

## Sunlands Energy Co. Thermal Energy Storage Technology Grant of Additional United States Patent

The Company is pleased to announce that its joint venture partner, Sunlands Energy Co. has been granted new Letters Patent from the United States Patent and Trademark Office (USPTO) for its TES Graphite Cell Technology (TES Technologies). The grant has the same priority date of 29 November 2017 as the original patent granted by the USPTO.



*United States of America*

*To Promote the Progress of Science and Useful Arts*

*The Director*  
of the United States Patent and Trademark Office has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

*Therefore, this United States*

**Patent**

**United States Patent**  
Catalano et al.

(10) Patent No.: **US 12,510,306 B2**  
(45) Date of Patent: **Dec. 30, 2025**

(54) **THERMAL BATTERY AND ELECTRICITY GENERATION SYSTEM**

(71) Applicant: **THE SUNLANDS COMPANY PTY LTD, Melbourne (AU)**

(72) Inventors: **Sal Catalano, Melbourne (AU); Bruno Ruggiero, Melbourne (AU)**

(73) Assignee: **THE SUNLANDS COMPANY PTY LTD, Melbourne (AU)**

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/627,399**

(22) Filed: **Apr. 4, 2024**

(65) **Prior Publication Data**  
US 2024/0271878 A1 Aug. 15, 2024

**Related U.S. Application Data**

(63) Continuation of application No. 16768,030, filed as application No. PCT/AU2018/051274 on Nov. 29, 2018, now Pat. No. 11,971,221.

(30) **Foreign Application Priority Data**  
Nov. 29, 2017 (AU) ..... 2017904817

(51) **Int. CL**  
**F28D 20/00** (2006.01)  
**C09K 5/12** (2006.01)  
(Continued)

(52) **U.S. CL**  
CPC ..... **F28D 20/0034** (2013.01); **C09K 5/12** (2013.01); **F28D 20/0056** (2013.01);  
(Continued)

(58) **Field of Classification Search**  
CPC ... Y02E 10/14; F28D 20/0056; F28D 20/021; F28D 20/028; F28D 20/047  
See application file for complete search history.

(56) **References Cited**  
U.S. PATENT DOCUMENTS  
4,089,176 A 5/1978 Ashe  
5,994,681 A 11/1999 Lloyd  
(Continued)

**FOREIGN PATENT DOCUMENTS**  
ES 237789 A1 \* 4/2012  
WO WO.2014057014 A1 \* 4/2014 ..... F24D 11/003

**OTHER PUBLICATIONS**  
International Search Report and Written Opinion received for PCT Patent Application No. PCT/AU2018/051274, mailed on Feb. 6, 2019, 13 pages.  
(Continued)

*Primary Examiner* — Eric S Ruppert  
(74) *Attorney, Agent, or Firm* — Workman Nydegger

(57) **ABSTRACT**  
A thermal battery includes a heat sink material that remains solid across an operating temperature range (i.e., for all operating modes) of the battery, and a heat conductive material in direct heat transfer relationship with the solid heat sink material. The heat conductive material has a melting point below that of the heat sink material so that in use the heat conductive material is a fluid, for example molten when the heat conductive material is a metal, in the operating temperature range of the battery.

9 Claims, 5 Drawing Sheets

The newly granted patent covers additional technology elements and represents a significant expansion of the claims protected under the original US patent. It delivers a broader and more robust protection of the TES Technologies and ensures Sunlands Energy Co.'s freedom to commercialise the technology.

The main additional technology elements include:

- The capability to utilise an unrestricted range of heat transfer fluids (the mechanism for the transfer of heat from the TES Graphite Cell to the thermal power plant) i.e., the electricity generation unit;
- Greater versatility in the methods of heating TES Graphite Cells; and
- Inclusion of the electricity generation unit with the TES Graphite Cell to form an Electricity Generation System

