

Tesla - Powerwall



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Energy Storage

The new Tesla Powerwall battery stores energy in the home. It can be charged by Solar PV through the day, to be stored in the battery so that it can be used in the evening, and can also be charged from the grid at off peak times to reduce energy bills. With the export tariff being split 50-50 between assumed use and the grid, the Powerwall battery would store up this energy meaning you would be using 100%

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Energy Storage

Tesla is not just an automotive company, it's an energy innovation company. Tesla Energy is a critical step in this mission to enable zero emission power generation.

With Tesla Energy, Tesla is amplifying its efforts to accelerate the move away from fossil fuels to a sustainable energy future with Tesla batteries, enabling homes, businesses, and utilities to store sustainable and renewable energy to manage power demand, provide backup power and increase grid resilience.

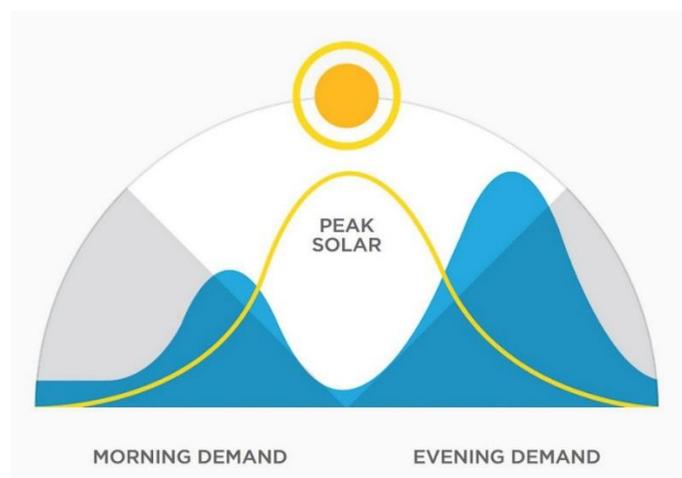
Tesla is already working with utilities and other renewable power partners around the world to deploy storage on the grid to improve the resilience and cleanliness of the grid as a whole.

Energy storage for the sustainable home

Powerwall is a home battery that charges using electricity generated from solar panels, or when utility rates are low, and powers your home in the evening. Automated, compact and simple to install, Powerwall enables you to maximise self-consumption of solar power generation.

Reducing electricity bills

In the United Kingdom, the price you are paid for the excess solar power your home generates is lower than the price you pay for electricity from the utility grid. Given this rate structure, it is more cost effective to consume your solar power than to sell it back to the utility. By storing your home's surplus power and using it when you would otherwise need to pull from the grid, Powerwall minimises your net spending.



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Existing Batteries

- Expensive
- Unreliable
- Poor integration
- Poor lifespan
- Low efficiency
- Not scalable
- Unattractive

Solar powered day and night

The average home uses more electricity in the morning and evening than during the day when solar energy is plentiful. Without a home battery, excess solar energy is often sold to the power company and purchased back in the evening. This mismatch adds demand on power plants and increases carbon emissions. Powerwall bridges this gap between renewable energy supply and demand by making your home's solar energy available to you when you need it. The savings on energy would be immediate, the equation below sets this out.

