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**Talga Resources Ltd**

**ASX:TLG**

6 December 2016

Sydney, Australia



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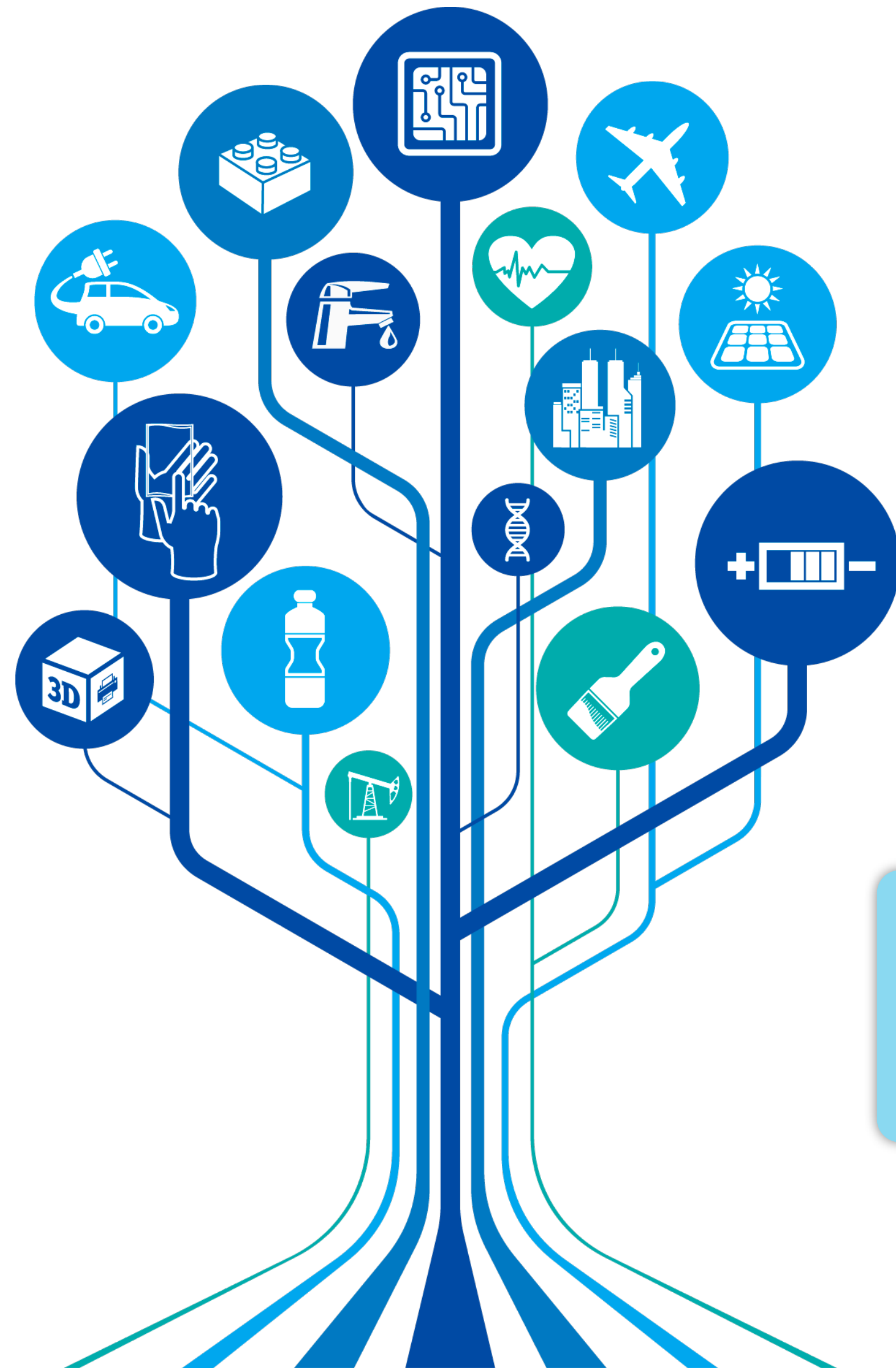
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**Technology minerals** enable new technologies, products and applications, or make current materials more:

- ▶ **efficient** (lighter, stronger, faster)
- ▶ **functional** (conductive)
- ▶ **sustainable** (lower emissions, 'greener' chemistry)

**Graphite** and particularly its 2-D version, **graphene**, have been shown over the last 10 years to be the most conductive, lightest, strongest and universally disruptive material additives on earth.



*Talga CTO Dr Siva Bohm with graphene dispersions at Talga Advanced Materials GmbH, Germany*

- ▶ Talga is an advanced materials company that owns the highest grade **graphite** mineral resource in the world # and has developed an innovative process to make the mass production of quality **graphene** possible.
- ▶ Talga is a listed public company on the Australian Stock Exchange (**ASX:TLG**) with operations in Sweden, Germany and UK.
- ▶ Pilot plant **operational** and rapidly developing **value-added product** pipeline and IP delivery underway.
- ▶ Talga is positioning to play a large role in the emerging trend towards low emission **energy** production/storage and a host of **technology** applications enabled by graphene and graphite.



