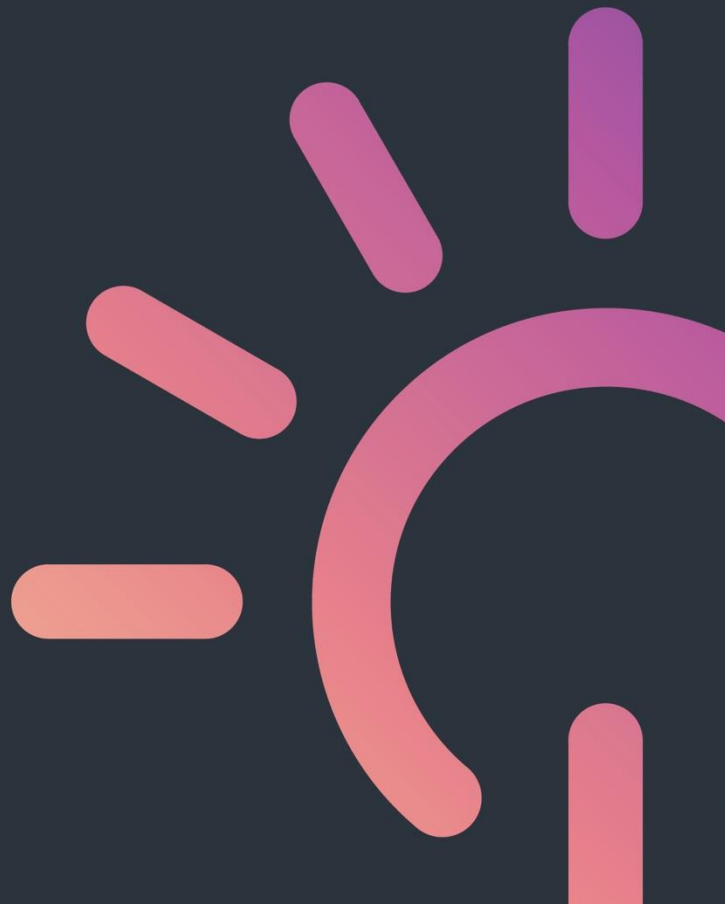


# Virtual Power Plant Handbook

April 2024



# VPP Handbook

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# 1. Introduction

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## Real life. Powered by Arcstream.

By joining the Arcstream by Qcells Virtual Power Plant (VPP), you are maximizing the value of your Q.HOME CORE system. Qcells' cutting-edge software technology connects a network of Qcells customer homes together, just like your own, and optimizes their use in a real-time orchestrated manner. This ensures benefits are delivered to your home first, while also supporting your community with cleaner and more reliable electricity.

As a contributor of clean energy to your local electricity grid when most needed, the Arcstream VPP can reduce fossil fuel use and subsequently lower electricity costs.

### 1.1. Arcstream VPP Value Offering

Receive guaranteed \$30 bill credits<sup>1</sup> each month for your grid support from your Q.HOME CORE system. These grid services are all managed by Arcstream, so there is no need for you to do anything other than enjoy your bill credits.

Access to Qcells' cutting-edge software technology deployed worldwide on solar-plus-storage solutions which unlocks the full potential of your Q.HOME CORE system. The technology leverages machine-learning prediction and world-class optimization to operate your Q.HOME CORE system in an optimal manner, to maximize the value and green benefits for you and your community. Our software control ensures that your Q.HOME CORE system is operated and maintained under system warranty terms.

### 1.2. Arcstream Wholesale Arbitrage Trial

A small selection of our customer base in Victoria have been asked to participate in a trial of an improvement of our optimisation approach.

If you have been notified that you are on this trial, we have identified that your favourable system setup is suitable for inclusion in the trail of new technology that can contribute to improvements in grid security and reliability and lower overall costs for all users of the electricity system.

## 2. VPP System Operation, Explained

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The Q.HOME CORE system provides value by shifting your home's energy usage from peak to lower priced periods. With visibility of your Time-Of-Use (TOU) periods, Qcells' technology can minimize grid imports during peak periods and supply your load using your Q.HOME system instead. This is called 'Time-Of-Use (TOU) arbitrage' and helps to minimize your bill and reduce the cost of powering your home. As a result, Arcstream can pass on lower energy rates, credits, and competitive tariffs for your home.