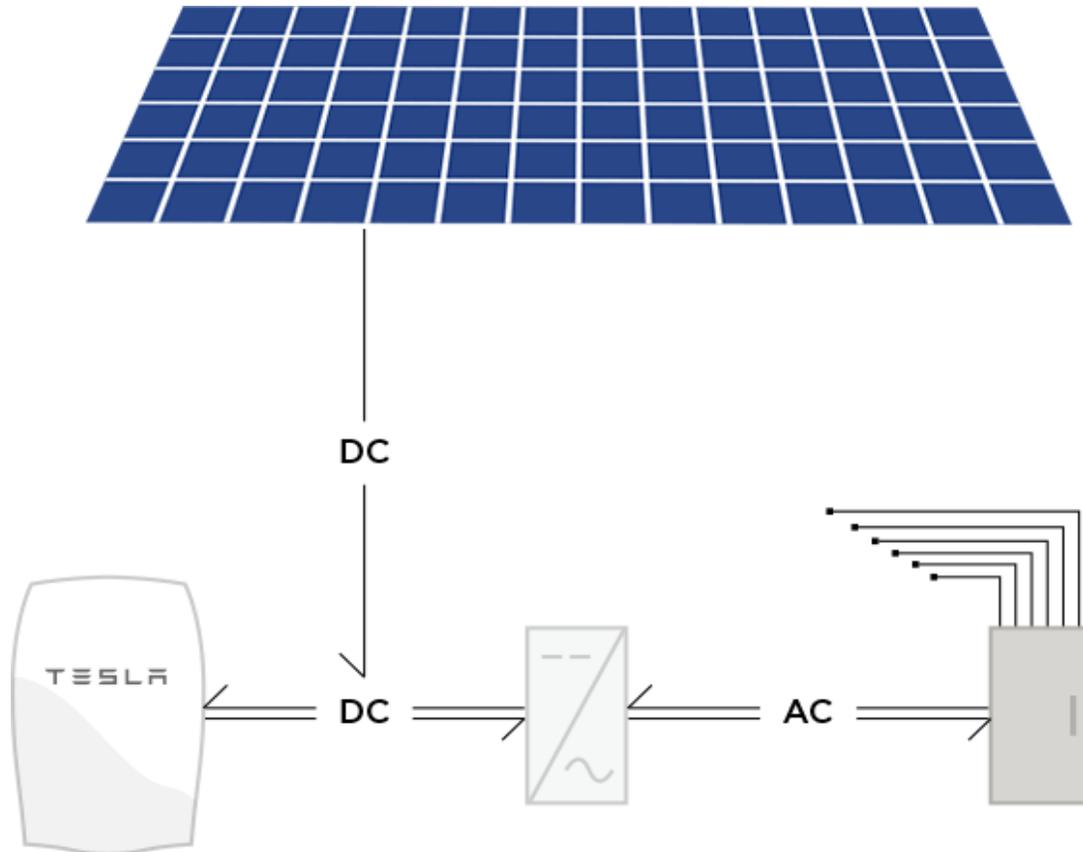
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If your Solar PV is producing 3500kwh a year and this is divided by 50% (to account for the export tariff) this equals 1750kwh, the export tariff rate is 4.85p (£0.0485) if this is multiplied by the 1750kwh it equals £84.87, yet when buying back from the grid at 15p (£0.15) the cost to the consumer is £262.50 a year. With the use of a Powerwall, at a cost of £2275 for a 10kwh system, the payback period would be 8.7 years meaning it will pay for itself within the 10 year warranty.



Capacity

Powerwall comes in 10 kWh weekly cycle and 7 kWh daily cycle models. Both are guaranteed for ten years and are sufficient to power most homes during peak evening hours. Multiple batteries may be installed together for homes with greater energy need, up to 90 kWh total for the 10 kWh battery and 63 kWh total for the 7 kWh battery.



How it Works

Home solar installations consist of a solar panel, an electrical inverter, and now a home battery to store surplus solar energy for later use.

- **Solar panel** - Installed in an array on your roof, solar panels convert sunlight into electricity.
- **Home battery** - Powerwall stores surplus electricity generated from solar panels during the day or from the utility grid when rates are low.
- **Inverter** - Converts direct current electricity from solar panels or a home battery into the alternating current used by your home's lights, appliances and devices.

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Contained within Powerwall's outdoor-rated enclosure is a rechargeable lithium-ion battery, a liquid thermal management system, a battery management system and a smart DC-DC converter for controlling power flow.



The stationary home battery offers 10 kWh of storage capacity for the relatively modest price of US\$3,500 (£2275) a smaller unit is also available at 7 kWh for \$3,000 (£1950) and homeowners can stack multiple units if needed.

Consisting of a DC to DC converter, the battery works with solar systems right out of the box (though installation is extra), to store energy during the day for powering the home at night or during outages due to storms or natural disasters.

The units can work in cold climates, operating within a temperature range of -20° C (-4° F) to 43° C (110° F). Non-solar homes can also benefit by storing energy from the grid during low rate periods and using it during expensive peak hours. The lithium-ion battery also consists of a liquid thermal control system and software that receives dispatch commands from a solar inverter.

No special battery room is needed, and the flat, roughly 4-ft by 3-ft (0.9 x 1.2 m) unit can be mounted indoors on a garage wall or the outdoor wall of a home.

In remote areas of the world that lack an energy infrastructure, Tesla likened their hopeful adoption to that of cell phones, which leapfrogged landlines in places previously without phone service. Meaning places that have no electric can be powered through the use of Solar panels and the Powerwall. Without the need for wires reaching out of countrysides benefiting those in remote locations and with intermittent heat. Powerwall automatically switches to battery power in the event of an electric company outage, bringing peace of mind to those who live in areas prone to storms or unreliable utility grids.

