MEDIA RELEASE
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Sunlands Energy Co. Thermal Energy Storage Technology Grant of United States Patent

The Company is pleased to announce that its joint venture partner, Sunlands Energy Co., has received a patent grant from the United States Patent and Trademark Office (USPTO) for its TES Graphite Cell technology.

The USPTO granted a Patent for Sunlands Energy Co.'s THERMAL BATTERY AND ELECTRICITY GENERATION SYSTEM. The patent priority date is 29 November 2017.

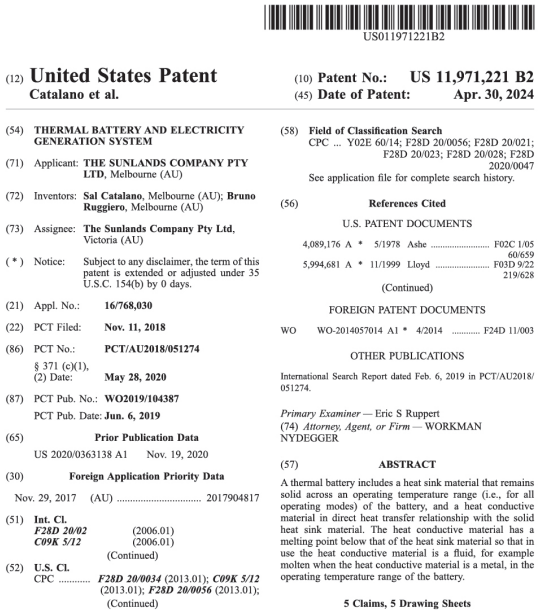

United States of America

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


US011971221B2

(12) **United States Patent**
Catalano et al.

(10) **Patent No.: US 11,971,221 B2**
(45) **Date of Patent: Apr. 30, 2024**

(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**, Victoria (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.: **16/768,030**

(22) PCT Filed: **Nov. 11, 2018**

(86) PCT No.: **PCT/AU2018/051274**
§ 371 (c)(1),
(2) Date: **May 28, 2020**

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PCT Pub. Date: **Jun. 6, 2019**

(65) **Prior Publication Data**
US 2020/0363138 A1 Nov. 19, 2020

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

(51) **Int. Cl.**
F28D 20/02 (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 60/14; F28D 20/0056; F28D 20/021; F28D 20/023; F28D 20/028; F28D 2020/0047
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS
4,089,176 A * 5/1978 Ashe F02C 1/05 60/659
5,994,681 A * 11/1999 Lloyd F03D 9/22 219/628
(Continued)
FOREIGN PATENT DOCUMENTS
WO WO-2014057014 A1 * 4/2014 ..... F24D 11/003
OTHER PUBLICATIONS
International Search Report dated Feb. 6, 2019 in PCT/AU2018/051274.

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(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.

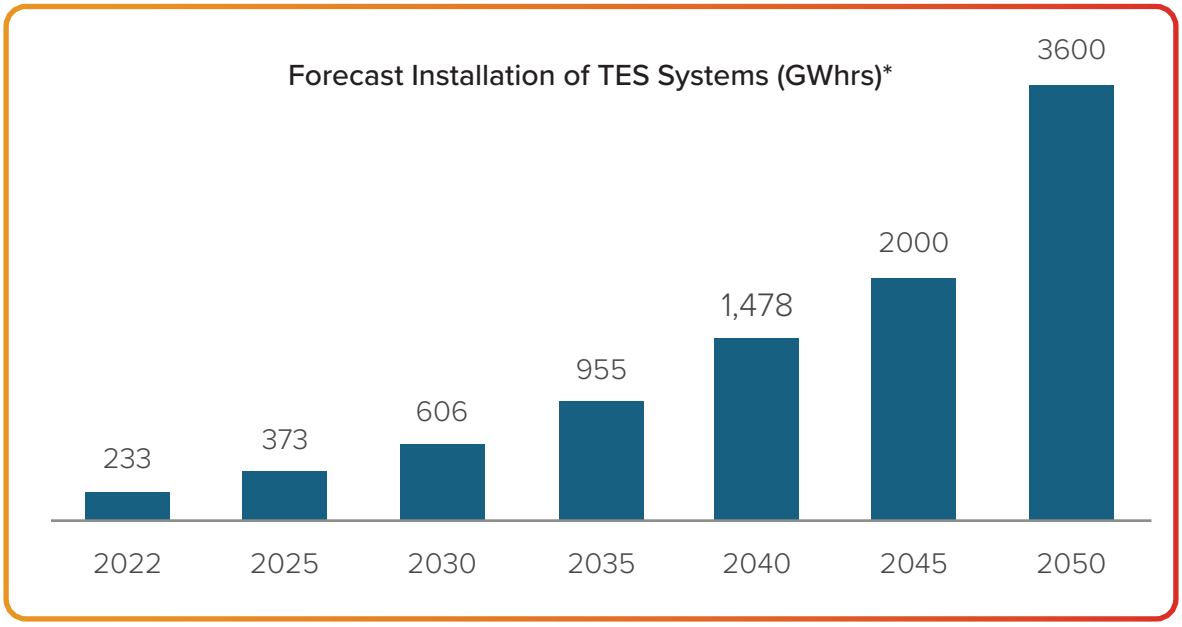
5 Claims, 5 Drawing Sheets

Sunlands Energy Co.'s TES Graphite Cell technology was the subject of an international patent application filed in November 2017 under the World Intellectual Property Organisation's Patent Cooperation Treaty which covers 155 countries. The grant of the US patent follows the South African patent grant for the same system in November 2021. Sunlands Energy Co. is now waiting on the Australian and European (including the United Kingdom) grants which are expected by the end of the year.

Sunlands Power, the 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 such as synchronous condensers.

In the last quarter of 2023, energy storage deployment achieved the highest quarter-on-quarter growth, across all segments, ever recorded in the United States. The US energy storage market is projected to grow by more than 100% within the next 5 years and experience exponential growth from 2030.



*LDES Council (www.ldescouncil.com), Catalysing the Global ETES Opportunity (System IQ 2024)

This patent grant ensures the Company's participation in the world's largest energy storage market.

FOR MORE INFORMATION PLEASE CONTACT:
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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

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

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

ABOUT TES and LDES

Thermal energy storage (TES) is a type of energy storage that stores heat typically from the conversion of renewables electricity generation. TES is an ideal solution for long duration energy storage, a scalable energy storage system that stores energy predominantly from renewable sources for more than 12 hours and capable of delivering dispatchable, synchronous energy to grid networks as required especially when renewables generation is not available. LDES is the critical solution underpinning the decarbonisation of grid networks