

Virtue FAQs

What are DUoS and TRIAD charges?

DUoS are not just a single charge for those with half-hourly meters, as charges comprise a number of distinct elements. They are as follows:

- **Fixed charge:** This is a fixed daily amount that suppliers apply to an organisation's bill, regardless of how much electricity it has actually used. This charge is used to cover the maintenance and administration costs of maintaining connection to the network.
- **Capacity charge:** This is also referred to as the availability charge and is a fixed daily fee that relates to a site's Maximum Import Capacity (MIC). If a site has a higher import capacity than it needs, money is effectively being thrown away. It is possible to reduce this figure by scheduling plant and other building services equipment and processes so they do not operate simultaneously.
- **Reactive power charges:** Some products and systems commonly found in buildings – such as fluorescent lights and air conditioning – use what's known as reactive power, which can lead to increased power flows in the distribution network. Reactive power charges will apply if more reactive units over and above a pre-determined figure are used. If levels are high then large amounts of useful electricity will, in effect be wasted, which then drives up costs. However, this can be controlled through the installation of power factor correction equipment, such as capacitors. Power factor correction can also help improve energy efficiency by reducing the amount of energy that is lost and lowering bills.
- **Unit charges:** These charges are for each unit of electricity used at various voltage levels and vary according to the time of day and how many kilowatt hours (kWh) of electricity have been consumed during each particular period. This is what we look to manage with Powerstar Virtue, by avoiding the red or peak unit charge.

TRIADS: The Triad refers to the three half-hour settlement periods with highest system demand between November and February, separated by at least ten clear days. National Grid uses the Triad to determine charges for demand customers with half-hour metering. These charges are similar to the DUoS in the sense that they are a charge that can be avoided.

What is DSR and what does it consist of?

Demand-Side Response (DSR) is any method of reducing electrical use and offering balancing services (frequency and capacity), in response to peaking demand on the National Grid. It allows system operators such as the National Grid to avoid using expensive and polluting "peaking" power stations. All the subsets of DSR are shown in figure 1.

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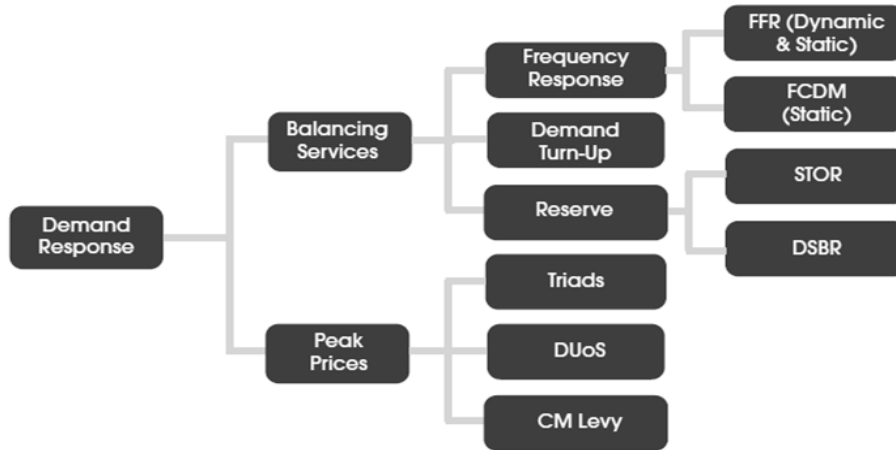


Figure 1 – All the subsets of the Demand Response Market.

What is the typical efficiency (dc out/dc in) for the battery charging /discharging cycle? How does it vary with the depth of the cycle (minimum charge level and the discharge/charge rates)?

The DC/DC Efficiency of the NMC Li – ion cells we use is 95.6% @ a discharge/charge rating of 0.5C. This can increase to 97% with lower discharge/charge ratings, with 0.23C being optimal. However, above 1C, the efficiency drops to 92 – 93%.

From 100% - 20% state of charge (SOC), the cells will see an almost consistent efficiency (depending on the c – rating), this changes below 20% SOC (over discharging) and above 100% (overcharging), where the batteries will start generating heat, and the coulomb efficiency degrades, until the battery cannot donate or receive charge.

What is C rating?

$$C_x = \frac{(\text{Output Power}) (kW)}{\text{Capacity of the battery (kWh)}}$$

Example: If we say that a battery will be discharged at 1C, and the battery has a capacity 1kWh, then in 1 hour the battery should be discharged fully. At 0.5C, the same battery would take 2 hours to discharge fully and so on. Understanding this relationship is fundamental to providing the best energy storage solution for the application, and this “C” rating must be known in order to choose the type of battery to be used in the project.

What are maximum charging and discharging rates and what effect does this have on battery lifetime?

LiFePO4: 10C pulse for 10s, with 3C constant.

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NMC: Three different batteries available with 6C - 8C pulse for 10s, and from 0.5C - 4C constant.

The specifications of almost all batteries are tested for 0.5C. The lower the discharge rating the better, and you may even exceed the cycling expectations that the specifications state. However, there is an inverse relationship between cycle life and charge/discharge rates, and this relationship becomes exponential past 1C. At 1C, 3,500 cycles may be reduced to 2500 for example. 3C may push the cycle life down to 700 – 1000 cycles.

Is there a bypass facility or a means to isolate the battery in case of an issue?

Each battery rack can be independently isolated, so that any live maintenance that is necessary can be achieved safely. If there are multiple battery faults, entire strings can be taken offline, with other strings remaining in operation, to ensure minimal revenue loss during the period of maintenance.

How fast can the system respond to an outage, and what equipment will be affected?

The system will respond to an outage within 15ms (three quarters of a 50Hz mains cycle). Almost all equipment will remain unaffected, with exception of certain types of lighting such as xenon arc lamps, which will see a flicker. If certain loads have been identified as extremely sensitive we can reduce this lag, but may increase system cost.

When battery power is introduced into the supply during a discharge, are there any effects on the load?

No, the inverter synchronises with the mains in such a way as to be seamless.

Does Virtue replace micro/ central solar inverters in new installations?

Yes, the Virtue contains its own MPPT (Maximum Power Point Tracking) charger that extracts the maximum power out of the solar panels. The solar can also be processed directly into storage, inverted and sent to the load or exported. In some scenarios however, it may be more economic to utilise separate PV micro- inverters on each solar string, or provide separate central inverters. We will choose the best option based on economics and efficiencies.

Does PV generation have any affect on paybacks with Virtue projects?

We would always encourage PV with Virtue because it will bring the facility closer to being carbon neutral. However, only if the site is considerably over producing solar energy, and

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continually exports as a result do we find that Solar reduces the payback with energy storage solutions (as we can take the excess, store it and use it for load lopping and Triad avoidance). Otherwise using night tariff to charge and day to perform peak shaving and demand response, generally offers better paybacks.

Can Virtue integrate with any renewable form of generation?

Yes, our system can integrate with Solar PV, Wind turbines, natural gas turbines, Anaerobic Digestion plants and biomass.

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