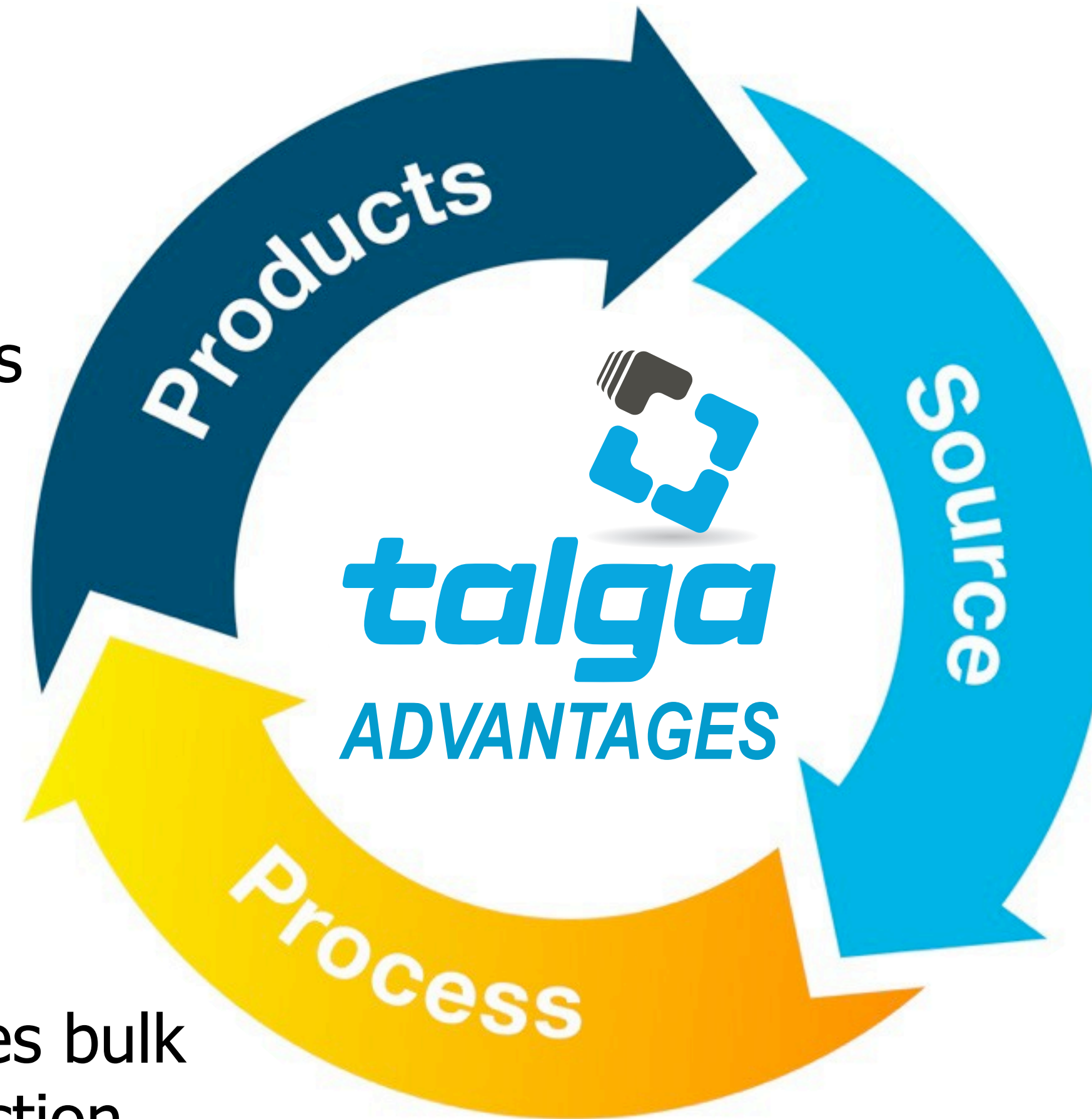
✓ **Vertically integrated** with in-house product expertise value-adding to raw materials

✓ **Pilot plant** operational & successfully scaling up

✓ **Product pipeline** across multiple large technology and bulk sectors

✓ **Process technology** enables bulk high quality graphene production

✓ **Low cost** 'no crush/grind' & low enviro-impact process



✓ **Highest grade** graphite resources in the world

✓ **Large and unique** 'electrode' style ore deposits

✓ Top class **jurisdiction** Sweden

## Capitalisation Summary 30 Nov 2016 (AUD\$)

|  |               |
|--|---------------|
| Shares on issue <b>TLG</b>                       | <b>181.9M</b> |
| Listed Options <b>TLGOA</b> (\$0.45 : 31 Dec 18) | <b>44.9M</b>  |
| Unlisted Options <sup>1</sup>                    | <b>34.7M</b>  |
| Market Capitalisation (undiluted @ \$0.27)       | <b>\$49M</b>  |

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

|  |              |
|--|--------------|
| Smedvig G P Ltd                        | <b>11.3%</b> |
| Lateral Minerals Pty Ltd (M.Thompson)  | <b>7.8%</b>  |
| Kamberg Investments Ltd                | <b>3.3%</b>  |
| Yandal Investments Pty Ltd (M. Creasy) | <b>3.0%</b>  |
| Pelmer Securities S A                  | <b>2.5%</b>  |

## Board

Managing Director - **Mark Thompson**

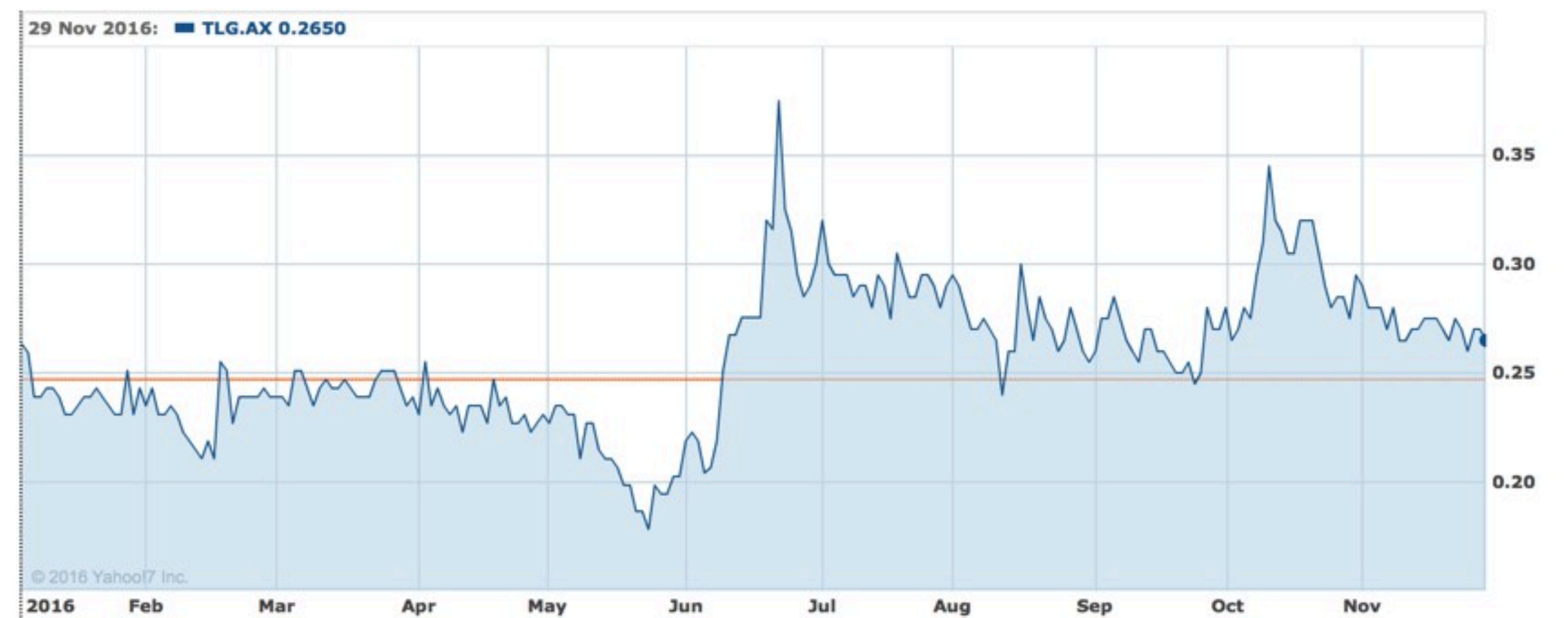
Chairman - **Keith Coughlan**

Non-Executive - **Grant Mooney**

Non-Executive - **Stephen Lowe**

Cash end Sept 2016 ~**\$10.3 million**. Nil Debt.

