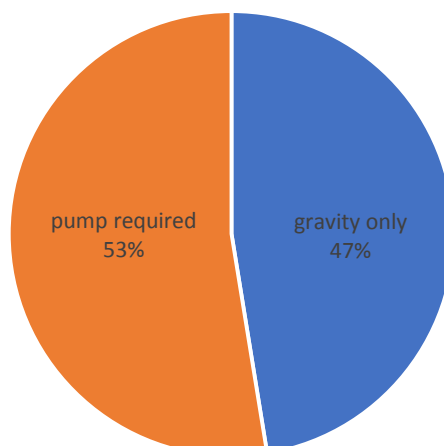
All properties had a water tank of some description, which is expected with no official town water supply. A small number of properties had a shared connection to mains water through a line running across the bay, coupled with storage tanks.

Water and sewerage system arrangements differ for all properties, due the variety of access sources to mains water (very few), access to rain water only and some properties with access to soaks or springs in the national park.

Very few homes (only 2 of those surveyed) had composting toilets. A wide variation in septic arrangements exists due to, for example, legislation at the time they were installed or preferred methodology of the plumber that installed the system. There is also a wide range of pumps being used, from submersible pumps with different types of macerators to a single tank running purely on gravity.

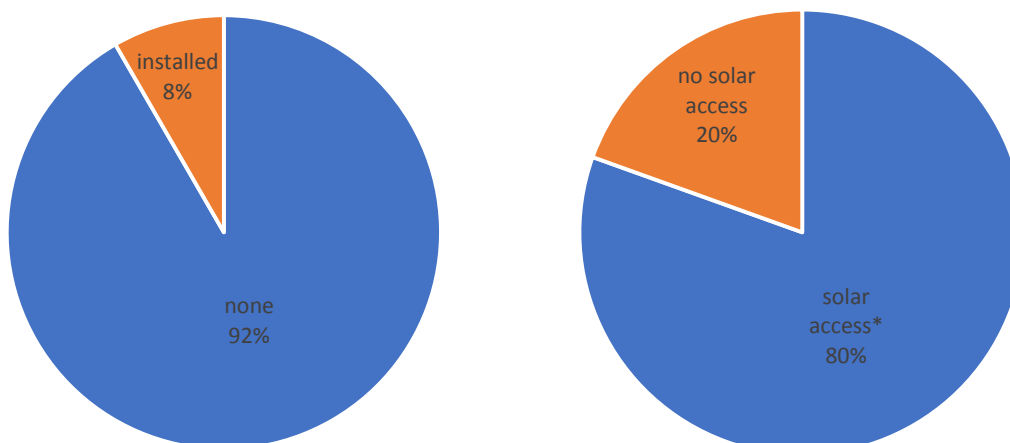
Both the water supply and septic disposal arrangements also vary due to the topography of the land, where the house is located in relation to rainwater tanks and dispersion pits.

Importantly, whilst affecting only a small number of properties, during an outage, there were some extreme cases of sewerage overflow due to pumps not being able to work.



All but two properties surveyed were served by septic systems, roughly evenly split between gravity fed and pumped systems. The pumped systems cannot function effectively during prolonged electricity supply outages, leading to odour and potential public/environmental health issues with uncontrolled septic overflows in several cases. These problematic properties could potentially benefit from solar pumps or an alternative sanitation technology/configuration to reduce their exposure to electricity outages.

4.10 Solar PV



**solar access of 2-3 hours or more of accessible sun light*

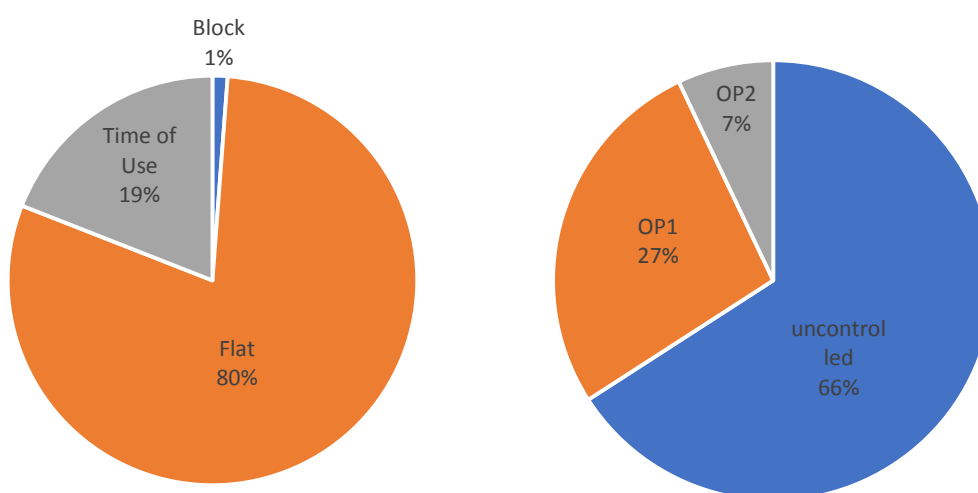
Only a small number of properties had solar PV systems installed (8%). Approximately 80% of properties were identified as having some level of solar access, however partial overshadowing is common. This could be mitigated with vegetation management in many instances, however the actual feasibility for solar would need to be investigated on a case by case basis. Note even in situations where solar PV generation is not feasible owing to overshadowing, solar pumping may still be practical for septic/rainwater supply in periods of electricity supply interruption.