“It’s designed to scale infinitely, to a gigawatt class or higher,” Elon Musk



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160 million of Tesla’s power packs could power the US, and 2 billion power packs could supply energy to the entire world.

Tesla has open source patents for its technologies, with the hope that other companies will build gigafactories of their own.

Competition

Daimler - Mercedes Benz

Daimler is doing it too – the German automotive corporation is launching its own home/business battery energy storage system. Developed by Daimler subsidiary Deutsche ACCUotive, the Mercedes-Benz energy storage unit utilises lithium-ion batteries to store energy generated by solar cells, wind turbines or other sources.

The battery modules will be available in two versions – a 2.5-kWh model for homes, and a 5.9-kWh model for industrial use. Up to eight 2.5 kWh modules can be linked together to form a 20 kWh energy storage unit for use by businesses.



Daimler is now establishing sales and distribution networks, both in Germany and internationally. Mercedes-Benz energy storage units can be ordered starting this month, with shipping scheduled to begin in the autumn (Northern Hemisphere). There is currently no word on pricing.

Powerwall



Powervault’s patent pending product is a complete system in a box, including batteries, charger, inverter and control unit, which can be

installed by an electrician in an hour. It is compatible with all solar PV systems, and requires no extra equipment or significant rewiring of the home. It is a British product, conceived, designed and manufactured in the UK for the needs of UK customers.

By contrast, many other companies only sell a battery-based partial solution rather than complete home storage systems. They require spending on additional components, are more complicated to install, and are not compatible with all solar systems.

The Powervault system was created to enable households with solar panels to store the excess electricity they generate during the day and slowly release it in the evening. It allows homeowners to keep their own power for when they need it, rather than exporting it to utilities and paying more to get it back. It can lower household energy bills by up to 15%. Homes which install it continue to receive feed-in tariff payments and “deemed” export payments.



The Powervault also reduces a home’s carbon footprint. The National Physical Laboratory assessed the appliance in 2014 and estimated that each unit reduced CO2 emissions by 0.3 tonnes a year, by displacing carbon from conventional generation.

The Powervault is a modular system which is currently available in three sizes and is not reliant on a particular brand or technology. This flexible approach allows Powervault to respond quickly to market developments and ensure its range of products is tailored to the needs of UK customers.

Lithium Ion vs Led acid battery

With Tesla and Daimler both using Lithium ion batteries and Powervault using led acid batteries there is a big contrast - with the acid batteries being more expensive, less efficient, won’t last as long, requiring more maintenance and would work worse in higher temperatures, there for the Lithium ion batteries are a better, more effective option.

	Flooded lead acid	VRLA lead acid	Lithium-ion (LiNCM)
Energy Density (Wh/L)	80	100	250
Specific Energy (Wh/kg)	30	40	150

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Regular Maintenance	Yes	No	No
Initial Cost (\$/kWh)	65	120	600[1]
Cycle Life	1,200 @ 50%	1,000 @ 50% DoD	1,900 @ 80% DoD
Typical state of charge window	50%	50%	80%
Temperature sensitivity	Degrades significantly above 25°C	Degrades significantly above 25°C	Degrades significantly above 45°C
Efficiency	100% @20-hr rate 80% @4-hr rate 60% @1-hr rate	100% @20-hr rate 80% @4-hr rate 60% @1-hr rate	100% @20-hr rate 99% @4-hr rate 92% @1-hr rate
Voltage increments	2 V	2 V	3.7 V

Specs



Technology

Wall mounted, rechargeable lithium ion battery with liquid thermal control.

Models

10 kWh \$3,500
For backup applications
7 kWh \$3,000
For daily cycle applications

Warranty

Ten year warranty with an optional ten year extension.

Efficiency

92% round-trip DC efficiency

Power

2.0 kW continuous, 3.3 kW peak

Voltage

350 – 450 volts

Current

5 amp nominal, 8.5 amp peak output

Compatibility

Single phase and three phase utility grid compatible.

Operating Temperature

-4°F to 110°F / -20°C to 43°C

Enclosure

Rated for indoor and outdoor installation.

Installation

Requires installation by a trained electrician. AC-DC inverter not included.

Weight

220 lbs / 100 kg

Dimensions

52.1" x 33.9" x 7.1"
130 cm x 86 cm x 18 cm

Certifications

UL listed

Note – we usually work in KWh/yr but the Powerwall uses KWh/hr.