## ASX: TLG year to date share price



<sup>1</sup> Various expiry and strike prices \$0.35-\$0.65

<sup>2</sup> Holdings rounded to nearest decimal point, as at 30 Nov 2016



**Mark Thompson**  
*Managing Director*

+25 years international industry experience in minerals-mining management. Member of the Australian Institute of Geoscientists and the Society of Economic Geologists, guest Professor in Mineral Exploration Technology at Chengdu University of Technology and the Southwest University of Science and Technology in China. Mr Thompson currently serves as a Non-Executive Director of Phosphate Australia Ltd.



**Keith Coughlan**  
*Non-Executive Chairman*

+30 years' experience in stockbroking/funds management. Largely involved in the funding and promoting of resource companies listed on the ASX, AIM and TSX. Advised various companies on the identification/acquisition of resource projects and previously employed by one of Australia's then largest funds management organisations.

Mr Coughlan is currently the managing director of ASX listed European Metals Holdings Limited.



**Grant Mooney**  
*Non-Executive Director*

Mr Mooney has extensive experience in resources and technology markets. Has served as Director and Company Secretary to several ASX listed companies including Director of renewable energy developer, Carnegie Wave Energy Ltd, Barra Resources Ltd, Phosphate Australia Ltd and Wild Acre Metals Limited. Mr Mooney is a member of the Institute of Chartered Accountants Australia.



**Stephen Lowe**  
*Non-Executive Director*

Mr Lowe's background is in business management and taxation and he has over 18 years' experience consulting to a range of corporate and high wealth clients. Mr Lowe is currently a non-executive director of Corizon Resources Ltd and Windward Resources Ltd and a former Chairman and non-executive director of ASX 200 company Sirius Resources NL. Mr Lowe is a Fellow of the Taxation Institute of Australia and a Member of the Australian Institute of Company Directors.





Talga Resources Ltd  
**Australia - Corporate HQ**

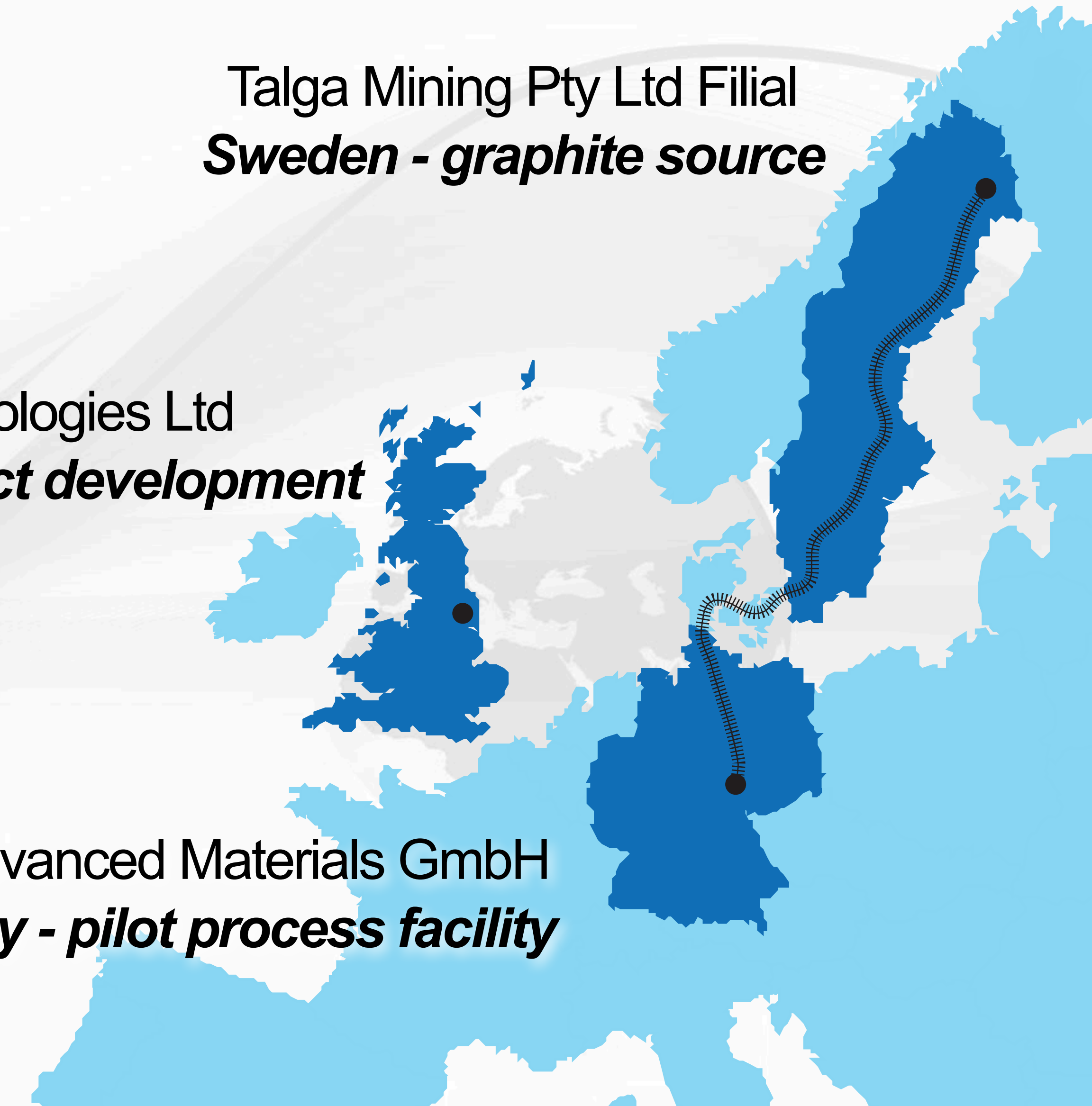


Part of Talga team at Phase 2 pilot plant commissioning in Rudolstadt, Germany

Talga Mining Pty Ltd Filial  
**Sweden - graphite source**

Talga Technologies Ltd  
**UK - product development**

Talga Advanced Materials GmbH  
**Germany - pilot process facility**



This financial year we have:

## **Test Mined**

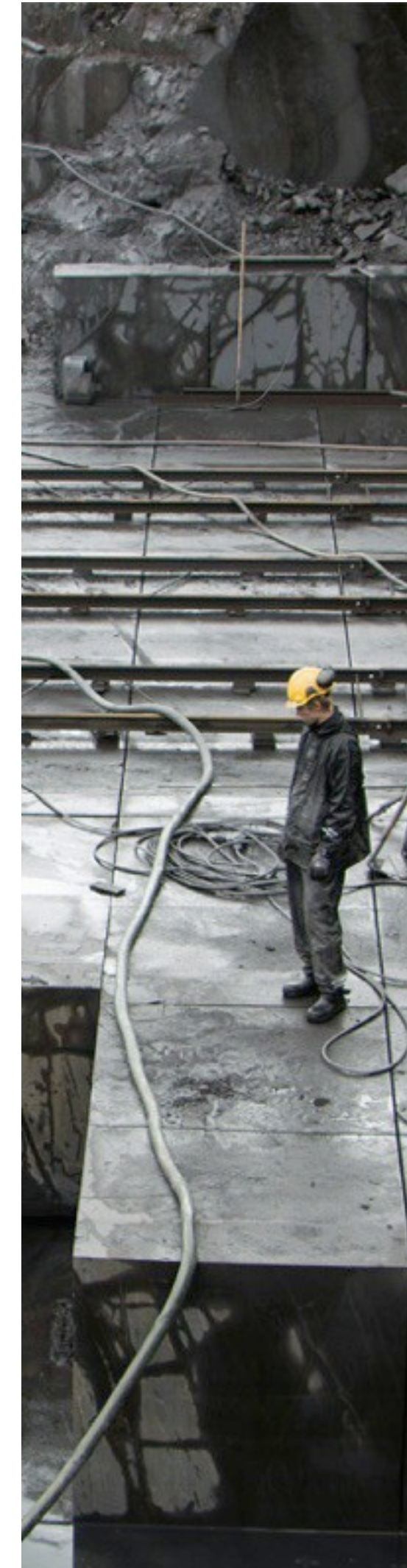
- ▶ Produced ~5,000 tonnes low cost electrode-quality ore
- ▶ Opened up our ore bodies
- ▶ Expanded resources

## **Built and Operated a Pilot Plant**

- ▶ Provided new source graphene and micrographite to market
- ▶ Demonstrated potential supply scale to customers
- ▶ Developed key insights towards full scale project

## **Produced graphene and graphite products**

- ▶ Validated in-house expertise with peer-reviewed test results
- ▶ Gained market knowledge and customers across target markets



- ▶ Produce value added graphene **products** to complement supply of **raw** graphene & graphite
- ▶ Pursuit of revenue prior to full-scale production through **licensing** and royalties – plus sale of raw materials
- ▶ Initially aim to replace additives in **existing products** with better performing ones ('new products' not required)



*Test samples of Talphene™ graphene dispersion product for customer*

## COATINGS



- ▶ Higher performance anti-corrosion and anti-fouling paints
- ▶ Replace toxic amounts of chrome, copper and zinc
- ▶ Total coating market worth \$120B and uses 40Mtpa materials

## CONSTRUCTION



- ▶ Higher performance **concrete** and **tarmac** with electric & thermally conductive properties
- ▶ 'Snow & Ice-free' roads, paths, rail crossings, driveways, steps, airport aprons
- ▶ Total cement market worth \$450B

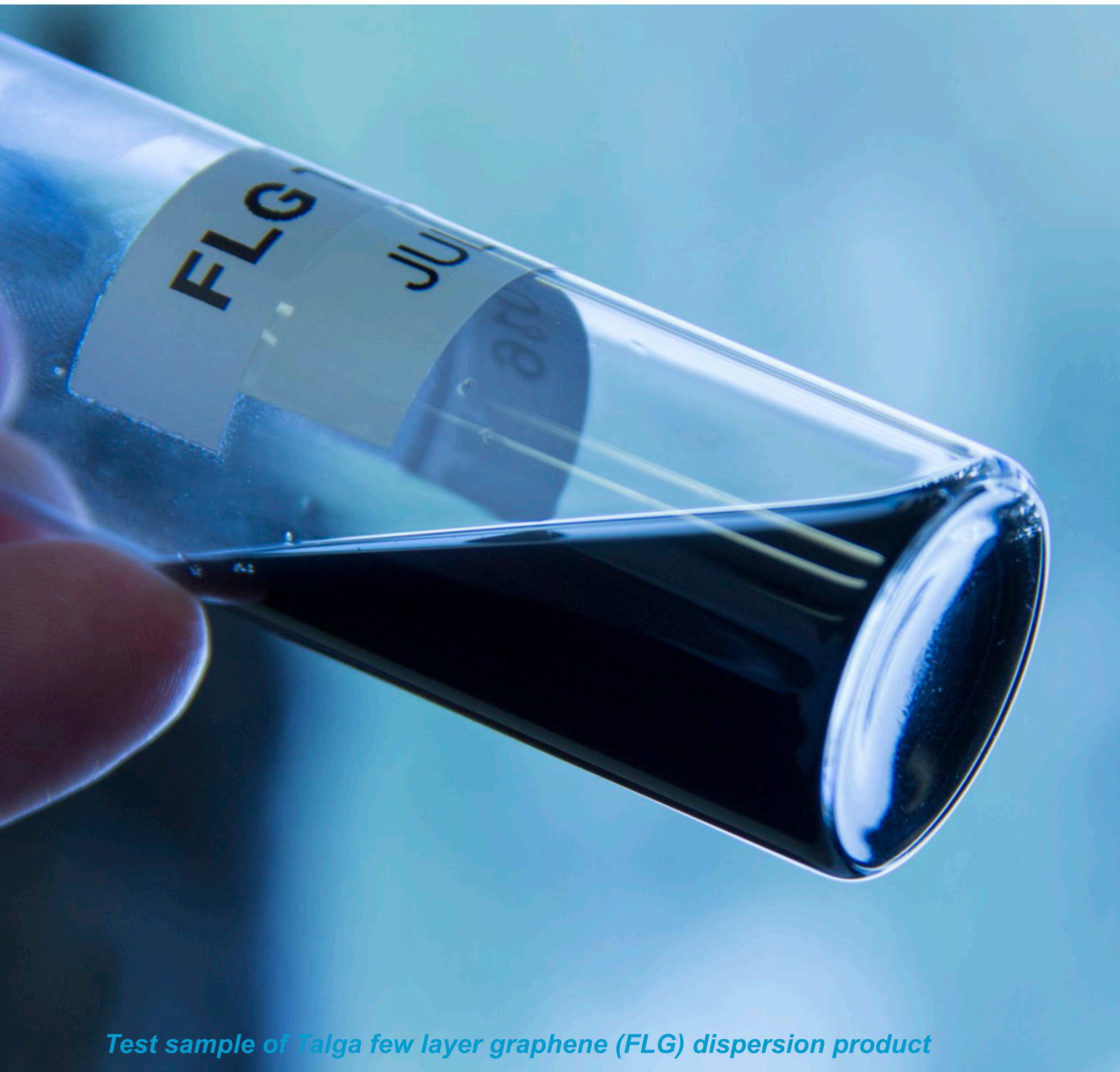
## ENERGY + -

- ▶ Higher performance or lower cost Li-ion, flow and alkaline **batteries**
- ▶ 'Wearable', printable batteries and other energy storage devices
- ▶ Batteries market alone worth \$24B

