Develop your long-term operational plan

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Ara Ake

Future Energy Development

Develop your long-term operational plan

The operational plan is not something to be left until the end. It is necessary for creating the financial model and engaging in productive discussions with funders, EDBs, and contractors. Funders and EDBs require assurance that the project will be effectively managed throughout its lifespan, with sufficient funds allocated for operations and maintenance, as well as repayment of the funding.

The operational plan often influences the system design as specific features may be required for intended operations. Additionally, having an operational plan ensures that the contractor constructs a system that can be maintained within the budget and avoids any unpleasant surprises. By considering the operational plan early on, all stakeholders can align their expectations and make informed decisions to support a successful project implementation.

Operations and maintenance (O&M)

Operations and maintenance (O&M) is often underestimated, especially for seemingly passive electricity systems like solar photovoltaics. However, even solar projects require regular maintenance. Panels need cleaning, wiring needs to be checked, and the system must be monitored to ensure optimal performance. If any issues arise, technicians need to be dispatched to adjust or replace components.

For projects with more complex equipment like batteries or wind turbines, O&M becomes even more crucial. Regular maintenance is necessary, and continuous monitoring helps identify when maintenance is required.

Managing O&M is an ongoing task that must be budgeted and planned throughout the project's lifespan. It comes after the construction phase, once the initial excitement of project development has subsided and the grand openings are over.

Supporting the community to get the most out of the system

Introducing a community-managed generation or storage system is a novel concept for many community members. Merely explaining it during the commissioning event is insufficient; we cannot expect community members to immediately adjust their behaviour to make the most of the energy system. It will be an ongoing educational process to ensure that community members understand how to effectively utilise the electricity generation system for their own benefit.

While some individuals may quickly embrace the system and experience immediate reductions in their electricity bills, others may struggle to adapt their behaviour to fully capitalise on the benefits of the energy generation system. Each person should be allowed to progress at their own pace, with access to educational resources and support from knowledgeable individuals throughout their journey. It's reasonable to anticipate that it will take at least a year or two for people to become fully comfortable with the new system and grasp the most effective ways to utilise it.

Shifting the biggest and most flexible energy users

Maximising the use of solar energy and minimising grid power costs can be achieved by shifting the operation of significant energy-consuming devices. Below some of the largest loads and how they can be timed to align with solar production or when grid power costs are lowest. On average, a household in New Zealand (without electric vehicles) consumes around 7,000 kWh per year, equivalent to potential savings of $2,100 annually. With an electric vehicle, total household energy usage can exceed 10,000 kWh. To fully leverage solar power, it is often beneficial to invest in load management technology that enables better control over energy consumption.

Electric Vehicles (EVs)

Charging an electric vehicle (EV) consumes a significant amount of electricity compared to the average household usage. While the cost per kilometre of running an EV is lower than that of a petrol car, it's important to note that a dedicated EV charger typically utilises around 7.3 kilowatts per hour, whereas the average household usage ranges from 2 to 3 kilowatts per hour. Therefore, if you ensure that your EV is charged using solar energy, it can lead to significant cost savings.

Space heating

Heating the home during winter is responsible for a significant portion of electricity consumption, typically around 30%. When it comes to electric heating options, space heaters and heat pumps are commonly used.

Heat pumps are approximately three times more efficient than space heaters. Small space heaters usually have a rating of 1.8kW to 2kW.

To maintain comfort during winter, you might have a space heater running for around six hours during the day and two to three hours in the evening, totalling approximately nine hours of usage per day. This translates to a cost of around $6 per day. On the other hand, a 2kW heat pump could cost you only about one-third of that, approximately $2 per day, while providing the same level of warmth.

By utilising a heat pump over 120 cold nights in a year, you could save nearly $500 compared to using space heaters. Additionally, if you have solar power, any heating you do during the day will be essentially free, further increasing your savings.

Hot water cylinder

Hot water is one of the major energy consumers in a household, accounting for approximately 15% of total home consumption. A standard hot water cylinder typically uses around 3 kW of power, while a hot water heat pump operates at around 0.5 kW. This highlights the importance of energy-efficient appliances. In fact, a hot water heat pump is about six times more efficient than a standard hot water cylinder. If you're considering replacing your hot water cylinder, opting for a hot water heat pump that is compatible with solar energy is highly recommended.

