TALGA BREAKTHROUGH IN LI-ION BATTERY PERFORMANCE

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Corporate Information

ASX Codes	**TLG, TLGOA**
Shares on issue	**203.4m**
Options (listed)	**44.7m**
Options (unlisted)	**32.7m**

Company Directors

Terry Stinson
Non-Executive Chairman

Mark Thompson
Managing Director

Grant Mooney
Non-Executive Director

Stephen Lowe
Non-Executive Director

Ola Mørkved Rinnan
Non-Executive Director

Advanced material technology company, Perth-based Talga Resources Ltd ("**Talga**" or "**the Company**") (**ASX:TLG**), is pleased to announce it has achieved a significant breakthrough in the performance of its graphite anode material in commercial-size cells for the lithium-ion ("**Li-ion**") battery market.

In tests at leading global independent facility WMG, part of the University of Warwick's Energy Innovation Centre, Talga's graphite anode material was benchmarked against a current market leading anode graphite product.

A summary of the battery test results is appended below in the Technical Summary section. Highlights are as follows:

Test Results - Performance benefits over reference anode graphite

- 20% higher capacity (total energy)
- 20% higher power (fast charge/discharge)
- No capacity fade after 300 cycles (>99% energy retention)
- 94% first cycle efficiency
- Successful scale up - from half coin cells to commercial size pouch cell

Cost and other efficiencies over current commercial anode graphite

- No micronisation
- No spheronisation
- No milling losses (high yield)
- No coating
- Potentially less waste, energy and environmental impacts

Benefits for Talga

- Can use as a by-product of graphene production
- European Li-ion battery market growing at CAGR 24% 2020-2025
- Increased near term sales potential in addition to graphene products
- Positions Talga to enter market at higher level of Li-ion anode supply chain and higher price point
- Results show potential to exceed synthetic and natural graphite standards used by global battery component supply chain and automotive industry
- Talks underway with European and Asian based battery manufacturers and end users.

Talga Managing Director, Mr Mark Thompson:

"These results are a highly significant development for Talga. The unique characteristics of our Swedish graphite ore body combined with our proprietary processing technologies produces a Li-ion battery with significantly higher power and energy as tested by WMG.

The Company considers that based on the results, Talga's graphite will set the industry standard for lowering cost of production as it eliminates comparatively expensive industry standard spheronisation/ micronisation and coating required for material currently sourced from Chinese and other graphite flake producers. We also don't see their large milling losses resulting from milling down large graphite flakes to suit battery anode size material.

The test results and Talga's unique position in the market create optionality for scale-up development, commercial partnerships and sales of advanced materials in addition to graphene-only products in future.

Talga's significant resources positions our energy products division to evolve into a stand-alone battery technology company with exclusive access to a lower cost and unique, high performance battery grade graphite, sourced from our wholly owned deposits in Sweden."

TECHNICAL SUMMARY

Test Battery Cell Production

A range of Li-ion battery pouch cells were fabricated using Talga's graphite anode and commercial nickel manganese cobalt ("NMC") cathode at the battery prototyping facility at the Warwick Manufacturing Group ("WMG") in the UK (Fig 1). Standard industrial roll to roll processing conditions were followed to prepare large format (A5) pouch cells that are currently used in commercial EV battery packs, e.g Nissan Leaf and BMW i3 (Fig 2).

The procedure to make the battery cells starts with the formulation of the active material slurries with optimised rheology to coat anode and cathode electrodes on copper and aluminium rolls respectively. The coated electrodes are then calendered to attain higher electrode densities and required porosity. This is followed by cutting the electrodes to the required size and stacking with a separator sandwiched between the electrodes to form an A5 size pouch cell which is then filled with a standard lithium salt electrolyte ($LiPF_6$) dissolved in a carbonate solvent.

A commercial reference graphite anode was prepared at the same time and under the same conditions to the Talga material. Both Talga's electrodes and the commercial reference electrodes had identical weight inside the cells and paired with the same type of NMC cathode.