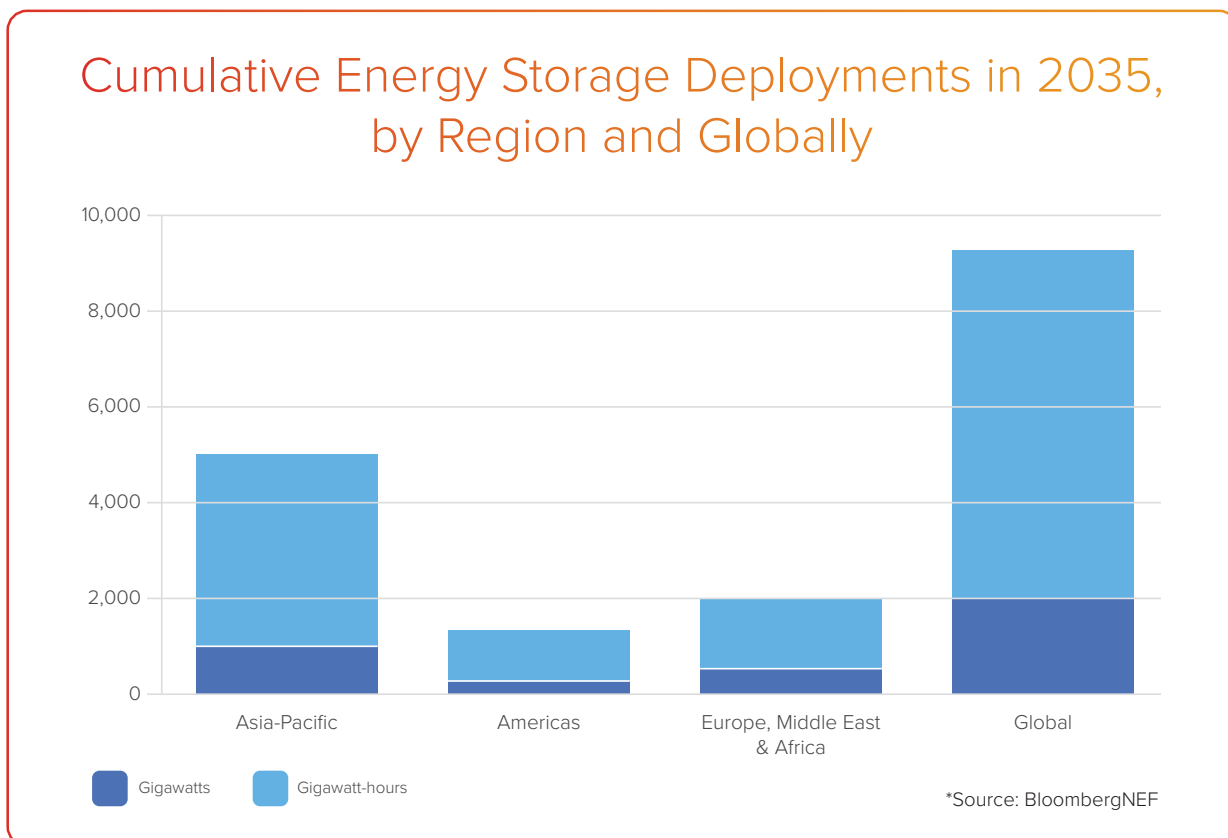
Sunlands Energy Co.'s TES Graphite Cell technology was the subject of an international patent application in November 2017 under the World Intellectual Property Organisation's Patent Cooperation Treaty, providing coverage across 155 countries. The new grant follows the grant of the first US patent and the Australian and South African patents. The patent application in Europe (including the United Kingdom) remains under examination and is expected to be granted by the end of the year.

Sunlands Power, the Company's joint venture with Sunlands Energy Co., cements Quantum Graphite's participation in a world-leading, long-duration energy storage technology, critical to the decarbonisation of our energy sector. Sunlands Power is responsible for the manufacture of TES Graphite Cells that utilise Uley 2 coarse graphite as the essential raw material and the critical component that underpins the world-leading performance of TES Graphite Cells.

These cells represent the only available technology capable of creating supercritical steam to drive commercial, industrial and utility-scale turbine generators. The technology offers coal-fired generators a viable path to retrofitting their facilities and achieving emissions-free generation. As a grid network tool, the technology has a capability (e.g., grid forming, voltage and frequency control) unmatched compared with existing technologies.

### Long Duration Energy Storage Market Context

The LDES market recognises the potential of thermal energy storage compared to all other storage technologies. The Sunlands Energy Co. TES Technologies hit the mark on the essential features that fulfill this potential. TES Graphite Cells are a low-cost system solution that delivers both economic and commercial scalability, with exceptional system lifespan and versatility.



BloombergNEF (BNEF) expects 2026 to be a record-breaking year for energy storage. In its 2H 2025 Energy Storage Market Outlook, BNEF estimated global installations of 92GW and 247GWh of energy storage capacity (excluding pumped hydro) by the end of 2025. This represents more than double the reported figures for 2023. Eighty-five percent of the 2025 installations were expected to be grid-scale systems.

The forecast annual growth for 2026 is estimated at 33%, consisting of global installations of 123GW and 360GWh. These figures suggest a compound annual growth rate of approximately 23% for the period to 2035, with cumulative global installed capacity expected to reach approximately 2TW and 7.3TWh by that time.

**FOR MORE INFORMATION PLEASE CONTACT:**

Company Secretary  
Quantum Graphite Limited  
**E:** [info@qgraphite.com](mailto:info@qgraphite.com)



**ABOUT QUANTUM GRAPHITE LIMITED**

QGL is the owner of the Uley flake graphite mineral deposits located south-west of Port Lincoln, South Australia. The company's Uley 2 project represents the next stage of development of the century old Uley mine, one of the largest high-grade natural flake deposits in the world. For further information, [qgraphite.com](http://qgraphite.com)



**ABOUT SUNLANDS ENERGY CO.**

Sunlands Energy Co. is the leading developer of thermal energy storage technology (TES Graphite Cells) designed to drive commercial, industrial and utility-scale steam turbine generators. The company's TES Graphite Cells are capable of restoring baseload generation, delivering critical synchronous support to grid networks and eliminating the large-scale curtailment of renewables generation. For further information, [www.sunlandsco.com](http://www.sunlandsco.com)



**ABOUT SUNLANDS POWER**

Sunlands Power is our joint venture with Sunlands Energy Co. for the manufacture of coarse natural flake based thermal storage media and the manufacture of TES Graphite Cells. The flake for the storage media will be sourced exclusively from the QGL's Uley mine. The manufactured media will be fitted within TES Graphite Cells and the completed cells delivered to Sunlands Co. for deployment as a grid connected long duration energy storage solution. For further information, [www.sunlandsco.com](http://www.sunlandsco.com)