

# Talga London Presentation for the Benchmark Mineral Intelligence Tour

Advanced materials company, Talga Resources Ltd (ASX: TLG or Talga), is pleased to provide a copy of the presentation delivered Monday, 6th June, by Managing Director Mark Thompson at the Benchmark Mineral Intelligence Tour event in London, United Kingdom.

The presentation is available on the Company's website via the link below:

<http://www.talgaresources.com/irm/content/presentations.aspx?RID=301>

For further information, visit [www.talgaresources.com](http://www.talgaresources.com) or contact:

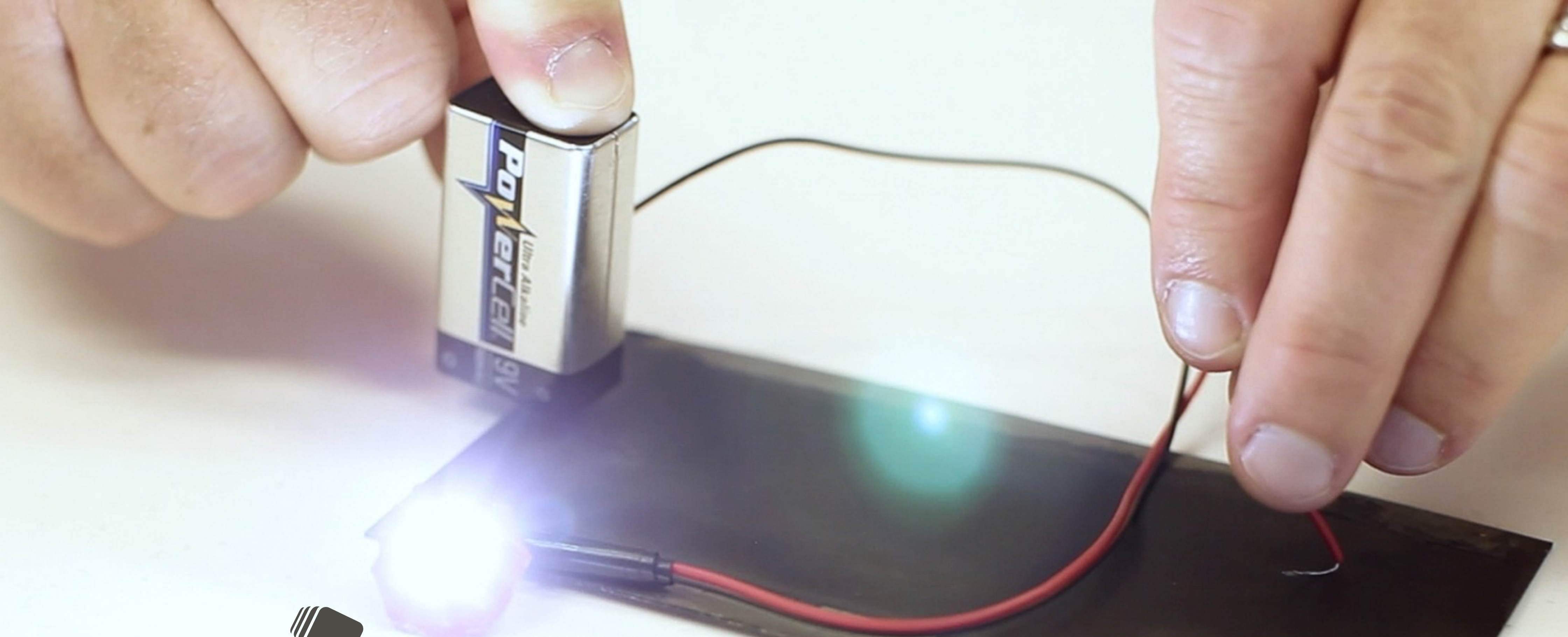
Mark Thompson  
Managing Director  
**Talga Resources Ltd**  
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## About Talga

**Talga Resources Ltd** ("Talga") (ASX: TLG) is an advanced materials company with patent pending technology to produce industrialised supply of graphene and micrographite sourced from its 100% owned natural graphite ore deposits in Sweden. Talga's unique deposits and proprietary processes provide a potential path to production that overcomes cost and volume barriers impeding supply. Micrographite as well as graphene platelets are being manufactured for industry partners at Talga's German pilot scale test-work facility.

The Company's processing technique relies on Talga's unique natural source and bypasses the need for traditional milling. Pristine particle morphology is maintained and significant operational and capital expenditure benefits are anticipated. Talga has the opportunity to be a global leader with respect to pricing, volume and quality of graphitic advanced materials in key sectors like construction, coatings, energy and composites.





# Talga Resources Ltd

**ASX:TLG**

**Benchmark Mineral Intelligence Tour | London 2016**

**6 June 2016**



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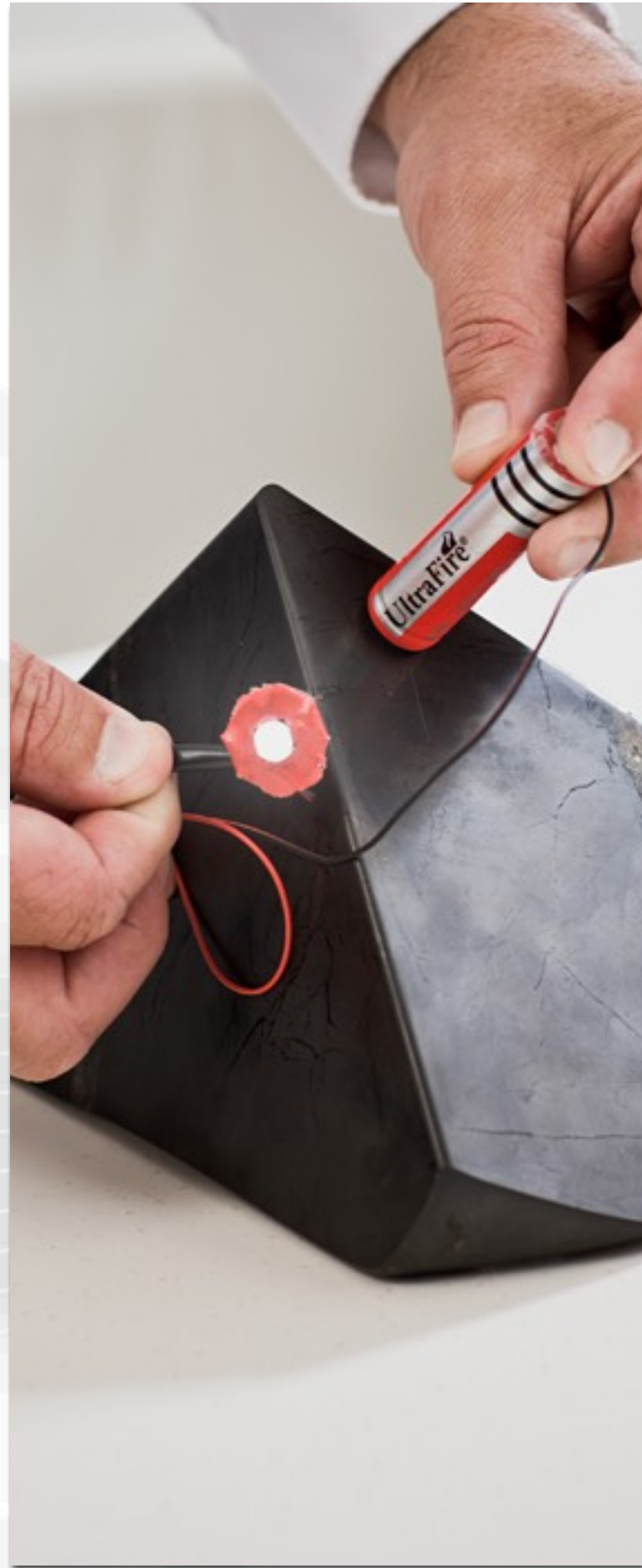
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# What we do



- ▶ Talga is an **advanced materials** company with a **scalable** and **cost effective** process to liberate **graphene** and **graphite** from its large **high quality** graphite ore deposits **without** crushing or grinding.
- ▶ Talga is a listed public company on the Australian Stock Exchange (**ASX:TLG**) with operations in Sweden and Germany.
- ▶ Potential to be worlds best margin, large volume supplier of graphene and related ultrathin micrographite materials for battery applications.