Figure 1 *Full scale pouch cells (A5) targeting 4Ah capacity containing Talga graphite anode and NMC cathode.*

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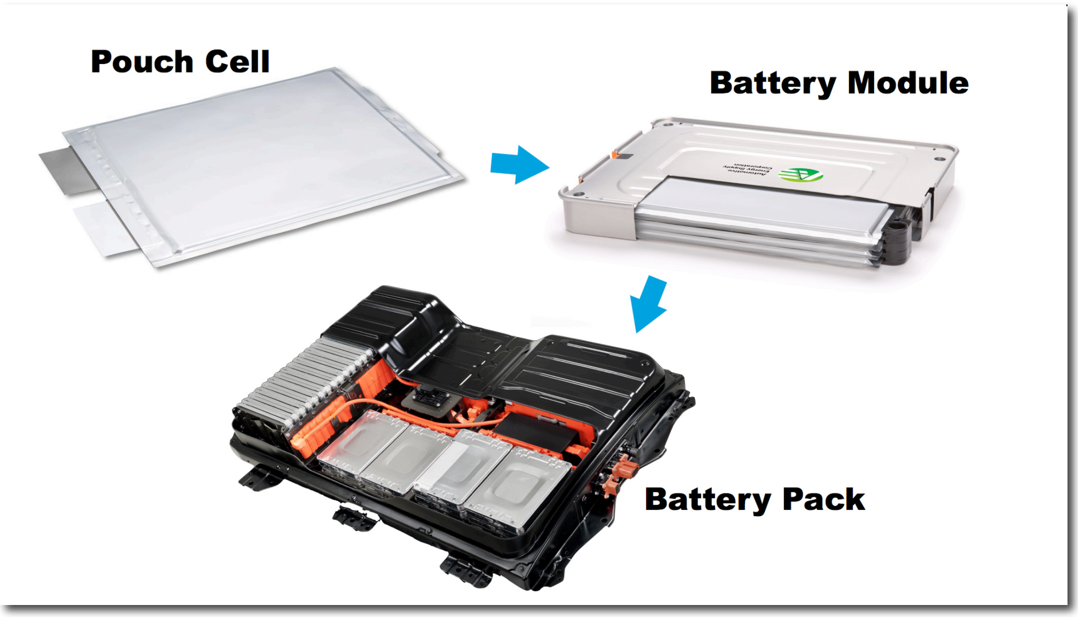
Figure 2 *Packaging of pouch cells in current commercial electric vehicle battery packs eg. Nissan Leaf, BMWi3*



Battery Tests and Results

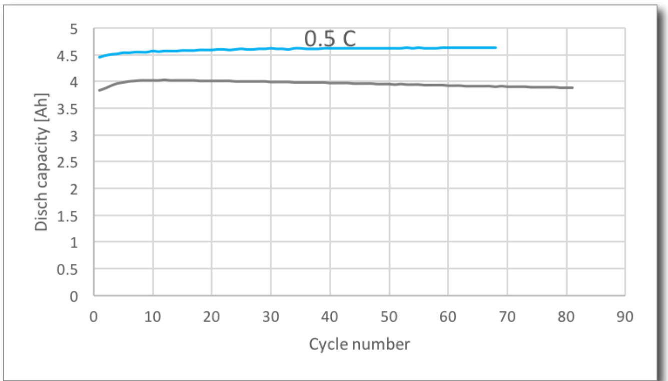
Following assembly, tests of the cells formation process and the charge-discharge cycle were performed under identical conditions for all the reference commercial graphite anode based NMC cells and the Talga anode based NMC cells.

Measurements of the pouch cell performance at WMG show significantly reduced cell resistance for the Talga anode, with higher capacity and better power characteristics compared to the commercial anode graphite benchmarked in this work. 20% higher capacity is observed for identical active material content at 0.5C and 2C rates respectively for cells with Talga's anode (Fig 3), and the first cycle loss in the full cell is lower at 6%. Talga battery cells demonstrate superior rate capability at faster charge-discharge rates up to 2C (Fig 4).

Voltage charging profiles at the higher 2C rate perform much better with the Talga anode compared to the reference graphite and is extremely stable, retaining more than 99% of their initial capacity under accelerated tests to 300 cycles. The cycling stability compares well to the best commercial cells available in the market today and indicates normal life of greater than 4,000 cycles (Fig 5).