## COMPOSITES



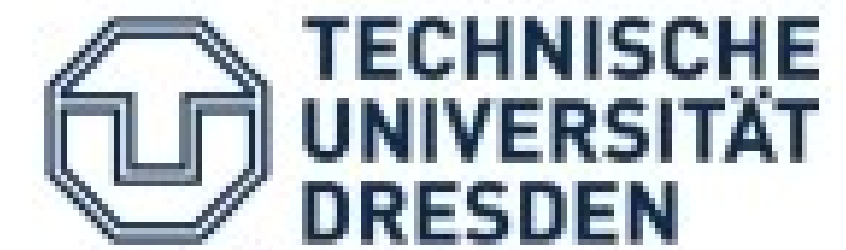
- ▶ Conductive, stronger and lighter **plastics** and **fibres**
- ▶ Flexible electric and thermally conductive materials
- ▶ Market worth \$18B



*Test sample of Talga few layer graphene (FLG) dispersion product*

- ▶ Products enhanced with graphene & micrographite are being used **now** (not distant possibility) - **no need to re-tool manufacturing lines in target products**
- ▶ **Real world products** with addressable markets
- ▶ Aim to remove the **supply volume** and **pricing** bottleneck to enable rapid industry uptake
- ▶ **Disrupt** graphene market - even during pilot plant phases

# Current Collaborations



MAX-PLANCK-GESELLSCHAFT





▶ **100% ownership** of **five** graphite projects in Sweden containing **three resources and over 25 deposits**

▶ **Full range** of graphite flake sizes from micro to jumbo flake

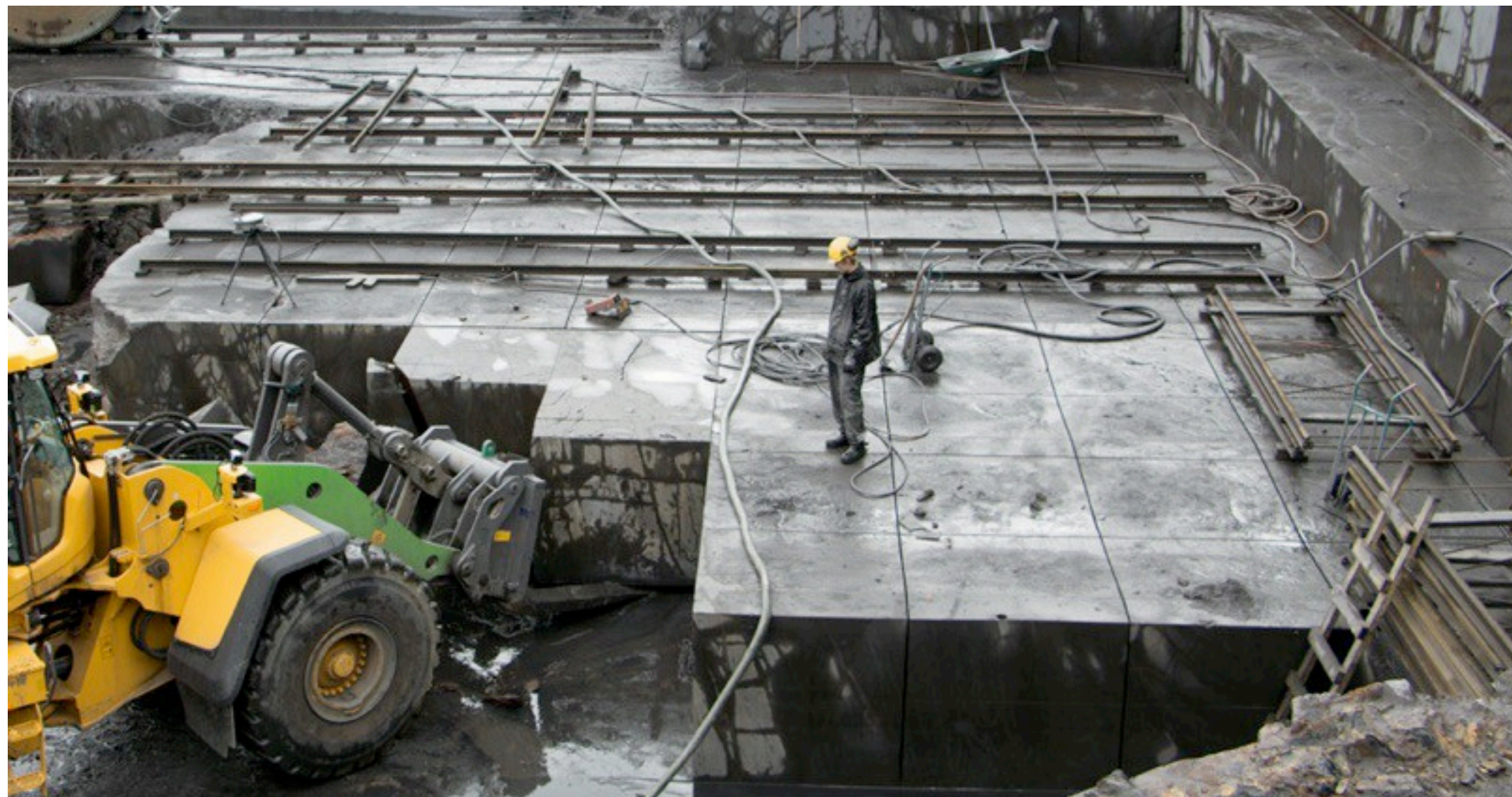
▶ Current JORC compliant Mineral Resources\*

| Project    | Tonnes     | Graphite Grade |
|------------|------------|----------------|
| Vittangi   | 9,800,000  | 25.3 %Cg       |
| Jalkunen   | 31,500,000 | 14.9 %Cg       |
| Raitajärvi | 4,300,000  | 7.1 %Cg        |