By utilizing the Q.HOME CORE system in combination with Qcells technology, your solar generation and home energy usage will be continuously monitored by considering historical patterns and future predictions. In instances where solar generation exceeds your consumption, such as during periods of ample sunlight in the summer, charging of your home energy system will be prioritized. Conversely, when solar generation is insufficient to offset your anticipated peak period electricity usage, such as during winter when sunlight is less abundant, the Q.HOME

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<sup>1</sup> Consumers who have signed up post-August-2022 have received a \$30 VPP credit as part of their energy plan offer.

CORE system will import energy from the grid during periods of lower pricing to avoid doing so during peak pricing.

Qcells' algorithms are designed to prioritise your expected home energy consumption based on the usage and solar generation information provided by your Q.HOME CORE system. On occasion, your Q.HOME CORE system may discharge energy to support the grid and ensure grid stability. This assistance helps to lower energy costs for both you and your local community.

However, please note that predictions cannot always be 100% accurate due to unforeseeable circumstances beyond our control. In such cases, you may notice different system operation than you might expect. Nevertheless, you can be confident that the Q.HOME system will always strive to minimize inherent error and therefore reduce your energy bill by taking advantage of lower priced periods based on anticipated solar energy production and your home's energy needs.

## 2.1. What is FCAS Frequency Support?

The term "frequency support" refers to the process of regulating the flow of electricity into or out of the grid to maintain a stable frequency of 50 Hertz. Any deviation from this frequency can cause instability, leading to power outages. To ensure an uninterrupted supply of electricity, the Q.HOME CORE system is equipped to continuously provide frequency support to the grid through the AEMO's Frequency Control Ancillary Services markets. While this service is rarely required, unforeseeable contingency events can arise, and the energy required for this service is extremely minimal.

All Q.HOME CORE systems enrolled in the Arcstream by Qcells Virtual Power Plant can be called upon to provide frequency support as a coordinated fleet. This service is critical not only for ensuring an uninterrupted power supply across the electricity network to keep the lights on, but also generates value that is shared with you, either in the form of VPP Credits for Arcstream OneBill customers or in a discount that is built into our Arcstream Flexi tariff rates. Traditionally, fossil fuels have been used to provide frequency support services, but with the Q.HOME CORE system, the service can be provided using clean energy and with a much faster response time.

## 2.2. What is Wholesale Market Arbitrage?

Wholesale market arbitrage is the act of buying electricity from the market when the price is low and selling it when the price is high. The wholesale price reflects supply and demand within the electricity market, as well as the generation mix supplying to the electricity grid (solar, wind, coal, gas, batteries). Typically, wholesale prices are lower during peak sunlight hours due to an abundance of solar generation, and prices are often high in the late evening when solar electricity drops after sunlight hours and coal and gas-fired power plants ramp up to meet customer demand as they come home.<sup>2</sup>

At times, Arcstream by Qcells may charge your Q.HOME CORE system from and then discharge it to the grid for wholesale market arbitrage. The Q.HOME CORE system is used to store energy when prices are low and to sell that energy back to the grid when energy prices are higher. In turn, by discharging your stored excess solar generation or imported cheap 'spilled solar' electricity into the grid during a high market price period, you are directly contributing to a cleaner energy mix for your community and reducing reliance of polluting fossil fuel-based power plants.

Arcstream by Qcells shares this value with customers through Bill Credits and competitive tariff rates. The software technology by Arcstream by Qcells is constantly assessing opportunities to participate in the energy market, all while helping to reduce your energy bill by learning your consumption behaviour and assessing opportunities to minimize grid fluctuations.

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<sup>2</sup> Note there are also times where unpredictable grid incidents happen which affect the supply and therefore the price. These events can occur at any time, including night-time. Events could be coal power plant breakdown, storm coming which affecting wind and solar generation, or other. This requires support from your battery to reduce the negative impacts that could result in higher prices to customers or even black outs.