# Talga is different

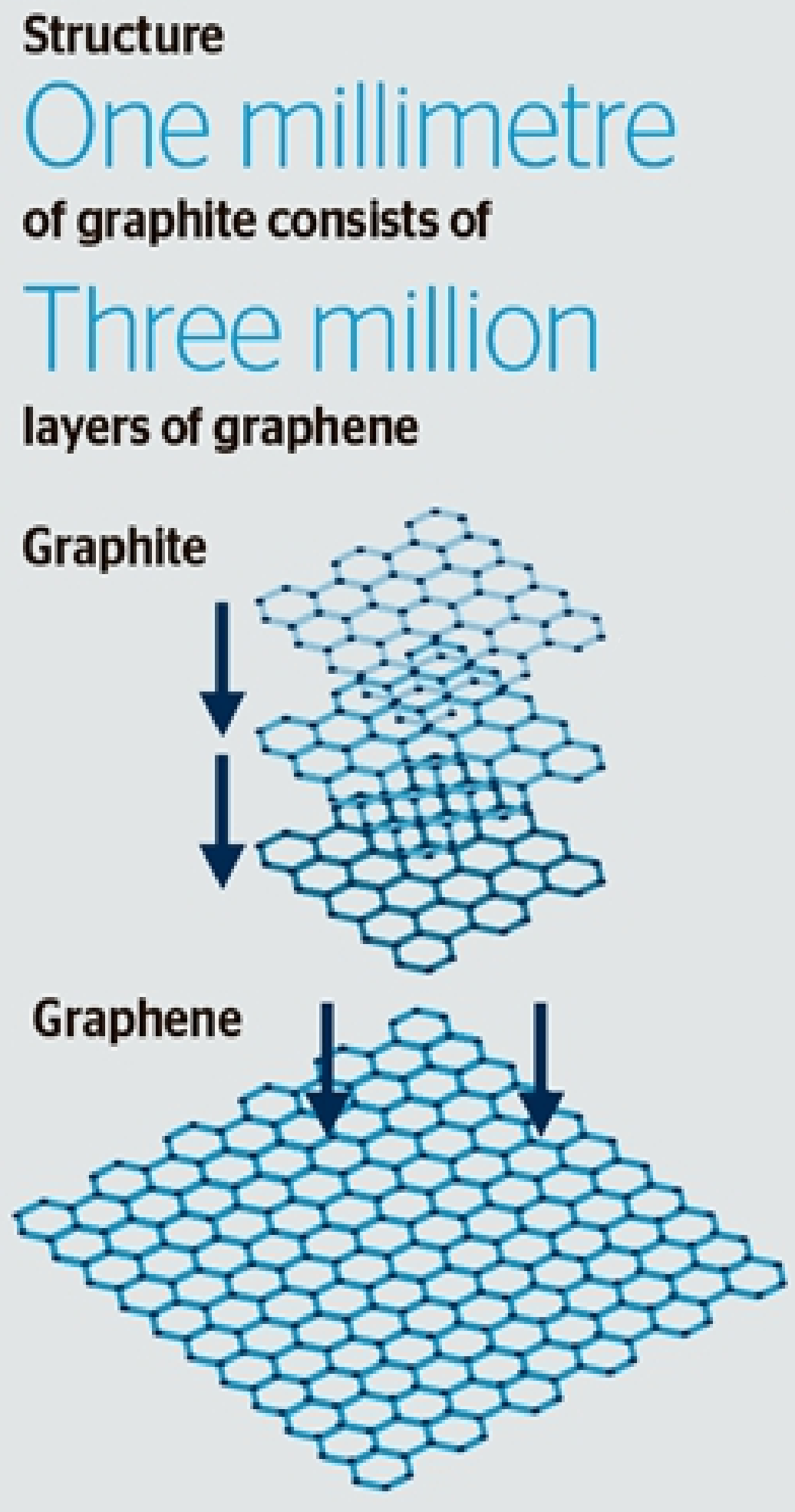
Talga Vittangi ore  
25.3% graphite

Synthetic  
99.9% graphite



- ▶ World's **highest grade** JORC/NI43-101 graphite resource<sup>#</sup>
- ▶ **Process technology** requires **no crushing, no grinding**
- ▶ Deposit in **Sweden** - top class jurisdiction
- ▶ German pilot plant **scaling up technology** and **sample supply** to customers
- ▶ Potential to be disruptive in **energy** (batteries) and **advanced material** (functional) products
- ▶ **Low** capex/opex/funding requirements

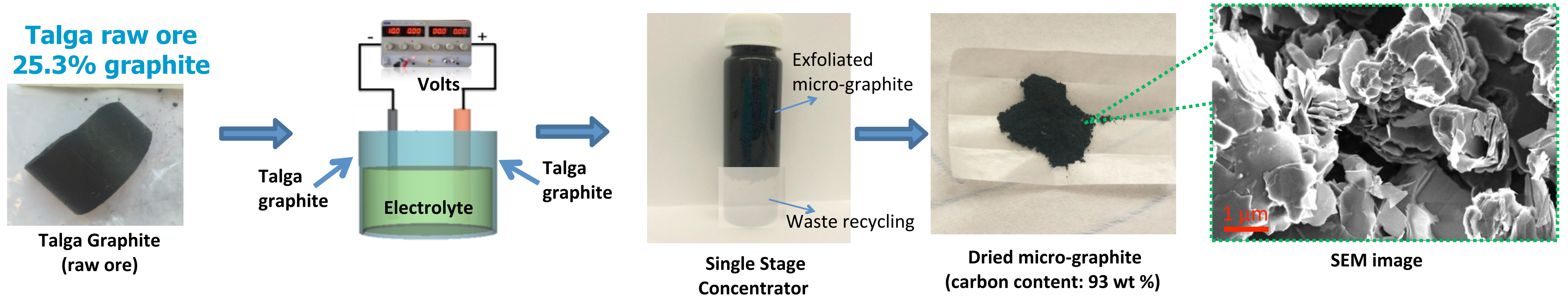
# Graphite and Graphene



- ▶ **Graphite** - is crystalline carbon, arranged in stacked layers of hexagonal sheets (graphene)
- ▶ **Graphene** can be easily made technically, but the high costs and lack of scalable methods has bottlenecked industry
- ▶ **Micrographite** is graphite less than 40 microns diameter. It can be used in applications spanning from batteries to refractories, brake linings, lubricants and foam panels
- ▶ Can be processed into 'galaxy' of materials - extraordinary conductivity, strength and other properties increase the closer you are to single layer (graphene)
- ▶ Graphene dubbed the 'wonder-material' with potential uses as an additive across almost all physical materials



# Talga Process Technology



- ▶ Patent pending technology liberates **graphene and micrographite** directly from **raw ore**
- ▶ **Process** requires **no crushing, no grinding, no jet milling**
- ▶ Makes **ultrafine** and **ultrathin** size particles **without** rounded edges, a type of material not previously available **economically** at this **scale**
- ▶ Lowers **energy, costs** and **emissions**
- ▶ Potentially higher performance in some applications



# Non-Spherical Thinking



Spheronised Graphite

Peer Processing Steps

Crush
Grind Stages
Flotation stages
Micronisation
Purification (chemical/thermal)
Shaping (spheronisation)
Coating
Mix binder and dispersant



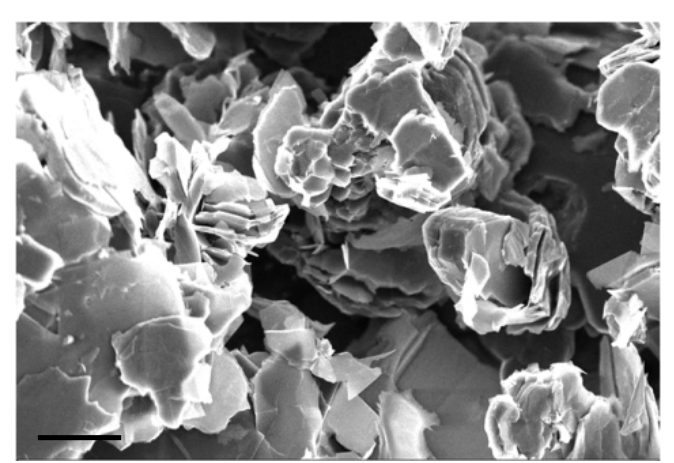
Battery average capacity ~360 mAh/g



Talga Graphite

Talga Processing Steps

Exfoliate
↓
Concentrator single stage
↓
↓
↓
Mix binder and dispersant



Battery average capacity ~360 mAh/g

- ▶ Ore is directly electrochemically exfoliated into ultrathin flakes (graphene and micrographite)
- ▶ Benefits:
  - Potentially **lower** energy and environmental **cost**
  - Suits **current** and **emerging** battery technologies (Silicon anode, Li-S, Li-al, Li-air, Flow, Printable,3D)
  - Unique **deposit** and patent pending **process** enables differentiation, price advantages and market **leadership** potential



# Corporate Snapshot

## Capitalisation Summary 3 June 2016 (AUD\$)

Shares on issue (TLG Ordinary)	<b>146.3M</b>
Unlisted Options <sup>1</sup>	<b>23.3M</b>
Market Capitalisation (undiluted @ \$0.27)	<b>\$40M</b>

## Board

Managing Director - **Mark Thompson**

Chairman - **Keith Coughlan**

Non-Executive - **Grant Mooney**

Non-Executive - **Stephen Lowe**

Cash (end of Mar 2016) ~**\$3.8 million**. Nil Debt.

## Top 5 Shareholders <sup>2</sup>

Lateral Minerals Pty Ltd (M.Thompson)	<b>9.8%</b>
HSBC Custody Nominees Australia Limited	<b>4.7%</b>
Yandal Investments Pty Ltd (M. Creasy)	<b>3.8%</b>
Gregorach Pty Ltd and related entities	<b>3.5%</b>
UBS Nominees Pty Ltd	<b>2.6%</b>

## ASX: TLG year to date share price



<sup>1</sup> Various expiry and strike prices 45-65c

<sup>2</sup> Holdings rounded to nearest decimal point, as at 3 June 2016

# How we intend to make money

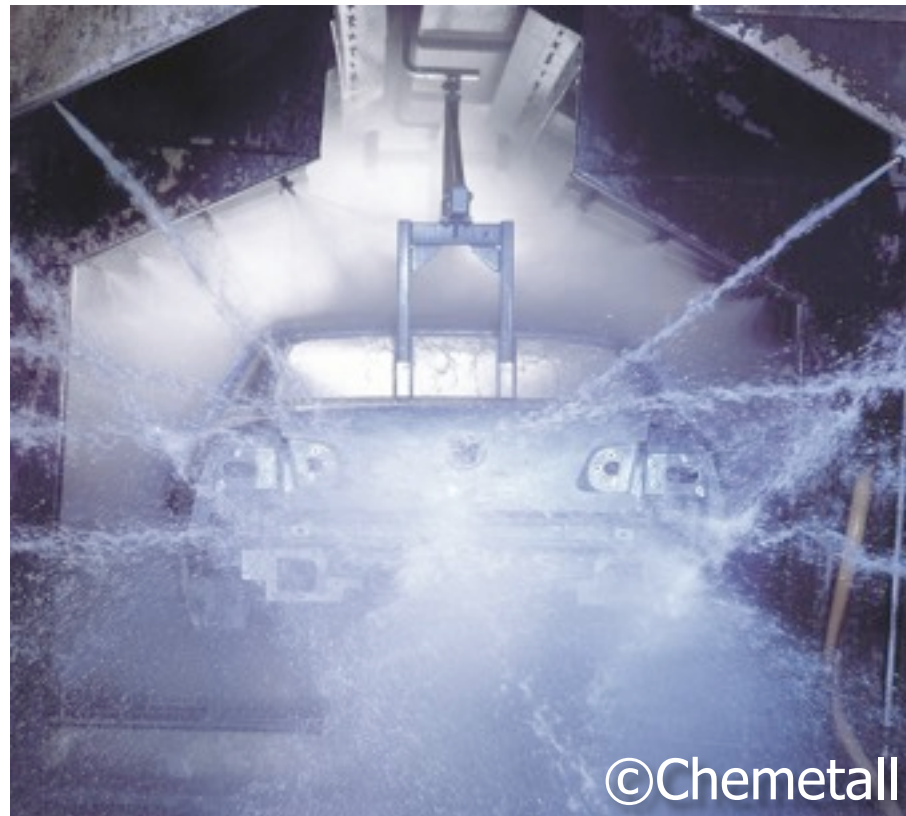


- ▶ Patent pending high volume efficient process and large high quality carbon supply
  - ▶ **Future revenues:**
    - Graphene and micrographite **raw products**;
    - **Value added** materials; and
    - **Licensing** deals on product use, application systems and market exclusivity.
- ▶ Economic Model<sup>a</sup> shows low capital 20 year operation
- ▶ Products can be used **across** the battery material chain; anodes, cathodes, casing coating, membranes, separators, current collectors, conductive polymers, pack composites and printed circuits



# Target Markets

## Coatings



### Corrosion Protection

Market Size: \$11B (2013)  
Metal pretreatments for steel and aluminium,  
Anti-corrosion coatings,  
Anti-fouling coatings