Figure 3 *(left) Talga full capacity at 0.5C: 5.63 Ah, capacity retention at 68 cycles: 100% (5.63Ah). Reference graphite at 0.5C: 4.02Ah full capacity and 3.90Ah at 68 cycles, capacity retention: 97.0%.*

(right) Talga full capacity at 2C: 4.57Ah, capacity retention at 108 cycles: 100% (4.57Ah). Reference graphite full capacity at 2C: 3.83Ah, capacity retention at 108 cycles: 95.8% (3.67Ah).



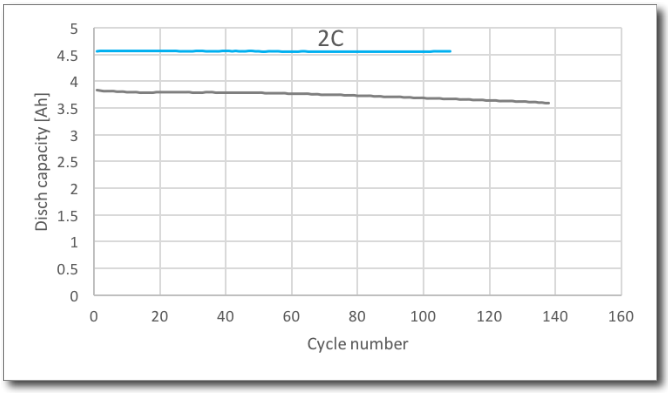


Figure 4 *Graph of the performance of the Talga cells (blue) and commercial graphite cells (grey) at different higher current discharges (Charge: CC-CV 0.5C, 1C and 2C to 4.2V with 100 mA cut, Discharge: 0.5C, 1C and 2C at 25degC).*

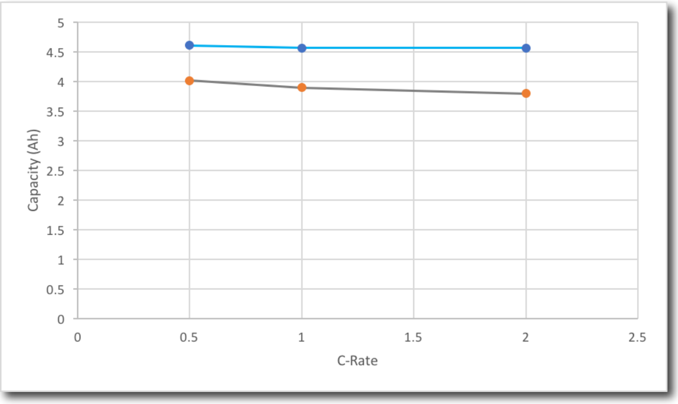
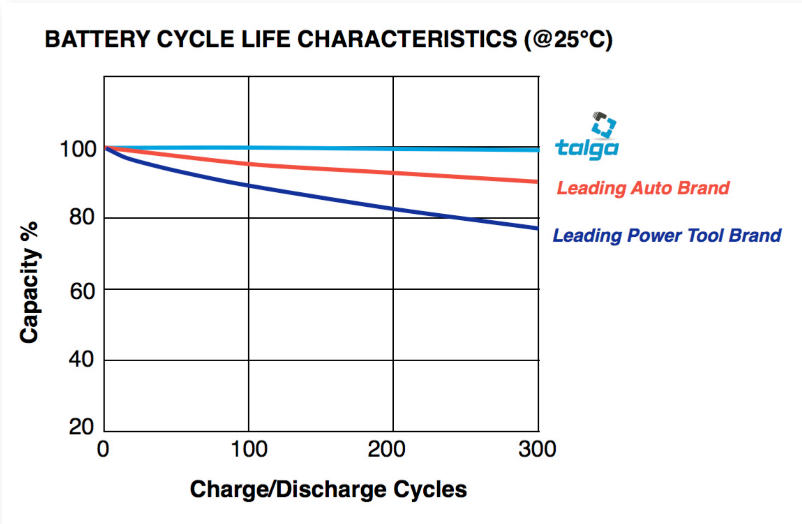


Figure 5 *Comparison of Talga battery capacity characteristics compared to available specification data from global leading electric vehicle and power tool battery makers over 300 cycles, normalised to same start discharge capacity, showing stability of Talga's graphitic carbon anode.*



Conclusions and Next Steps

The results show potential for Talga graphite anodes to exceed synthetic and natural graphite standards used by the global battery component supply, with higher performance, energy, power and life span at potentially lower cost and no decrease in safety (Fig 6). Additionally the results open up potential for Talga to enter the Li-ion battery anode supply chain at a much higher level (and higher price point).

