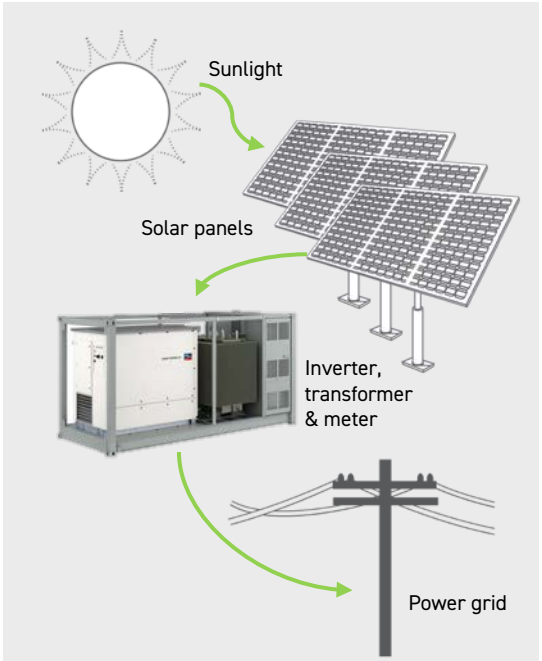
Solar + BESS

How solar energy is captured

Sunlight is composed of particles of solar energy, called photons. When these photons strike a photovoltaic (PV) cell – which is a semiconductor device – it is converted into electricity through a process called the photoelectric effect. The electrons are dislodged, absorbed by conductors, and generate an electrical current and a flow of electricity into an external circuit.

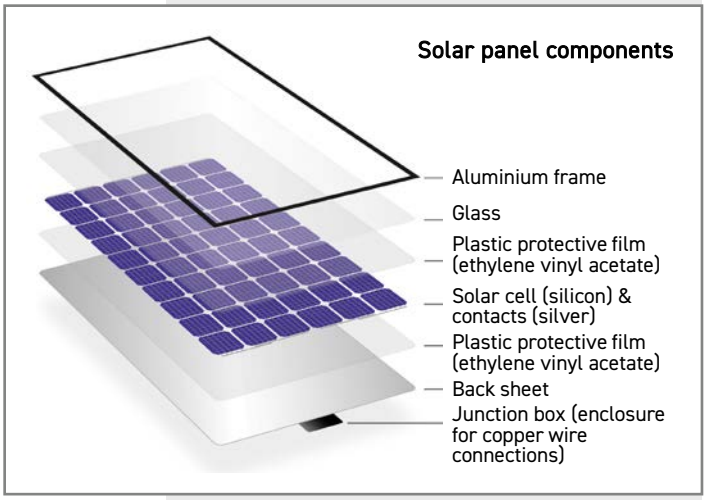
In a solar farm many solar panels are connected to form a string, and several strings are joined together and connected to an inverter. The inverter converts the electricity from the panels, which is direct current (DC) to alternating current (AC). The AC is connected to a transformer that changes the voltage to suit the transmission line which then transmits the electricity through the power grid.



Solar panel components and design

Richmond Valley Solar Farm will use silicon solar panels, which use silicon (refined sand) as the semiconductor. They have an aluminium frame, covers made of glass, wires of copper and silver, plastic to hold the components together and tiny amounts of boron or phosphorus within the solar cell.

The project is anticipated to have about 730,000 solar panels. The panels will be bifacial – which means they can produce power from both sides – and each capable of generating 690 watts of DC power. The solar farm's generation capacity would be up to 500 megawatts DC and about 118 solar inverters would convert the DC into about 480 megawatts of AC for the grid. The panels will be mounted on a single axis tracking system to maximise energy generation. They will be able to turn up to 60 degrees, to face east in the morning, follow the sun to be flat during the middle of the day, and turn to the west in the evening. The system will also have open row access for vegetation management and be designed to withstand extreme weather events.