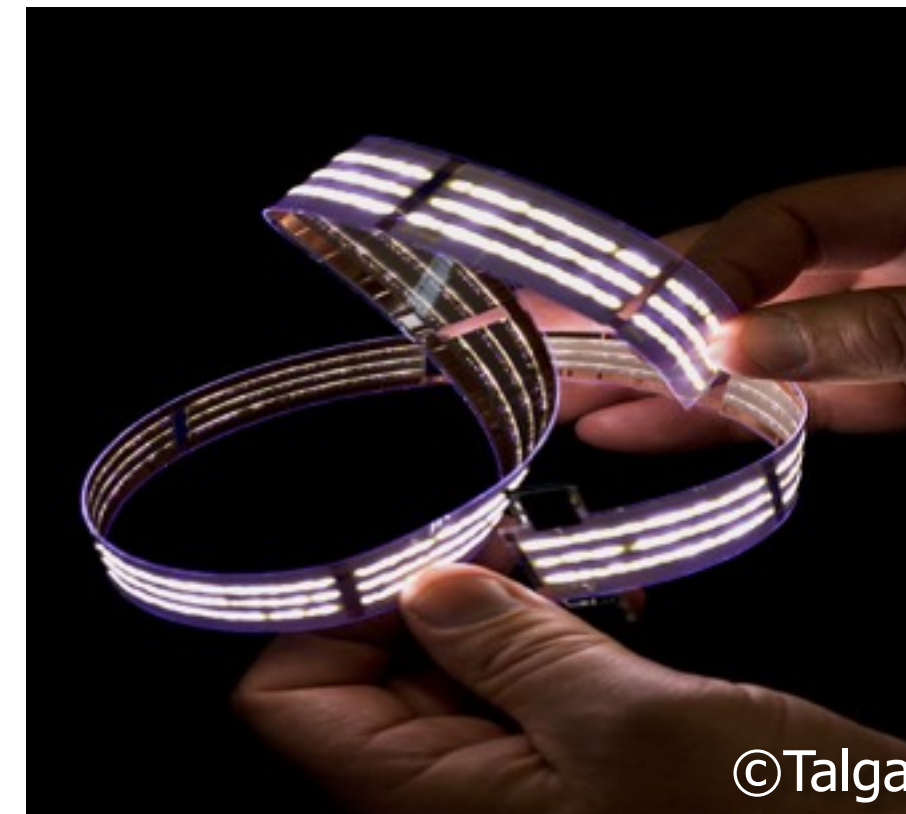
## Energy



### Batteries

Market Size: \$24B (2015)  
Conductive materials for Li-ion batteries, Printed batteries, Flow batteries, Fuel Cells and other harvest-store-transmit devices

## Conductives



### Conductive Ink

Market Size: \$18B (2015)  
Printable conductive ink for batteries and circuits in Internet of Things, Wearables and Medical devices

## Construction



### Concrete

Market Size: \$450B (2012)  
Conductive concrete  
High Strength concrete  
Functional concrete



# Talga Projects and Markets

PRODUCTS AND APPLICATIONS

GRAPHENE

vFLG = Very Few Layer Graphene (1-3 sheets)  
Flexible electronics, Water membranes, Bio-tech

FLG = Few Layer Graphene (2-5 sheets)  
Sensors, Conductive ink, Li-Air batteries

MLG = Multilayer Graphene (2-10 sheets)  
Functional coatings, Composites, Plastics

GNP = Graphene Nano Platelets (10-150 sheets)  
Functional coatings, Fuel cells, Cement and road additives

GRAPHITE

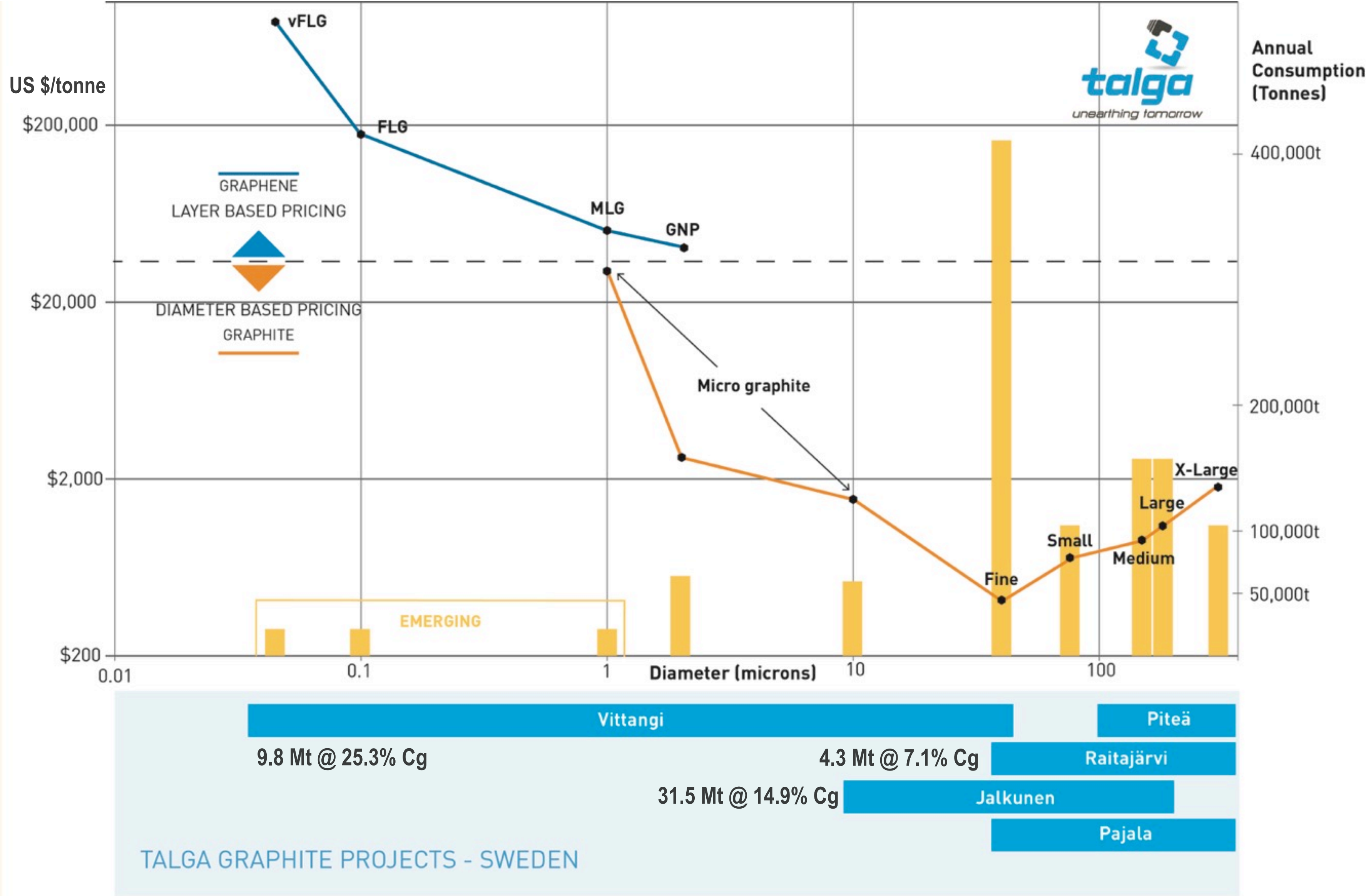
Micro to X-Large = Flake graphite (>3,000 sheets)

Micro - Insulation and construction products, Lubricants, Pencils, Flame retardants, Additives, Li-Ion batteries