With Talga's large and high grade graphite resources, in house technical team, unique product and cost profile there is clear potential for near term sales in addition to graphene products, particularly in Europe where the Li-ion battery market is growing rapidly (CAGR 24% for 2020-2025*). Talks are underway with major European and Asian based battery manufacturers and end users.

For further information, visit www.talgaresources.com or contact:

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* Data compiled from Bloomberg, Recruit, Avicienne and UBS.

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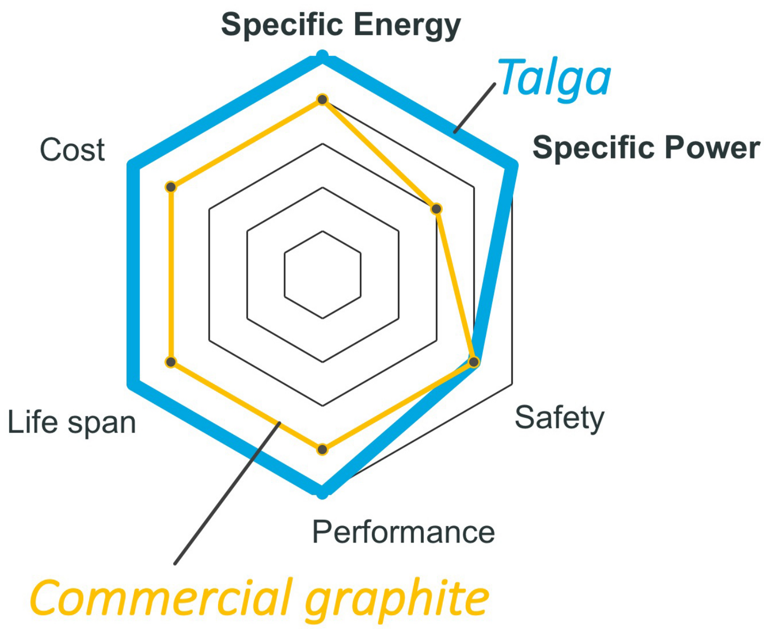
Figure 6 *Illustrative summary of Talga battery cell characteristics compared to current commercial cells showing the Talga battery has demonstrated higher performance, energy, power and life span with a potentially lower cost and no decrease in safety.*



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About Talga

Talga Resources Ltd ("Talga") (ASX: TLG) is a technology minerals company enabling stronger, lighter and more functional graphene and graphite enhanced products for the multi-billion dollar global coatings, battery, construction and carbon composites markets. Talga has significant advantages owing to 100% owned unique high grade conductive graphite deposits in Sweden, a test processing facility in Germany and in-house product development and technology. Advanced product testing is underway with a range of international corporations including industrial conglomerate Chemetall (part of BASF), Heidelberg Cement, Tata Steel, Haydale, Zinergy and Jena Batteries.