Hot water cylinders don't run continuously; they heat water and store it in an insulated tank. This means you can control when hot water is generated. To ensure the temperature in your hot water cylinder reaches at least 60 degrees Celsius once a day to prevent bacterial growth, it's essential to use a timer specifically designed for hot water cylinders or a solar divertor. A solar divertor automatically redirects energy to specific appliances when solar energy is being produced. By setting your hot water cylinder to operate between 10 am and 4 pm when solar generation is at its peak and, if applicable, between 10 pm and 5 am when electricity rates are lower (in case you have time-of-use rates), you could potentially reduce your annual cost from around $900 to $300.

You can also time other hot water-dependent devices to operate when the sun is shining. This includes dishwashers (even though they have their own heating element), clothes washing machines, and, if you have one, a spa pool. By aligning their operation with solar energy availability, you can further optimise energy usage and reduce costs.

Air conditioning or cooling

Air conditioning is less commonly used in New Zealand compared to other countries, and the proportion of households using it is likely around 10%. However, due to the increasing installation of heat pumps in recent years, more people are using them for cooling purposes. A notable advantage of cooling is that it often aligns with sunny days. To optimise solar energy utiliation, a useful approach is to pre-cool the house during the mid-afternoon, taking advantage of the ample sunlight. This process can be automated, particularly if you are away from home during the day.

Applying the lessons of solar to other technologies

The concept of utilising energy when it is generated applies to various technologies, including wind, geothermal, and small hydro. While wind energy may be less predictable, it can be beneficial for electric heating during cold and windy nights, even though automation might be more challenging.

Incorporating batteries into the system allows for the shifting of energy delivery. However, since batteries have limited storage capacity, it is advisable to establish solar basics and habits before adding batteries. This way, you can assess how much battery power is necessary to manage periods when solar generation is insufficient. Batteries are particularly useful for mitigating short-term fluctuations in production, such as intermittent cloud cover, as they can stabilise solar output and regulate energy supply to loads. Additionally, if you engage in spot market transactions for buying and selling energy, batteries can safeguard against the need to purchase power during price spikes.

The underlying principle remains the same: aligning energy consumption with the availability of the lowest-cost energy

Multiple Trading Relationships

Peer-to-peer trading involves individuals with excess energy selling or donating it to those in need. This surplus energy can come from solar systems or stored batteries.

In New Zealand, peer-to-peer trading at the consumer level is supported only when facilitated by a registered retailer. The registered retailer ensures accurate billing, compliance with regulations, and the ability to supply energy to both parties when generation is unavailable. Both the buyer and seller must be with the same retailer, and each can have only one retailer for their energy needs.

Combining peer-to-peer trading with other cost-saving measures, such as fixed-rate contracts, can bring value to both parties. However, if peer-to-peer trading is combined with access to the spot market for additional energy, consumers may be exposed to price spikes, especially during morning and evening peaks when they lack solar generation. These spikes have historically resulted in high bills. To address this, four key elements are necessary:

- The ability to adjust, reduce, or limit energy consumption.
- Energy storage to buy energy at low prices (including self-generated) and sell when prices are high.
- A control system that can interpret market signals and optimise trades.
- Long-term commitment and interest in managing these aspects.

Ara Ake is currently coordinating the Multiple Trading Relationships (MTR) pilot, which explores the benefits of consumers contracting with multiple electricity service providers simultaneously, at the same ICP (Installation Control Point). Enabling MTR would allow consumers to access peer-to-peer services as an additional offering alongside their regular consumption service. Currently, if a consumer wants to access a peer-to-peer service from you during surplus solar generation, both parties must switch all their electricity consumption to the same retailer capable of providing this service[1]. The Code currently prohibits contracting with multiple services, which acts as a regulatory barrier to wider adoption of peer-to-peer trading.

MTR would enable communities to better leverage their investments in electric vehicles, solar PV systems, and batteries by accessing multiple services simultaneously. As the MTR pilot focuses on community-centric approaches, this guide will be updated with further information as it becomes available. For more information visit araake.co.nz/projects/mtr/

1 Two retailers (one providing peer-to-peer and another general consumption) can have a bilaterial agreement at an ICP under existing regulations, but this still does not allow a community to be able to use a peer-to-peer service to share solar locally, as this would require many bilaterial contracts between retailers which is inefficient.

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