▶ Current JORC compliant Exploration Targets\*

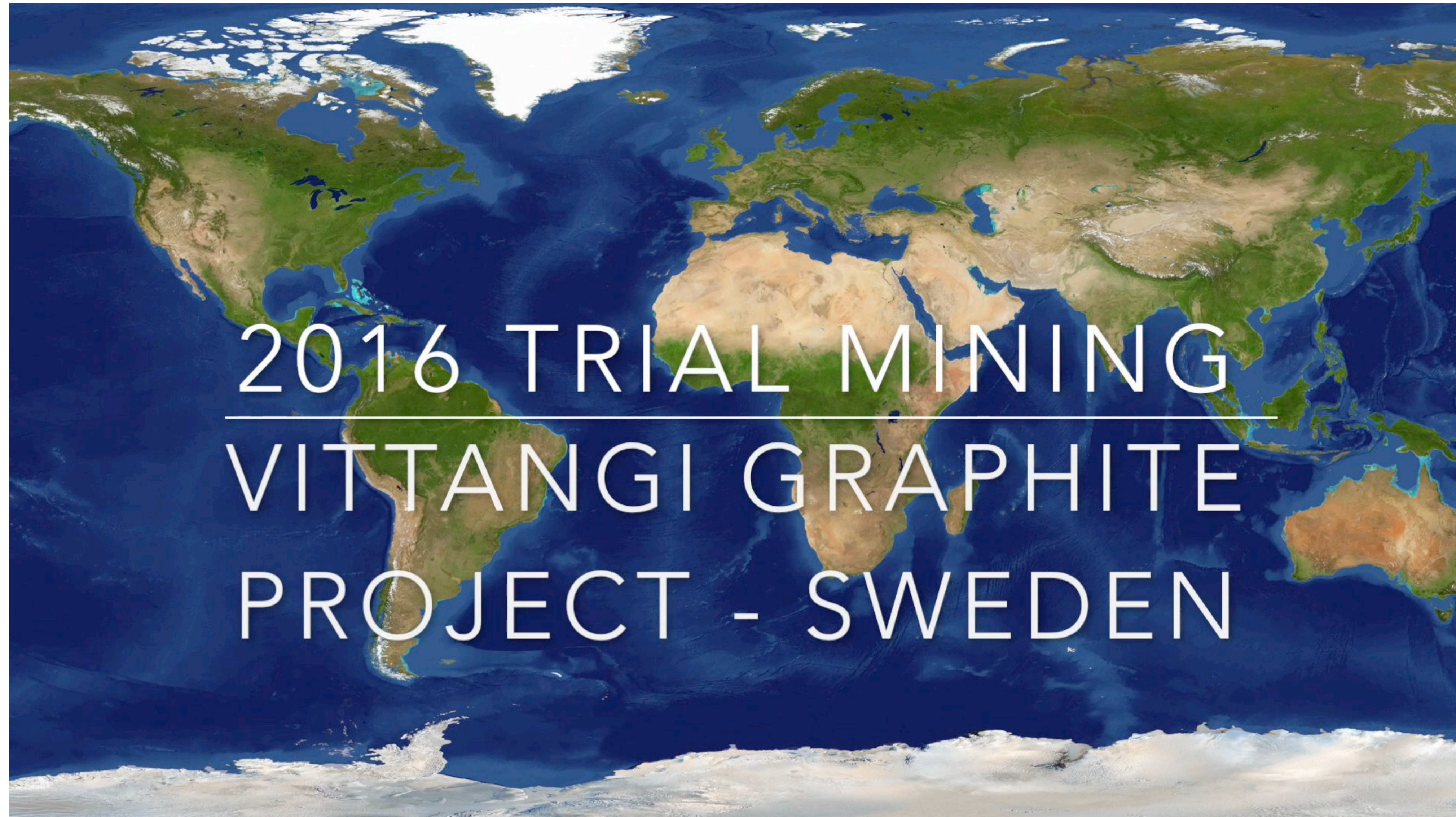
| 0-100m Depth | Tonnes                 | Graphite (%Cg) |
|--------------|------------------------|----------------|
| <b>Total</b> | <b>136-250,000,000</b> | <b>18-25</b>   |

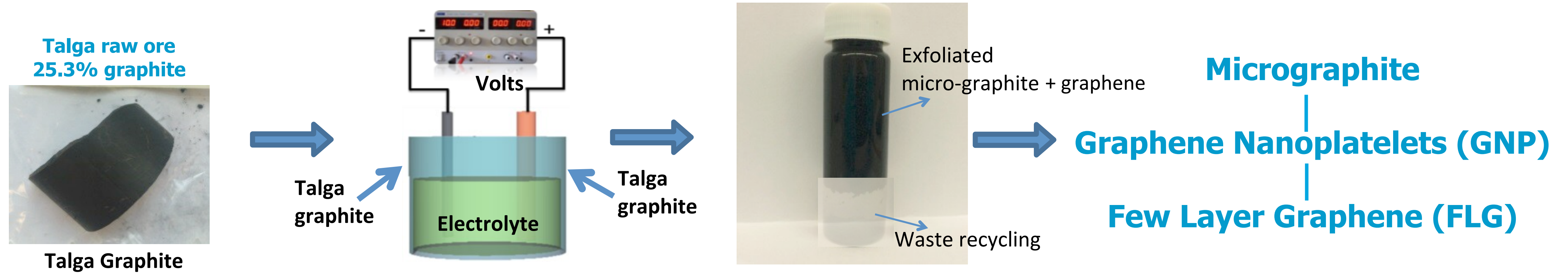
*Note: The Exploration Target is based on a number of assumptions and limitations with the potential grade and quantity being conceptual in nature. There has been insufficient exploration to estimate a Mineral Resource Estimate in accordance with the JORC Code and it is uncertain if future exploration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



- ▶ **Innovative** graphite ore mining technique
- ▶ Extracts ore as direct use “**electrodes**”
- ▶ No ‘drill and blast’ of ore = less dust and noise/  
**minimise environmental impact**
- ▶ Trial of larger, tailor-made and automated ore block cutting equipment successful
- ▶ ~5,000t extracted to date to feed upscaled pilot test processing and graphene product development