Fine - Refractories

Small-Large - Recarburisers, Li-Ion batteries

X-Large - Various industrial uses





# EU Operations



## Research, Development and Analytics

- ▶ JV Uni of Dresden/Max Planck
- ▶ Friedrich-Schiller-University Jena

## Local Industry/Potential End users

- ▶ EU Graphene Flagship



## German Operations

*Talga Advanced Materials GmbH*

- ▶ Rudolstadt Pilot test facility

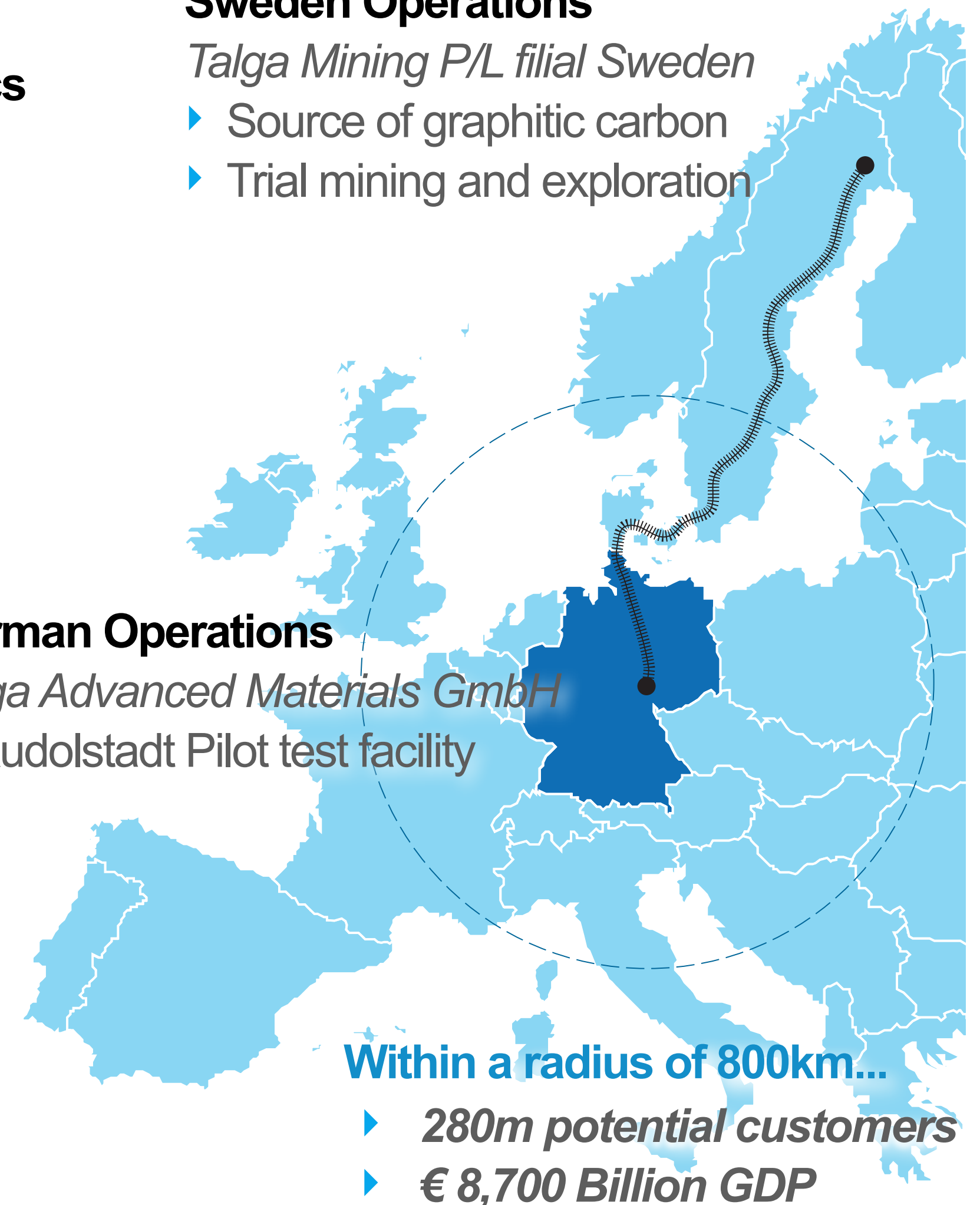
## Consultants

- ▶ General Research GmbH
- ▶ Conduit to research, industry, local finance

## Sweden Operations

*Talga Mining P/L filial Sweden*

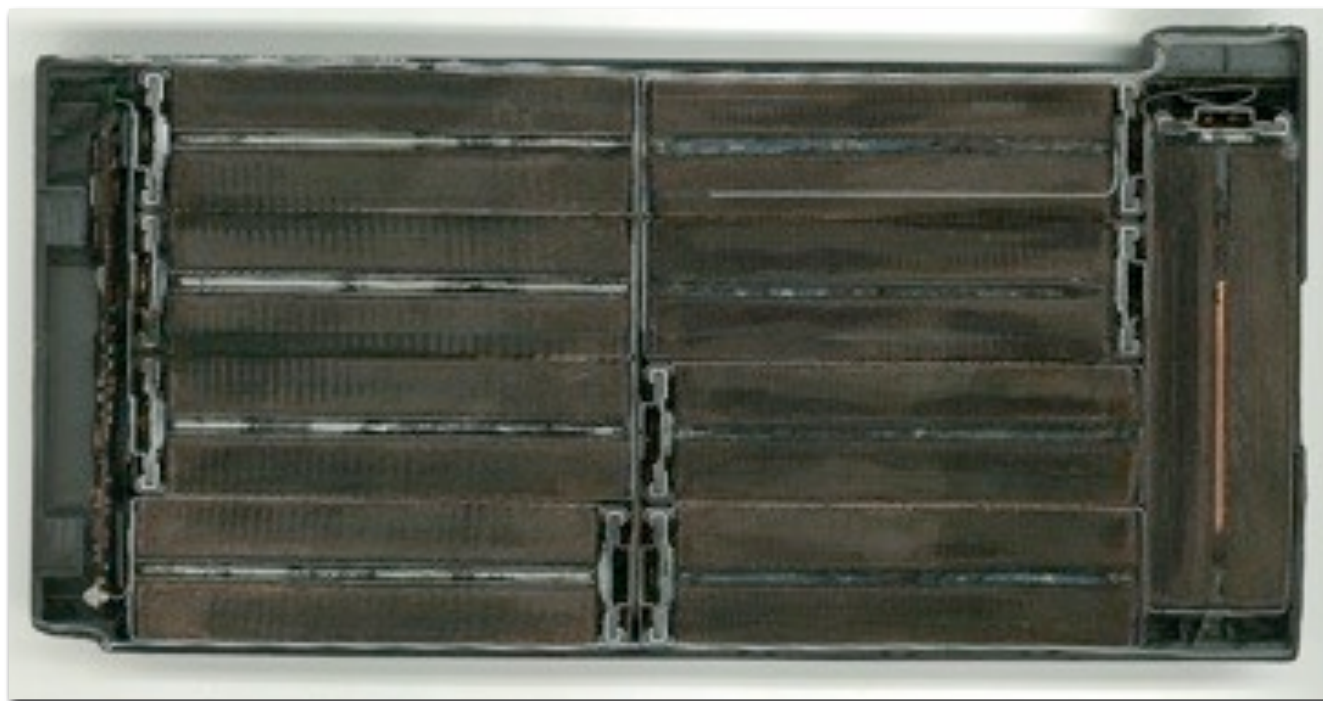
- ▶ Source of graphitic carbon
- ▶ Trial mining and exploration



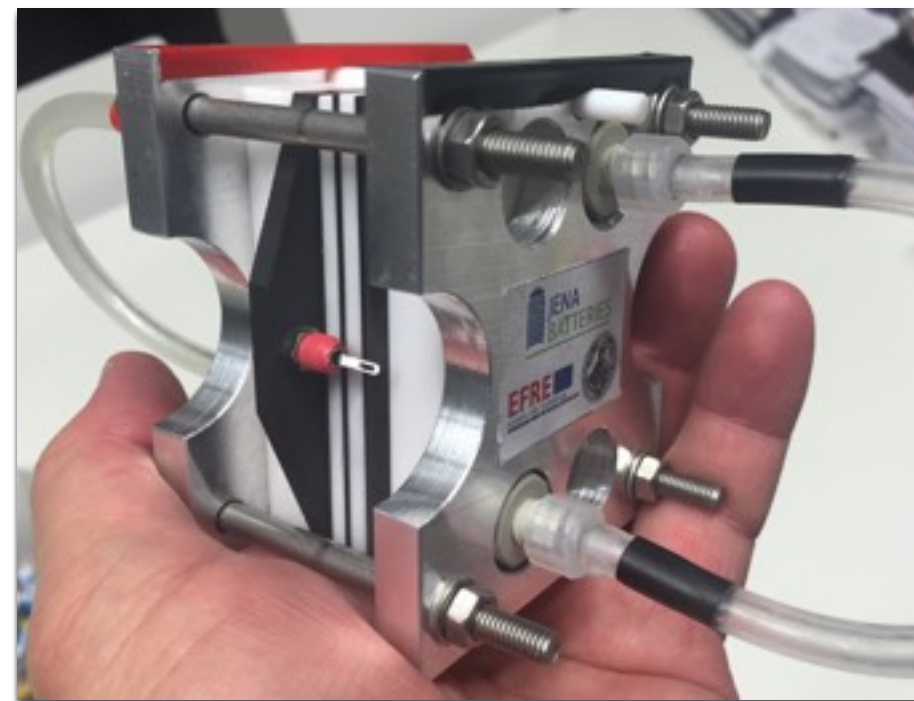


# Energy - Storage (batteries)

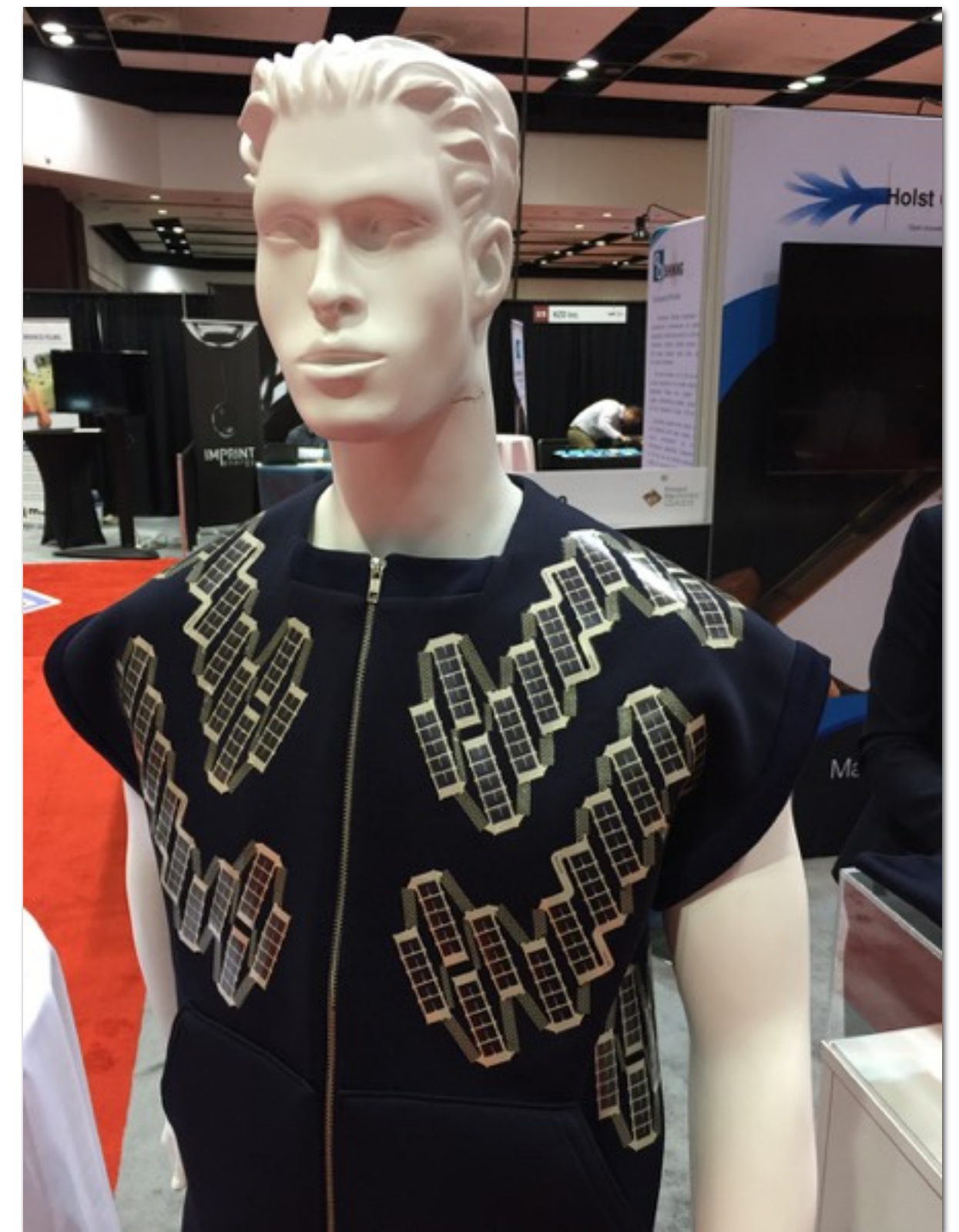
- ▶ Talga produces graphite in the **same process** as the graphene
- ▶ Graphite is currently a significant component of **many types** of energy storage devices
- ▶ Advantage of Talga is less energy (**no grinding, micronising and spheronisation**) to produce sized graphite for Li-ion anodes. Positive first tests of anodes at Max Planck Institute
- ▶ Ability to make multiple battery types for both current and emerging technologies increases market and captures exposure to disruptive new products