Solar panel safety

In Australia solar panels must meet high standards for performance, safety, and reliability. Silicon solar panels are considered safe for both the environment and human health. They are fire resistant and non-toxic. The materials used (silicon, glass, plastic, copper, silver and aluminum) have been chosen for their stability. They do not release any harmful emissions, dangerous chemicals or by-products even under extreme conditions.

Example of a single access tracking system

Solar panel recycling

Solar panels and solar farms typically have an operational lifespan of 25 - 30 years. Upgrades or replacements can extend a solar panel's usability, and options at the end of a solar farm's life include extending operations via refurbishment, repowering the site with new infrastructure or decommissioning.

Most solar panel components can already be recycled, and technology and infrastructure is evolving rapidly in Australia and around the world to process decommissioned solar panels responsibly. Ark Energy will prepare a Decommissioning and Rehabilitation Plan prior to construction, and it will be updated periodically as technology and practices evolve. Ark Energy is committed to ensuring end of life management for the project aligns with the best practice recycling available at the time.

Battery energy storage system (BESS)

Richmond Valley Solar Farm includes an onsite long-duration battery energy storage system (BESS). A BESS uses batteries to store and distribute electricity. It enables variable renewable energy sources like solar to provide a stable and steady supply of electricity to the grid.

Battery type

The BESS will use lithium-iron phosphate (LFP) batteries, which are the same type of batteries commonly used in electric vehicles. LFP batteries are cobalt free, use no rare earth metals, have a safe chemical and mechanical structure and are more resilient to extreme conditions. The components within LFP battery cells include the cathode, anode, electrolyte, separators and current collectors. These are typically made from lithium iron phosphate, graphite, aluminium and copper.

How the BESS works

The cells are put together in a module that includes battery cells, busbars, battery management, cooling, safety and firefighting systems. Multiple modules are then connected together into a BESS storage container. These will be connected to battery inverters to convert the battery from DC to AC for the grid.

The BESS will store energy from the solar panels for future use. It is planned that each unit will be capable of storing up to 5 megawatt hours of energy, and the full BESS will have a discharge power capacity of up to 275 megawatts and an energy storage capacity of up to 2,200 megawatt hours over eight hours.

Each battery container will include a liquid cooling thermal management system designed to keep the batteries operating at the right temperature. Each container will also have its own comprehensive safety and fire suppression systems including detection, alarm, isolation, firewall and emergency cooling systems.

An energy management system (EMS) will monitor energy stored and manage charging and discharging of the batteries. This will provide stabilisation and inertia services to the electricity grid making the grid more resilient. It will charge when market prices are low and discharge when market prices are high which will reduce the overall cost of electricity for consumers.

Artist's impression of the BESS, which would occupy an area of approximately five hectares.

Battery recycling

LFP batteries have a longer life cycle than other batteries. They can last 2,750-12,000 cycles and when they reach their end of life they can be recycled. LFP batteries contain critical raw materials (lithium, phosphorus and graphite) so it is crucial to recycle these raw materials in an environmentally friendly way. There is a process available that separates each raw material from the battery to be recycled.

Ark Energy is committed to recycling the Richmond Valley BESS batteries when they reach their end of life. Ark Energy's parent company Korea Zinc has established a battery recycling business utilising its existing non-ferrous metals refining capability and Ark Energy's batteries will be recycled within the Korea Zinc Group.

Scan QR codes below for more information

Australian Renewable Energy Agency – Large-scale solar (web page)

Clean Energy Council – Large scale solar (web page)

Australian Renewable Energy Agency – Battery storage (web page)

CSIRO – Energy storage in Australia (web page)

Example of a DC Battery Storage Container

More information

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or scan QR code below

Scan the QR code to visit the Richmond Valley Solar Farm project website

Newsletters

Register online for email news at arkenergy.com.au/mailing-list-details, or to receive newsletters by post, send the project team your postal address and request to be added to the mail list.