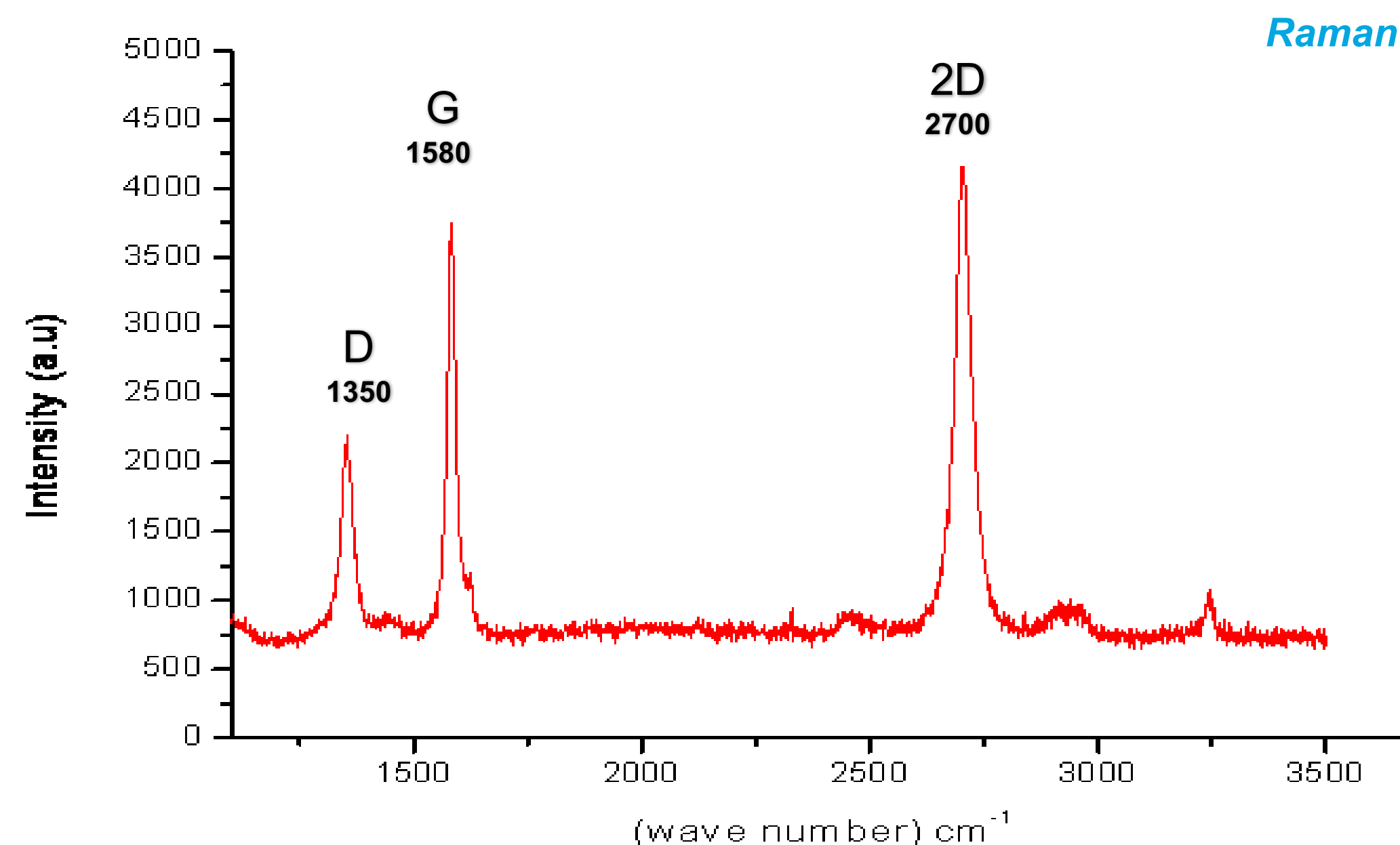
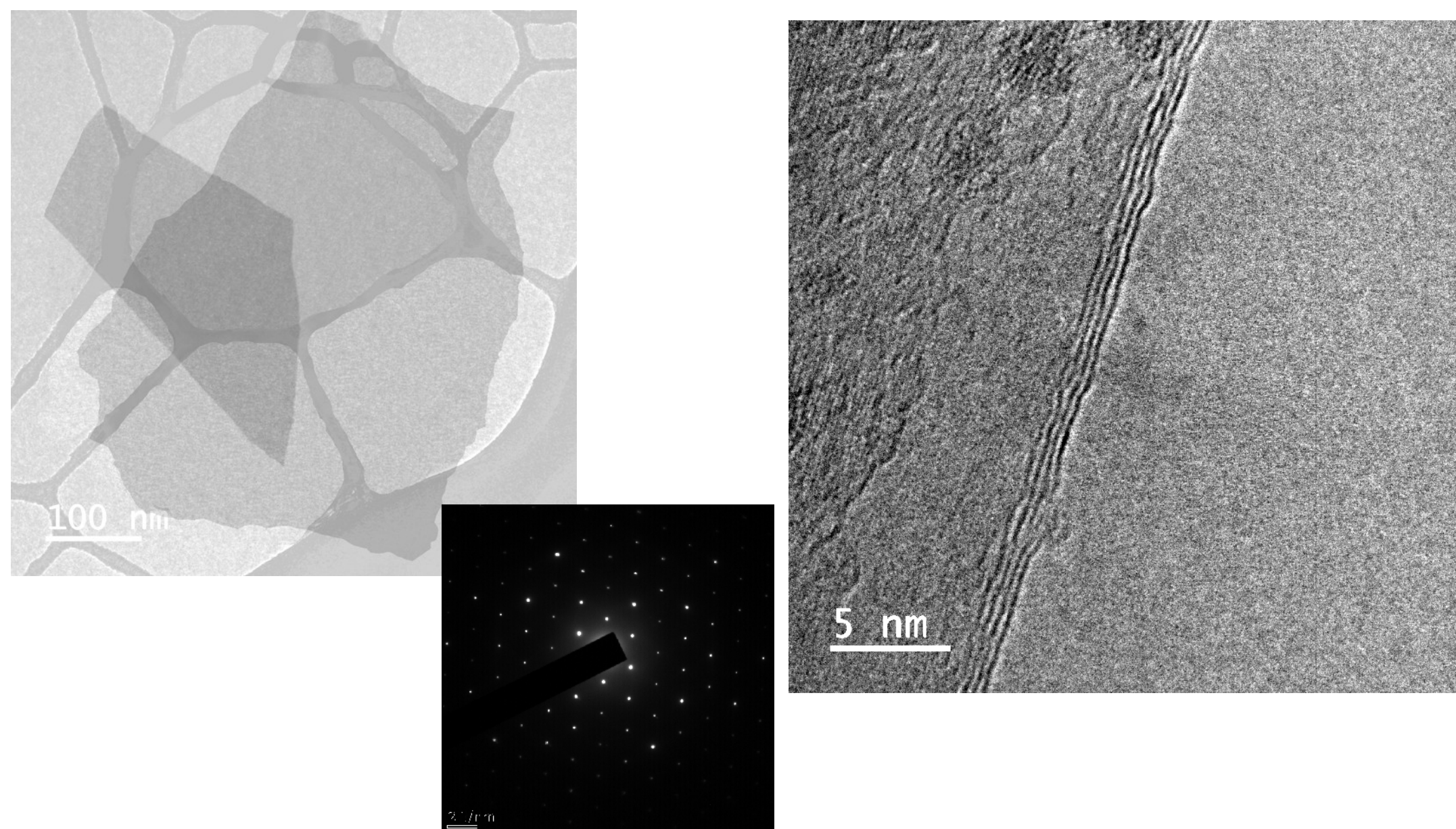