Li-ion battery graphite



Flow battery current collector



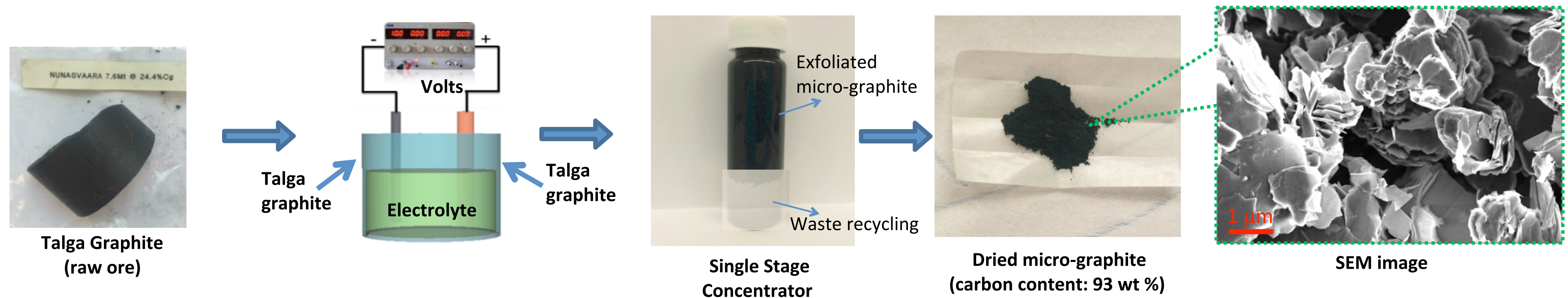
Wearable batteries, solar cells and flexible circuits



# Positive first Li-ion anode tests

- ▶ **Max Planck Institute** and **TU-Dresden** tests highlighting process steps used by Talga in achieving  $\sim 360\text{mAh/g}$  Li-ion battery anode graphite
- ▶ Further tests underway on larger scale batteries before material optimisations

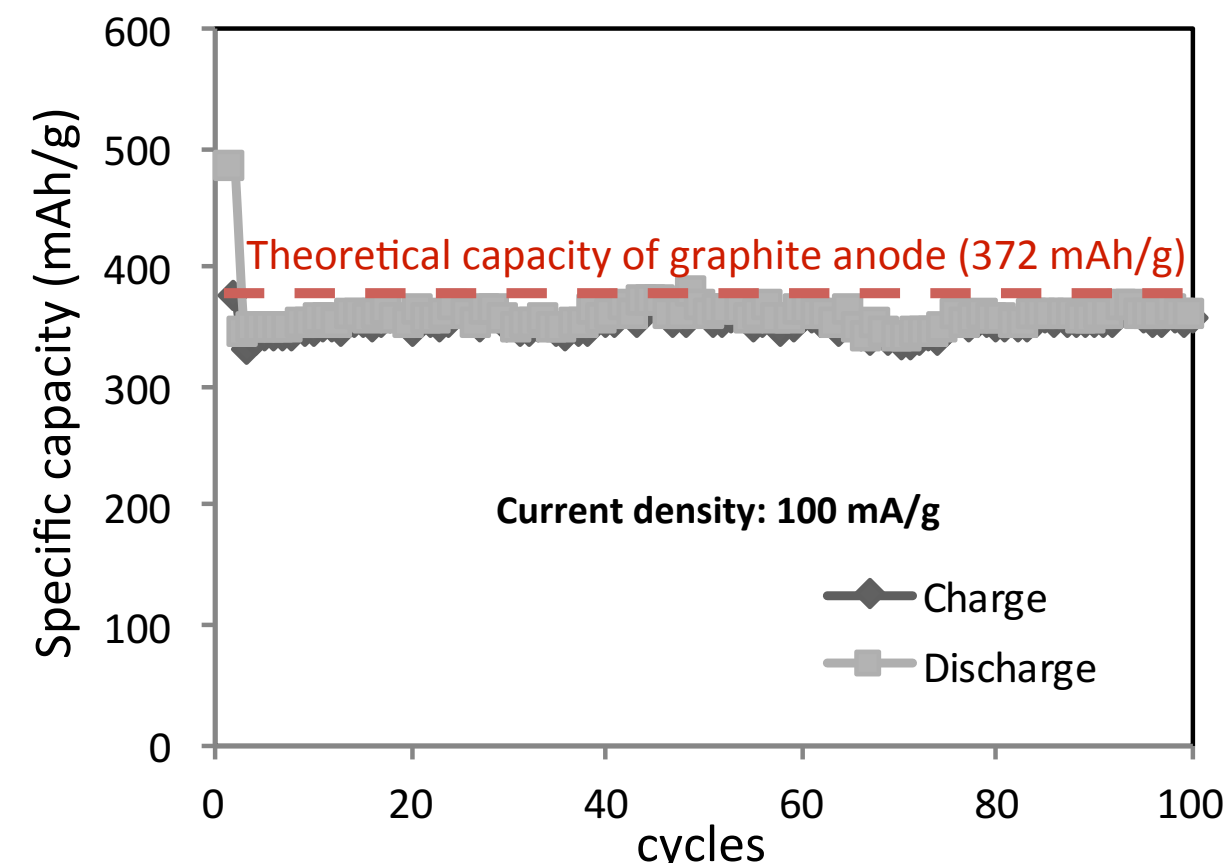
## 1 Exfoliation Process



## 2 Battery Test

### Condition

- LAND CT2001A battery system
- Active material: Talga Micro-graphite
- Preparation: binder, dispersant.  
Note: no prior spheroiding or coating
- Voltage: 0.01-3 V vs Li/Li<sup>+</sup>



Battery fabrication

Average capacity  
 $\sim 360\text{mAh/g}$

(the capacity of  
commercial graphite is  
 $\sim 340\text{mAh/g}$ )