TECHNICAL GLOSSARY

Anode	The negative electrode in a battery during discharge. It refers to the electrode in an electrochemical cell where oxidation takes place, releasing electrons across a load cell. In Lithium-ion batteries, it consists of graphite and other carbons coated on copper.
Aqueous anode formulation	A chemical formulation that contains graphite mixed in a water based solution which is suitable to be coated on copper and dried to leave a pure graphite based layer to form the Li-ion battery anode.
Battery capacity	The total battery capacity, usually expressed in ampere-hours or milliampere-hours, available to perform work. The actual capacity of a particular battery is determined by a number of factors, including the material properties, cut-off voltage, discharge rate, temperature, method of charge and the age and life history of the battery.
Battery efficiency	Refer to coulombic efficiency.
Battery module	An assembly of cells in series and parallel encased in a mechanical structure.
Capacity	Capacity represents specific energy in ampere-hours (Ah). Ah is the discharge current a battery can deliver over time.
Capacity fade/ ageing	Permanent loss of capacity with frequent use or the passage of time due to unwanted irreversible chemical reactions in the cell.
Cathode	Electrode that, in effect, oxidises the anode or absorbs the electrons. During discharge, the positive electrode of a voltaic cell is the cathode. When charging, that reverses and the negative electrode of the cell is the cathode.
Charge	The conversion of electric energy, provided in the form of a current, into chemical energy within the cell or battery.
Cell	A closed electrochemical power source. The minimum unit of a battery comprised of 4 key components including cathode, anode, electrolyte and separator. Li-ion battery cells come in three different shapes (design architecture) being prismatic, cylindrical or pouch.
C-rate	C-rate is a measure of the rate at which a battery is charged relative to its maximum capacity. A 1C rate means that the charge current will charge the entire battery in 1 hour (60 minutes), 0.2C means complete charging is made during 5 hours (60minutes/0.2 = 5 hours) and 5C means that complete charging was made in 12 minutes (60 minutes/5 = 12 minutes).
Coin cell	An electrochemical device, composed of positive and negative plates and electrolyte, which is capable of storing electrical energy. It is the basic “building block” of a battery in lab scale tests using circular half or full coin shaped cells.
Coulombic efficiency	The ratio (expressed as a percentage) between the energy removed from a battery during discharge compared with the energy used during charging to restore the original capacity.
Cylindrical cell	Components of a battery assembled inside a cylindrical metal container.
Discharge	The conversion of the chemical energy stored within a cell to electrical energy, and the subsequent withdrawal of this electrical energy into a load.
Few layer graphene (FLG)	Stack of graphene having a total thickness of 5 layers or less.

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Graphene	A single atom thick layer of crystalline carbon, with properties of strength, conductivity and transparency that stem from its unique 2D structure.
Graphene nanoplatelets (GNP)	Stack of Graphene having a total thickness of 5-100 layers and properties of strength and conductivity that far exceed that of Graphite.
Graphite	An allotrope of carbon in which carbon has sp2 hybridisation. Can be found as a natural mineral or can be synthesised using great pressure and temperature. Natural Graphite consists of many stacked layers of Graphene, approximately 3 million layers of Graphene per millimetre of Graphite.
Lithium	A soft, silvery-white metallic element of the alkali group, the lightest of all metals.
Lithium-ion	Elemental Lithium devoid of an electron having an oxidation state of +1.
Lithium-ion battery	Rechargeable battery where lithium-ion shuttles between graphitic anode and cobalt, manganese, nickel and/or other metals in combinations as cathode.
mAh/g	Milli Ampere hours/ per gram – a unit for battery capacity/materials.
Milling	The process of breaking material into small fine parts by grinding following crushing, or machining/cutting material using rotating equipment.
NMC	Lithium Nickel Manganese Cobalt Oxide ($LiNiMnCoO_2$ or NMC). Is one of the most successful Li-ion systems is a cathode combination of nickel-manganese-cobalt (NMC). These systems can be tailored to serve as Energy Cells or Power Cells.
Packaging efficiency	The mechanical structure used to contain and protect a battery's components (cells, electronic circuits, contacts etc.) – the efficiency with which the battery components can be packed in a given volume.
Pouch cell	Battery cell packaged into a flat-shaped flexible, heat-sealable foil pouch.
Prismatic cell	A slim rectangular sealed battery cell in a metal or inflexible case. The positive and negative plates are stacked usually in a rectangular shape rather than rolled in a spiral as done in a cylindrical cell.
Rate Capability	The rate capability specifies the speed a battery is charged or discharged
Reversible Capacity	The reversible capacity is the capacity that is available to the load after the electrode is formed.
Roll to roll fabrication	Continuous fabrication of battery cells using rolled sheets of battery components and coating them with the active materials as they roll onto a spool for subsequent cutting and packaging into cells.
Shaping/ Spheronising	The milling of graphite flakes into sub-15 micron sized spherical shaped particles to reduce size and surface area to suit formulations for Li-ion battery anodes.
Specific Capacity	Specific energy, or gravimetric energy density, defines battery capacity in weight (Wh/kg); energy density, or volumetric energy density, reflects volume in litres (Wh/l). Products requiring long runtimes at moderate load are optimised for high specific energy; the ability to deliver high current loads can be ignored.
WMG	Warwick Manufacturing Group belonging to the University of Warwick, UK.

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