A suitable site for a large solar installation in the assessor's perspective was in front of the Pittwater Youth Hostel, as seen below.



Almost all households expressed interest and support for solar and/or battery storage systems.

4.11 Tariff features

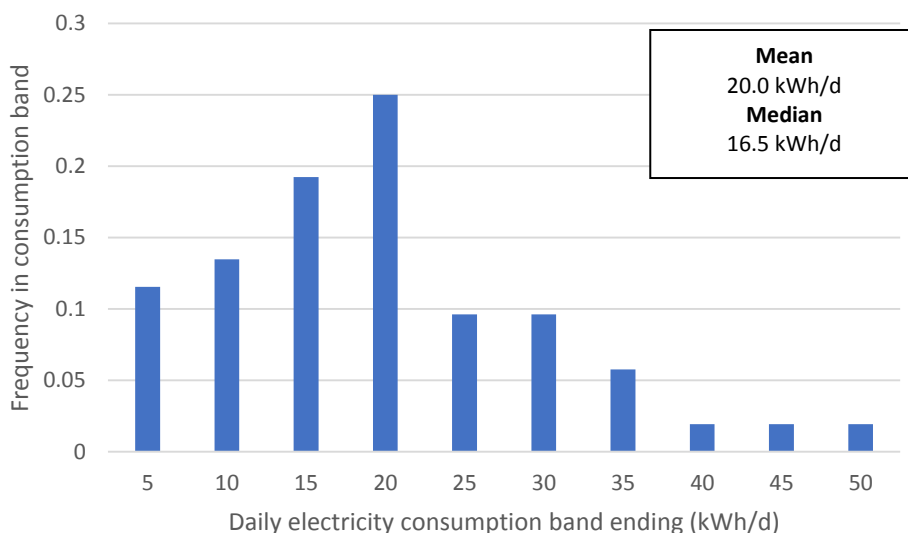


A considerable majority (80%) of properties were on flat tariffs, with only 19% on time-of-use tariff.

Approximately two thirds of households have no controlled tariffs in place. Of the remaining third, most are on the OP1 tariff (27%) with a small number of OP2 tariffs (7%). This

supports the notion that electric storage hot water systems provide a potential opportunity for adding ripple or more advanced hot water system control devices, leading to load management and lower costs for households.

5 Energy consumption analysis



The energy consumption of surveyed properties was comparatively low by regional norms especially given the relatively low solar PV uptake, with a sample mean of 20.0 kWh/d and median 16.5 kWh/d. This is likely related to the minimal penetration of active heating and cooling systems in the region, combined with the relatively lower occupancy levels.

The dominant driver of electricity consumption appears to be water heating, with a significant number of electric hot water systems in use.

Some individual properties had very high energy consumption, usually driven either by high use of electric heating systems. These households could benefit from advice on how to more cost-effectively heat their homes.

6 Recommendations

Building performance improvement – although a large proportion of surveyed properties were pre-code and therefore likely to have poor passive thermal design, draught-sealing and insulation, the uptake of ceiling insulation was quite high overall, and the uptake of active heating/cooling systems was quite low. Retrofit ceiling or wall insulation is therefore unlikely to be of great benefit, however draught-sealing improvements may be beneficial, especially when comfort improvements and other co-benefits are taken into consideration.

Hot water systems - there is considerable opportunity in the replacement and/or control of hot water systems. There is a large number of electric storage hot water systems in use.

Heating systems – although electric heating was not widely used, many of those households that do have high electricity consumption, suggesting a possible behavior change program to raise awareness of the energy costs of electric and underfloor heating systems.

Lighting – many households have inefficient halogen lighting suggesting opportunity for a lighting retrofit program.

Fridges / freezers – many households have non-essential secondary fridges operating at all times, suggesting a possible program to switch off/remove secondary refrigeration.

Other electronics – compared to Sydney averages, the surveyed households had quite a high uptake of high usage appliances, including heated towel racks and underfloor bathroom heating, suggesting a potential program combining behavior change/timers/standby power boards.

Septic systems – a large proportion of surveyed properties require electrical pumping for effective septic tank operation, making a small number of properties vulnerable to supply interruptions and health/hygiene issues which suggests a potential program to provide solar pumps to problematic pumps.

Solar PV systems – solar PV uptake is quite low overall, largely driven by perceived solar access constraints. The preliminary site assessments suggest at least partial solar access is available in a significant proportion (80%) of households, suggesting further solar PV site assessments in specific instances.

Battery systems - Many surveyed properties expressed an interest in battery storage to assist with supply interruptions.

Tariff switching – many households are likely to benefit from switching to a time-of-use and/or controlled load tariffs, suggesting a potential tariff switching program.