This may lead to instances where your Q.HOME CORE system is kept idle, meaning your home's energy usage will come from solar or the grid. This occurs while Q.HOME system is waiting for an opportunity to discharge into higher priced periods, or allowing your home's energy needs to be met by the grid during negative pricing. This method of operation allows us to help keep energy prices down for you and the community and helps balance the electricity grid.

*Qcells' technology constrains imports to below your usage thresholds.*

If wholesale market prices are low or negative, the Q.HOME system may charge your Q.HOME system or import from the grid to cover your home's energy needs. Conversely, if wholesale market prices are high, the Q.HOME system may export your solar or battery energy to help stabilise and support the grid.

In the summer, your system is likely to produce more solar energy, which means the Q.HOME system will be charged more from solar than from the grid. In contrast, there will be less solar energy generated by your system during winter, which means you will notice the Q.HOME system charging more from the grid.

## 2.3. Typical VPP Operation Scenarios

### Sun Is Shining

Operation Mode	Operational Rationale
1. Solar powers your home and exports to grid:	Solar generation covers your home's energy needs, with excess exported to the grid. Your Q.HOME CORE battery is not charging from excess solar generation as it may be full, or a lower-cost charge is predicted later in the day.
2. Solar powers your home and charges Q.HOME CORE battery:	Solar generation covers your home's energy needs, with excess utilized to charge your battery.
3. Solar powers your home, charges your Q.HOME CORE battery and exports to grid:	Solar generation covers your home's energy needs, with excess utilized to charge your battery. Any further excess solar generation is exported to the grid.
4. Solar and Q.HOME CORE battery power your home:	Solar generation alone doesn't cover your home's energy needs, therefore Q.HOME stored battery energy is provided to cover the missing energy.
5. Solar and grid power your home:	Solar generation alone doesn't cover your home's energy needs; therefore, the grid covers the missing energy. Q.HOME CORE battery is not discharging as it may be empty, or a higher-value discharge is predicted later in the day.
6. Solar powers your home, with excess solar & Q.HOME CORE battery discharge exported to grid:	Solar generation covers your home's energy needs, with any excess solar supplemented by Q.HOME CORE battery discharge power to take advantage of high market prices. You receive guaranteed Arcstream bill credits and competitive tariff rates.

<p>7. Solar powers your home and charges your Q.HOME CORE battery. Q.HOME CORE battery is also being charged by the grid:</p>	<p>Solar generation covers your home's energy needs with excess solar charging your Q.HOME battery. Additionally, the Q.HOME battery is charged from grid with low priced electricity, which is stored to meet your predicted energy needs during peak pricing periods.</p>
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### Sun Is Not Shining

Operation Mode	Operational Rationale
<p>1. Q.HOME battery powers your home:</p>	<p>No solar generation, Q.HOME CORE stored battery energy meets home's energy needs.</p>
<p>2. Grid powers your home:</p>	<p>Your home's energy needs are met by electricity grid energy with competitive Arcstream rates. Q.HOME CORE battery is either empty or optimised to discharge later.</p>
<p>3. Grid powers your home and charges Q.HOME battery:</p>	<p>With no solar generation, your home's energy needs are met by electricity grid energy with competitive Arcstream rates. Q.HOME CORE system is also prioritizing charging from the electricity grid to take advantage of lower priced electricity available. This energy is stored for future predicted energy needs during peak pricing periods.</p>
<p>4. Solar and Q.HOME CORE battery power your home:</p>	<p>Solar generation alone doesn't cover your home's energy needs, therefore Q.HOME CORE stored battery energy is provided to cover the missing energy.</p>

## 3. Contacts and Version Control

### 3.1. Contact Information

If you have any questions about our customer contract, please contact us at the details below.

<b>Email:</b>	<a href="mailto:customer@arcstream.solutions">customer@arcstream.solutions</a>
<b>Phone:</b>	1800 170 150
<b>Address:</b>	15 Blue St, North Sydney NSW 2060

### 3.2. Version Control

<b>Version:</b>	ARCROVPPUGV1April2024
<b>Effective:</b>	April 2024