Battery fabrication



# Printed Batteries and Thin Films

Smart Packaging



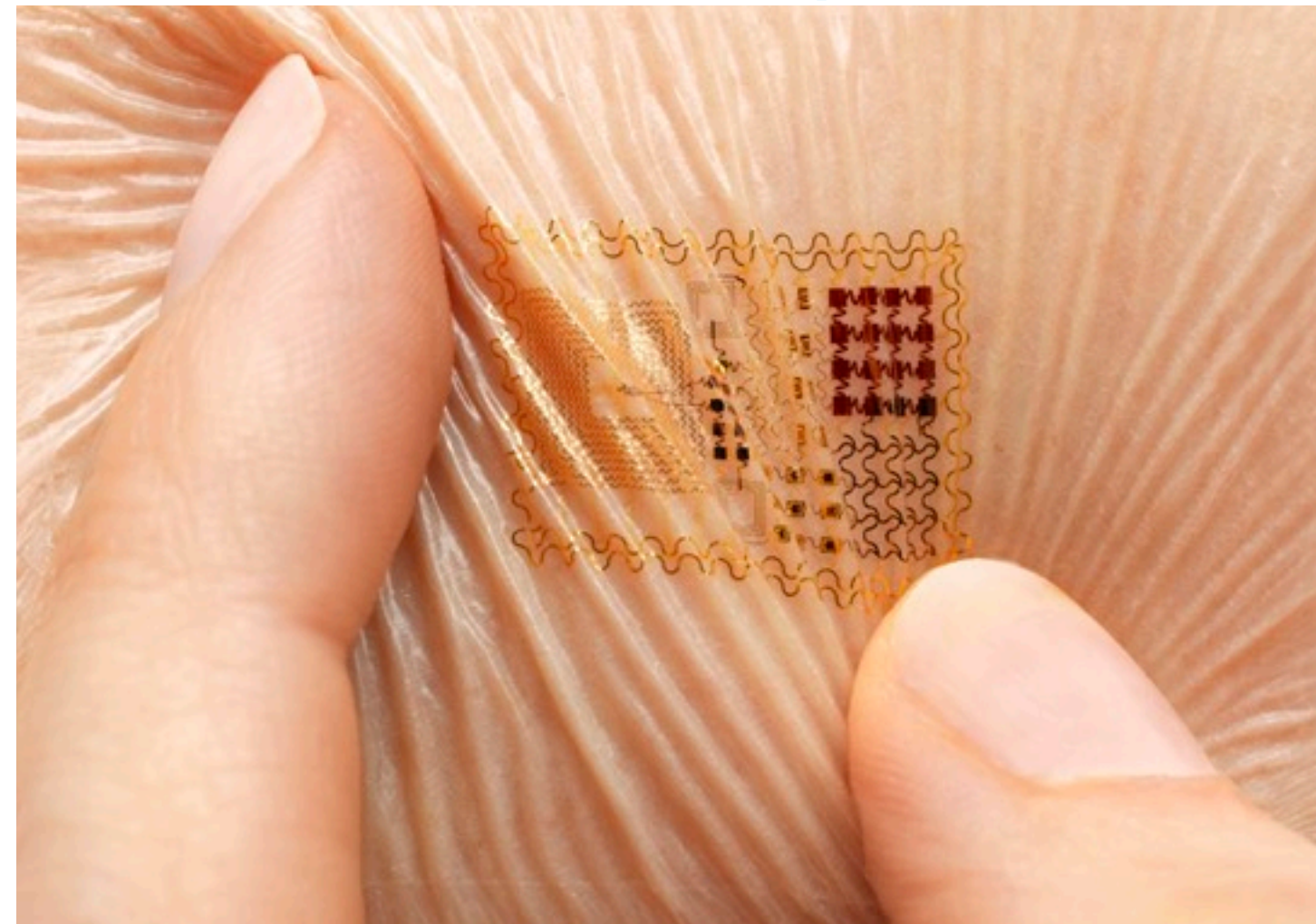
Wearables



Internet of Things



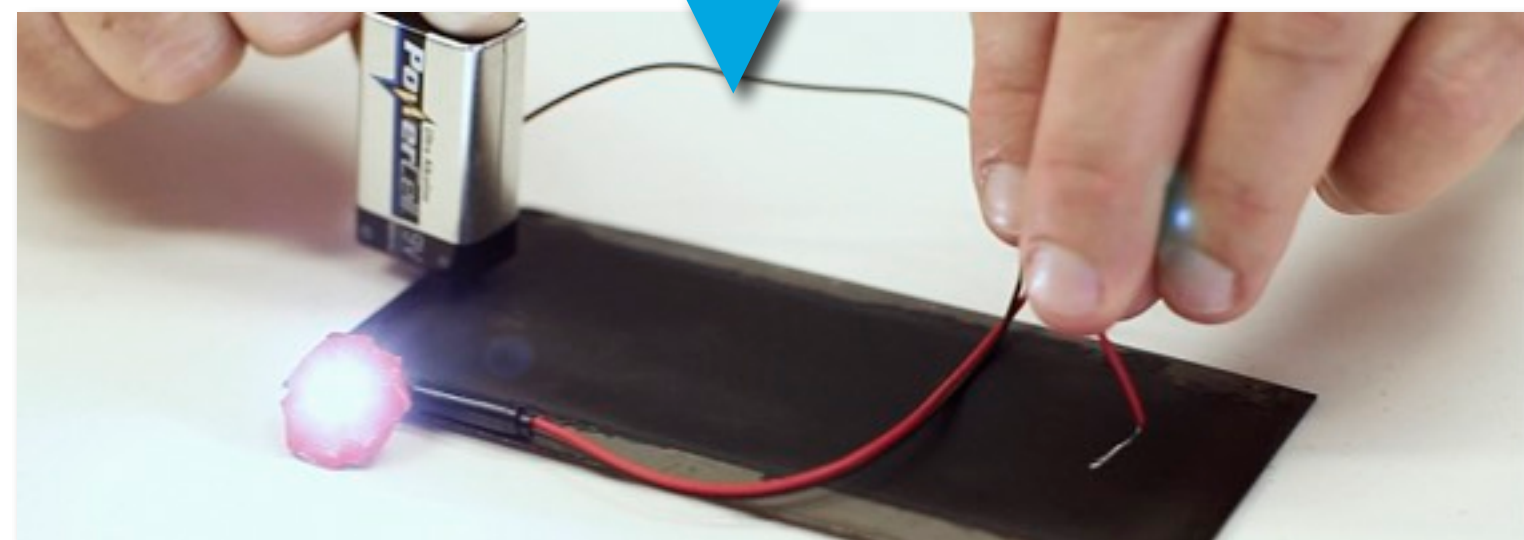
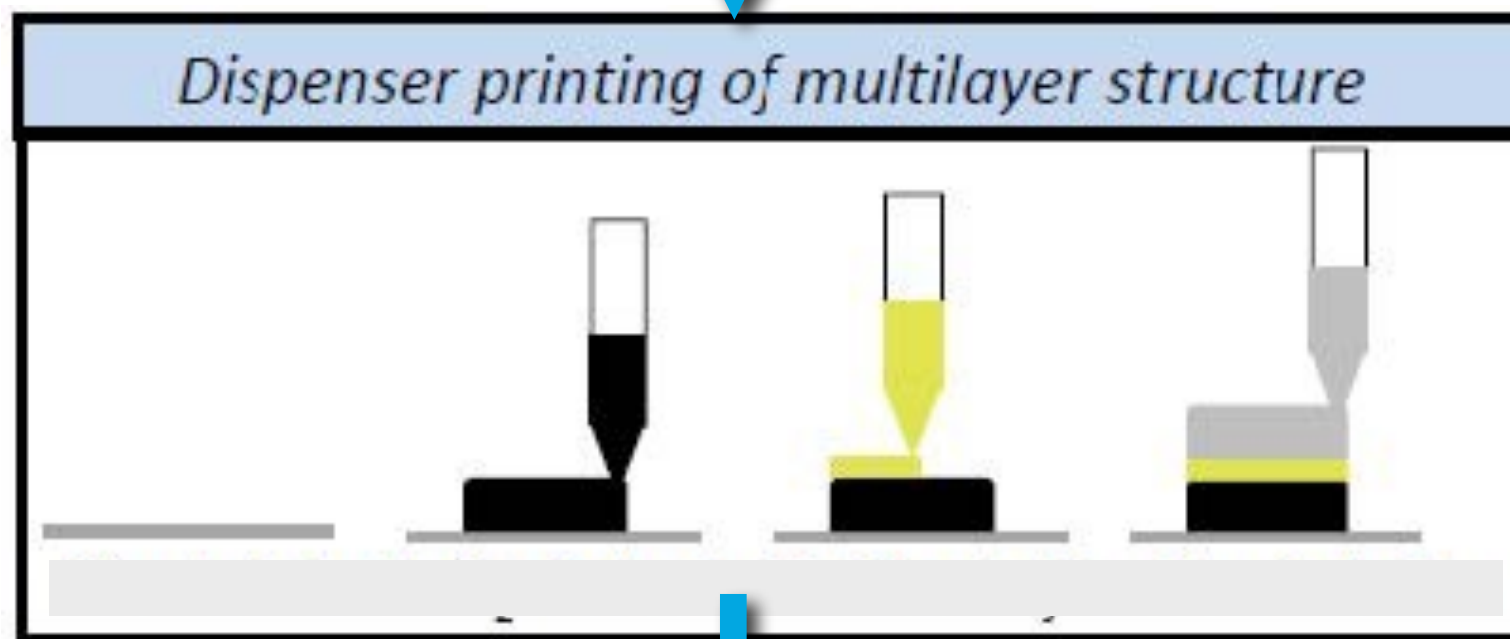
Medical and Disposables



- ▶ Graphene and micrographite can form conductive inks suitable for **printed batteries**, sensors and circuits.
- ▶ Target values:
  - **Ultrathin**
  - **Flexible**
  - Easy to manufacture
  - Recyclable
  - Rechargeable

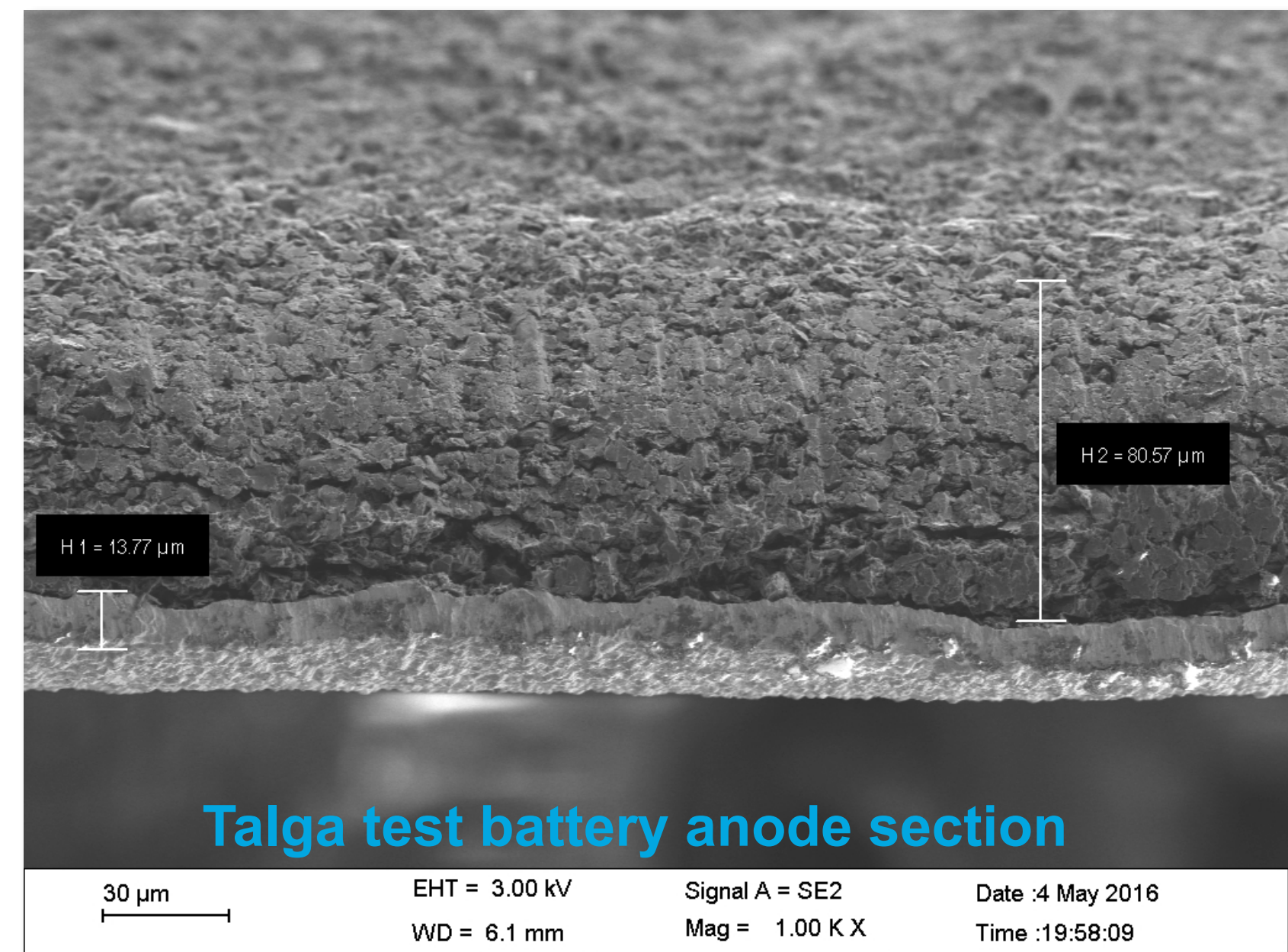


# Printed Batteries



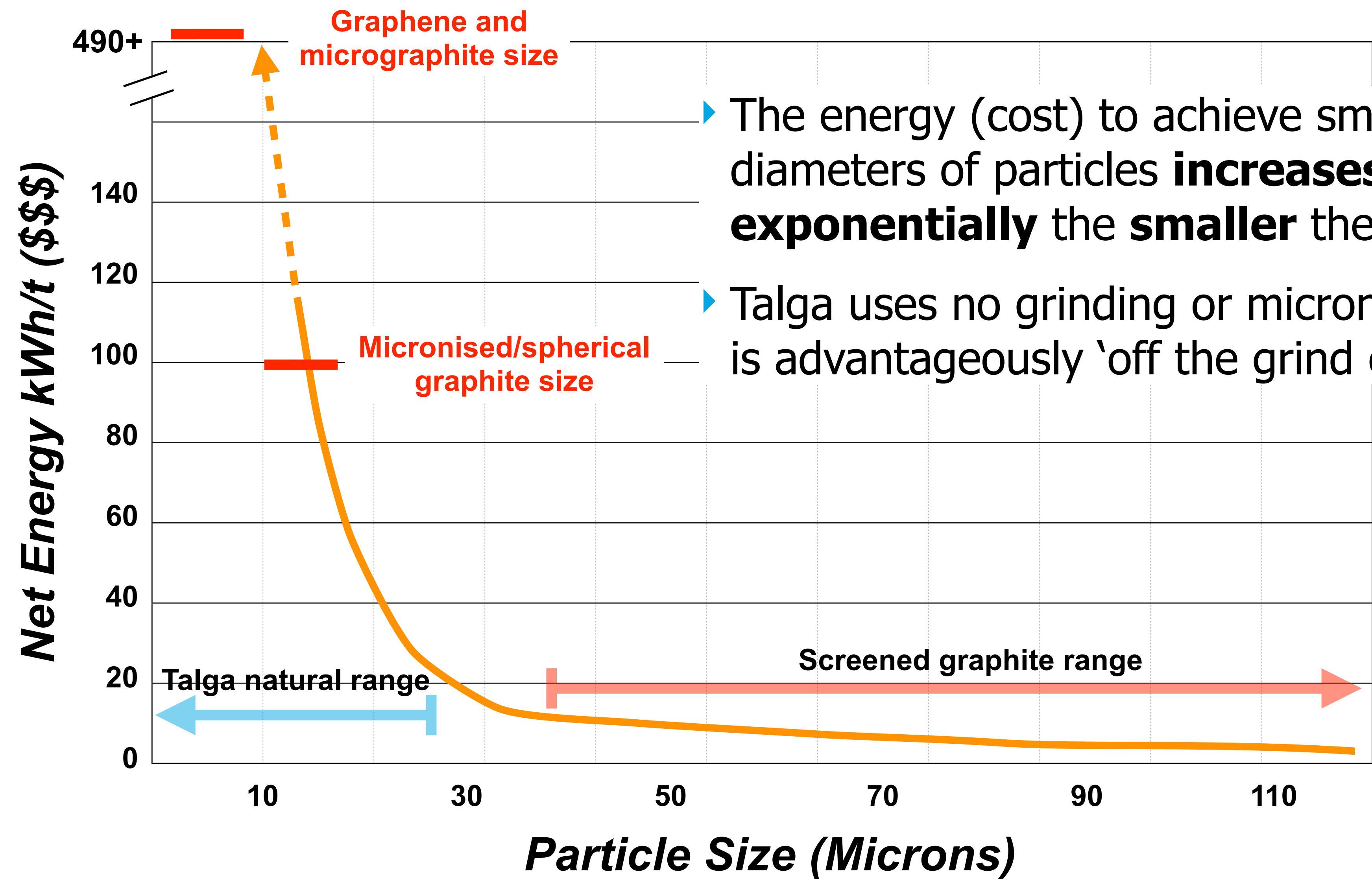
Talga sprayed conductive coating

- ▶ Thin film and sprayed applications require **very small** graphite flake size
- ▶ Flakes for maximum conductivity **not spheres**
- ▶ Talga Vittangi particles naturally <15 micron
- ▶ No grinding and micronising costs





# Grinding/micronising costs increase exponentially



- ▶ The energy (cost) to achieve small diameters of particles **increases exponentially** the **smaller** the grind.
- ▶ Talga uses no grinding or micronising, so is advantageously 'off the grind curve'.





- ▶ **100% ownership of five** graphite projects in Sweden containing **multiple deposits**
- ▶ Full range of graphite flake sizes from **graphene, micrographite** to **jumbo**
- ▶ Current JORC compliant Mineral Resources\*

Project	Tonnes	Graphite (%Cg)
Vittangi	9,800,000	25.3
Jalkunen	31,500,000	14.9
Raitajärvi	4,300,000	7.1

- ▶ Current JORC compliant Exploration Targets\* 0-100m Depth

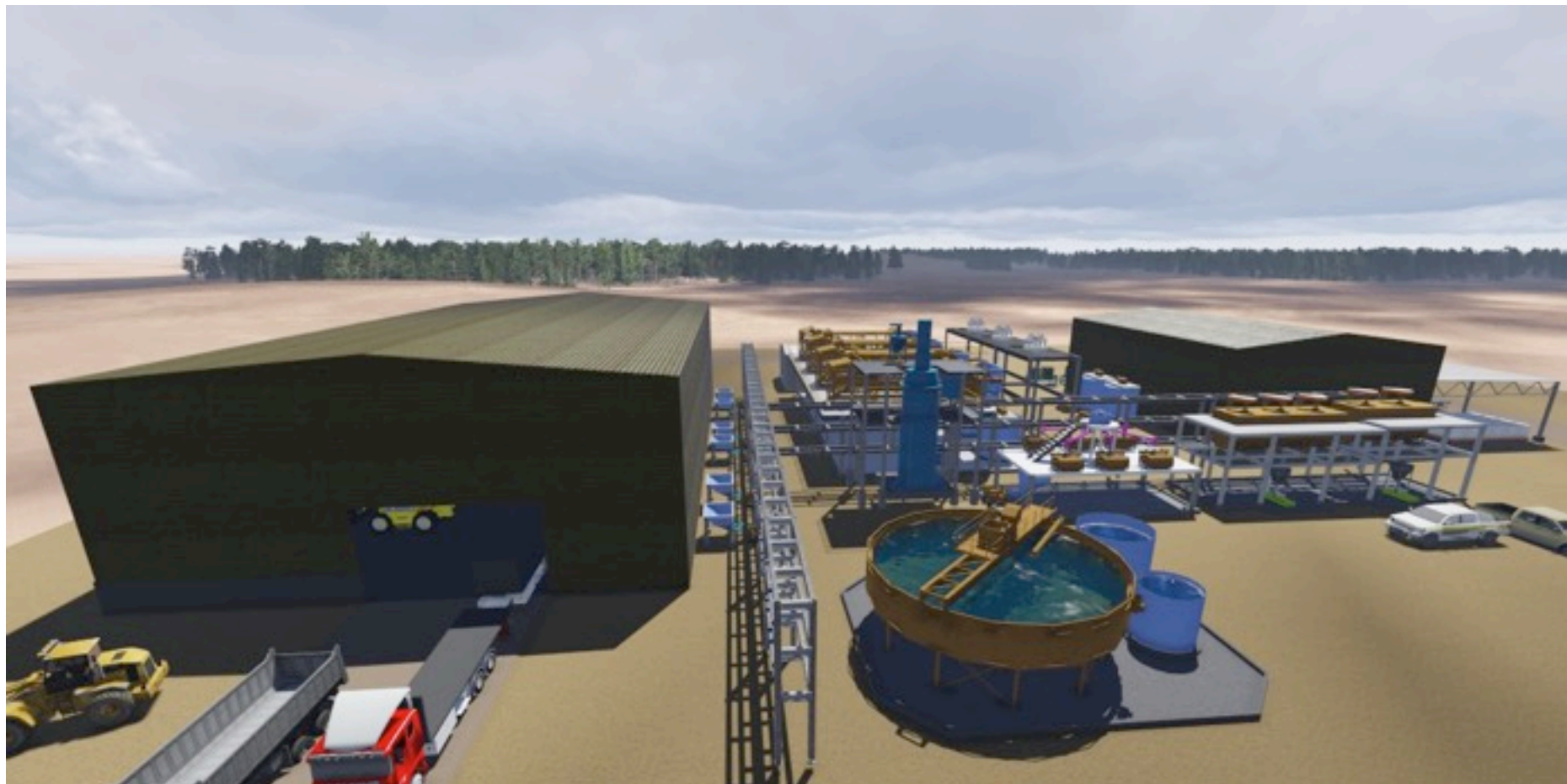
0-100m	Tonnes	Graphite (%Cg)
Total	136-250,000,000	18-25

*Note: The Exploration Target is based on a number of assumptions and limitations with the potential grade and quantity being conceptual in nature. There has been insufficient exploration to estimate a Mineral Resource Estimate in accordance with the JORC Code and it is uncertain if future exploration will result in the estimation of a Mineral Resource.*

\*See Appendix 1 for resource and exploration target details



# Talga's Development Story



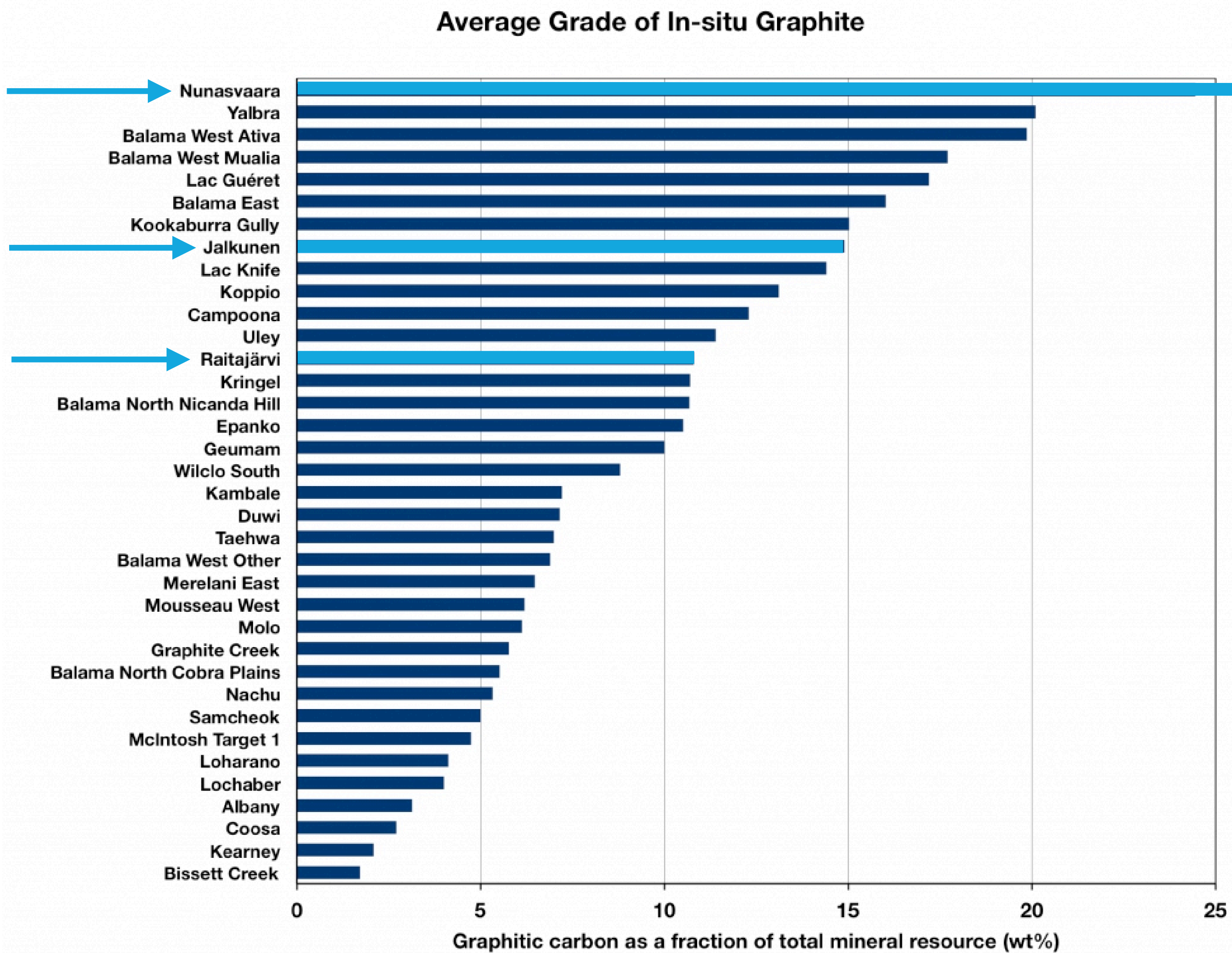
Items		Base Case
Plant throughput	(tpa)	250,000
Diluted Feed Grade	(%)	23.6*
Graphite production	(tpa)	~46,000
Graphene production	(tpa)	~1,000
Life of Mine Strip Ratio	W:O	4:1
Graphite price assumption	(USD\$/t)	480
Graphene price assumption	(USD\$/t)	55,000
Capital cost	(AUD\$m)	29.3
Mine Life	(years)	19.7
Discount Rate	(%)	12
Pre Tax Net Present Value (NPV)**	(AUD\$m)	~490
Payback from construction start	(years)	1.4

\*Feed grade after mining dilution factors. \*\* Pre-tax and other impositions but including state and private royalties.

- ▶ Following successful scale up of process, full scale development planned for Sweden
- ▶ Scoping study ~20 years 250,000 tpa ore producing approximately **40,000t** graphite, **6,000t** micrographite and **1,000t** graphene
- ▶ Low **capital cost A\$29.3m** as no crushing/grinding circuit and ancillaries
- ▶ Does **not** require graphene to be financially robust
- ▶ **Conservative** assumptions - big revenue leverage in **value-adding** products
- ▶ Exploitation and environmental surveys for permitting underway



- ▶ Talga owns 3 of Top 10 grade graphite resources in world
- ▶ Pipeline of development to deliver into market
- ▶ Focus on margins and volume of market applications, not resource tonnes for tonnes sake





# Successful Trial Mine

- ▶ 2015 trial mining confirms amenability of ore to be shaped and extracted for process
- ▶ Further ore extraction permitted to 2018 while full scale exploitation permitting underway





# Trial Mining 2015 (Video)





# Talga Pilot Test Facility Rudolstadt, Germany





# Process Technology scale up - Exfoliation Unit





# Development Underway

- ▶ **Pilot test-work underway** in Talga's facility in Rudolstadt, Germany (8 employees) using trial mined Vittangi ore
- ▶ **3 phases** to upscaling process - first phase (10kg feed/cell) **complete**, second phase (total 365kg feed) commenced commissioning April 2016.
- ▶ Focus now on commercial relationships to place upcoming graphene and graphite production - samples being delivered to end users now
- ▶ Future full scale processing planned to shift from Germany to **Sweden** once statutory permitting completed - process commenced.



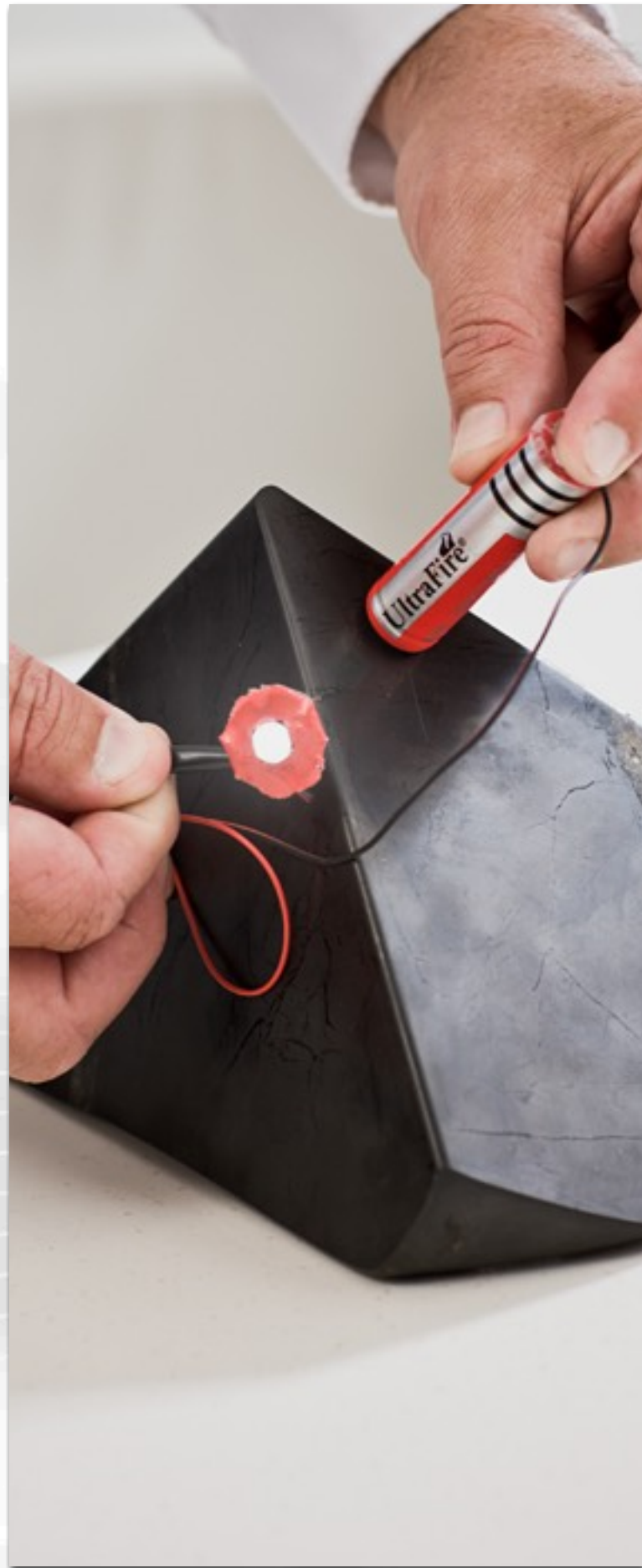
*Graphene samples, Rudolstadt*





- ▶ Further **validation** of products by industry partners, trials and research institution results
- ▶ Use results to secure **patents** and **licensable** technology packages
- ▶ New Chief Technology Officer **Dr Siva Bohm** appointed to lead product development
- ▶ Secure further industry and commercial **partnerships**
- ▶ Optimise Phase 2 pilot test work facility to **steady state** operation and design upscale to Phase 3
- ▶ Review opportunities for short term revenue **prior** to full scale development





- ▶ World's **highest grade graphite** JORC or NI43-101 mineral resource - 100% owned
- ▶ World first **processing technology** for industrial scale graphite and graphene production potential
- ▶ High quality low risk **jurisdiction** - Sweden
- ▶ **German pilot test-work facility creating path to commercialisation** via industry partnerships and product development
- ▶ Exposure to both resource and technology sectors with modest development funding requirements and access to high growth applications across multiple markets



# Appendix 1

## JORC Mineral Resources and Exploration targets

*Nunasvaara JORC (2012) Mineral Resource<sup>1</sup> (10% Cg cut-off)*

JORC 2012 Classification	Tonnes	Graphite (%Cg)
Indicated	6,900,000	24.2
Inferred	2,900,000	28.1
<b>Total</b>	<b>9,800,000</b>	<b>25.3</b>

*Jalkunen JORC (2012) Mineral Resource (5% Cg cut-off)*

JORC 2012 Classification	Tonnes	Graphite (%Cg)
<b>Inferred</b>	<b>31,500,000</b>	<b>14.9</b>

*Raitajärvi JORC (2004) Mineral Resource<sup>1</sup> (5% Cg cut-off)*

JORC 2004 Classification	Tonnes	Graphite (%Cg)
Indicated	3,400,000	7.3
Inferred	900,000	6.4
<b>Total</b>	<b>4,300,000</b>	<b>7.1</b>

*Talga Graphite Exploration Targets<sup>2</sup>*

Project	Exploration Target	Tonnes (0-100m Vertical Depth)		Graphite (% Cg)	
		Min.	Max.	Min.	Max.
Vittangi	Nunasvaara	62,400,000	93,600,000	20	30
	Kotajärvi	16,640,000	30,160,000	20	25
	Maltosrova	20,800,000	52,000,000	20	25
Jalkunen	Tiankijokki	2,600,000	5,200,000	15	25
	Nybrännan	5,200,000	10,400,000	20	30
	Suinavaara	2,600,000	5,720,000	15	25
	Lautakoski	26,000,000	52,000,000	15	25
Subtotal		136,240,000	249,080,000	19	27
<b>Rounded Total</b>		<b>136,000,000</b>	<b>250,000,000</b>	<b>18</b>	<b>25</b>

*1 Note: This information was prepared and first disclosed under the JORC code 2004. It has not been updated since to comply with the JORC code 2012 on the basis that the information has not materially changed since it was last reported. The Company is not aware of any new information or data that materially affects the information included in the previous announcement and that all of the previous assumptions and technical parameters underpinning the estimates in the previous announcement have not materially changed.*

*2 Note: The Exploration Target is based on a number of assumptions and limitations with the potential grade and quantity being conceptual in nature. There has been insufficient exploration to estimate a Mineral Resource Estimate in accordance with the JORC Code and it is uncertain if future exploration will result in the estimation of a Mineral Resource.*



## References

#) see <http://www.techmetalsresearch.com/metrics-indices/tmr-advanced-graphite-projects-index/>

\* see Industrial Minerals Natural Graphite report 2012, unpublished internal reports for Talga, and Scoping Study released to ASX 9 October 2014.

NB) any data not specifically referenced is based on personal communications with industry participants where appropriate and/or unpublished technical research.

## Cautionary Statement

The scoping study referred to in this report is based on low level technical and economic assessments, and is insufficient to support estimation and economic assessments, and is insufficient to support estimation of Ore Reserves or to provide assurance of an economic development case at this stage, or to provide certainty that the conclusion of the scoping study will be realised. The Company confirms that all material assumptions and technical parameters underpinning the scoping study results and projections in this release continue to apply and have not materially changed. The use of the word "ore" in the context of this report does not support the definition of 'Ore Reserves' as defined by the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. The word 'ore' is used in this report to give an indication of quality and quantity of mineralised material that would be fed to the processing plant and is not to be assumed that 'ore' will provide assurance of an economic development case at this stage, or to provide certainty that the conclusion of the scoping study will be realised.

## Competent Person's Statement

The information in this report that relates to Exploration Results and Exploration Targets is based on information compiled and reviewed by Mr Simon Coxhell, a consultant to the Company and a member of the Australian Institute of Mining and Metallurgy and Mr Mark Thompson, who is an employee of the Company and a member of the Australian Institute of Geoscientists. Mr Thompson and Mr Coxhell have sufficient experience which is relevant to the activity which is being undertaken to qualify as a "Competent Person" as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, mineral Resources and Ore Reserves" ("JORC Code"). Mr Thompson and Mr Coxhell consent to the inclusion in the report of the matters based on this information in the form and context in which it appears.

The information in this report that relates to Resource Estimation is based on information compiled and reviewed by Mr Simon Coxhell. Mr Coxhell is a consultant to the Company and a member of the Australian Institute of Mining and Metallurgy. Mr Coxhell has sufficient experience relevant to the styles of mineralisation and types of deposits which are covered in this document and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves" ("JORC Code"). Mr Coxhell consents to the inclusion in this report of the Matters based on this information in the form and context in which it appears.