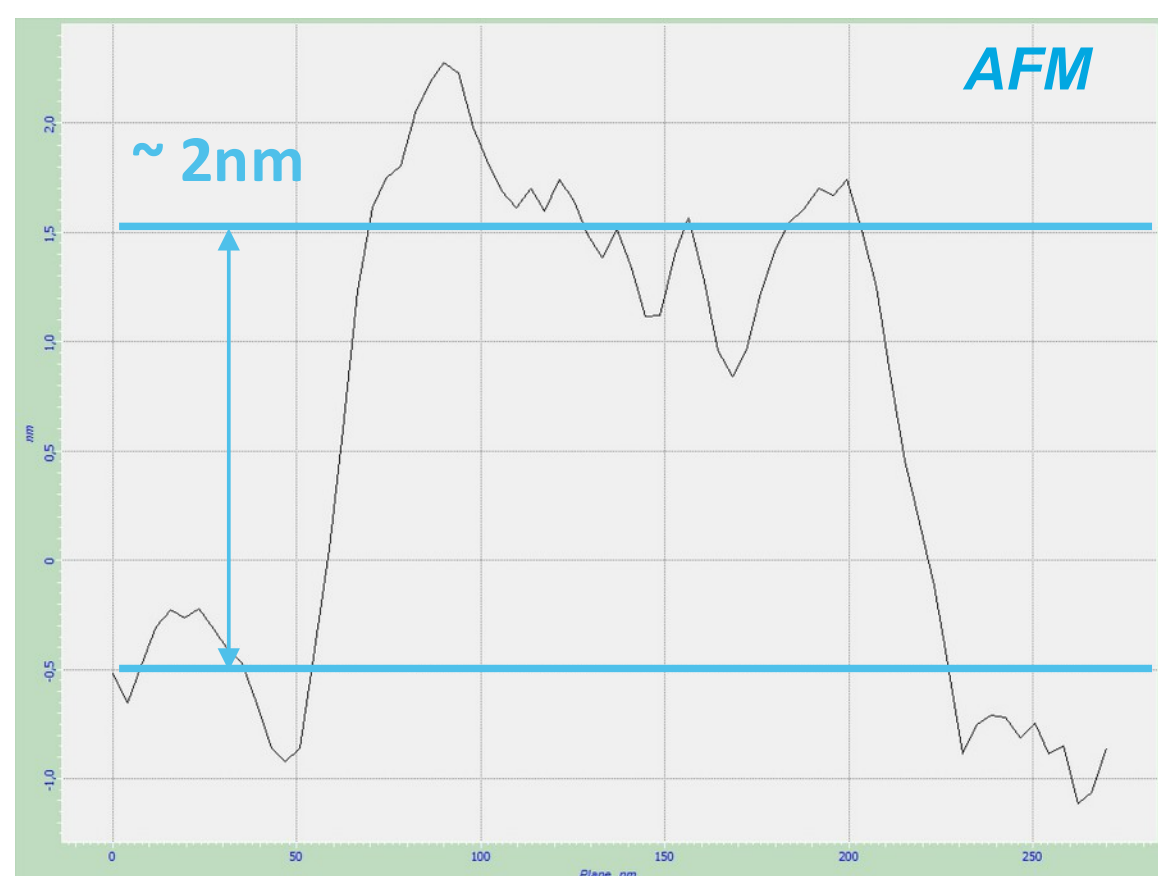


- ▶ Process liberates **graphene and micrographite** directly from **raw ore**
- ▶ Requires **no crushing, no grinding, no jet milling**
- ▶ Makes **ultrafine** and **ultrathin** size particles, a type of material not previously available **economically** at this **scale**
- ▶ Lowers **energy, costs** and **emissions of graphene production**
- ▶ Higher **performance** in applications

# Product - High Quality Graphene Talphene™



HR-TEM and other tests confirm high quality, 1-4 layer graphene.



- ▶ Talga can produce a range of products from pristine graphene to nano and micrographite
- ▶ Talga's graphene has been measured and tested by various and prestigious universities and scientists, including peer review studies on its use in coatings
- ▶ Talga has moved to trademark its few layer graphene product as Talphene™ in preparation for commercialisation of value-added products

# Pilot Test Plant Expansion

- ▶ Pilot process test-work **well advanced**
- ▶ 3 phases to upscaling process
  - **Phase 2 just commissioned**
- ▶ **High quality** graphene output confirmed
- ▶ **~76%** of input carbon converted to graphene
- ▶ Capacity **scale up continues** towards Phase 3
- ▶ Product outputs used to supply product feed, prototypes and **customer samples**

*Raw ore cut into 50kg electrodes for pilot test plant processing*

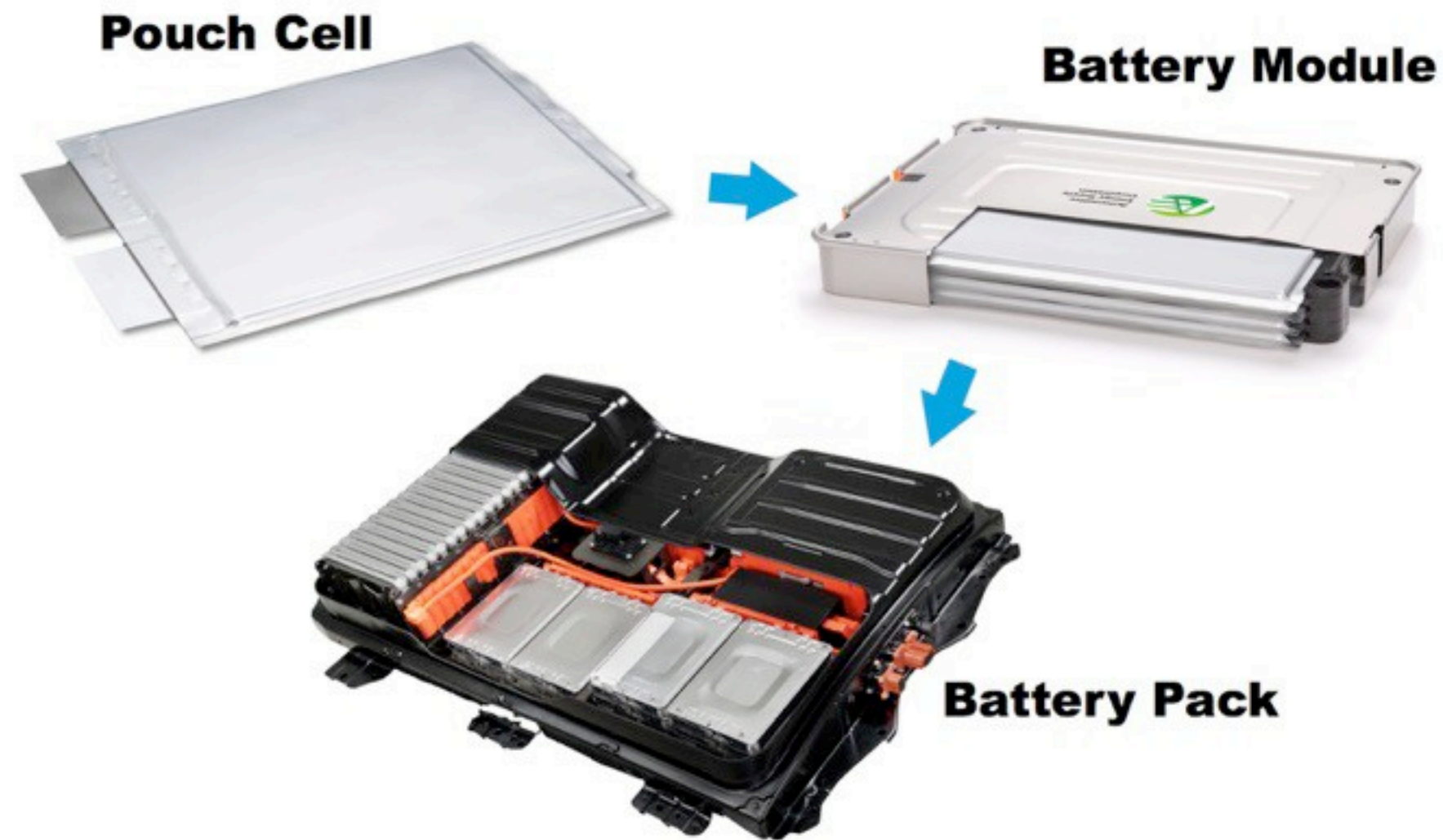


*Phase 2 pilot test platform*



*Few layer graphene test samples for customer program*





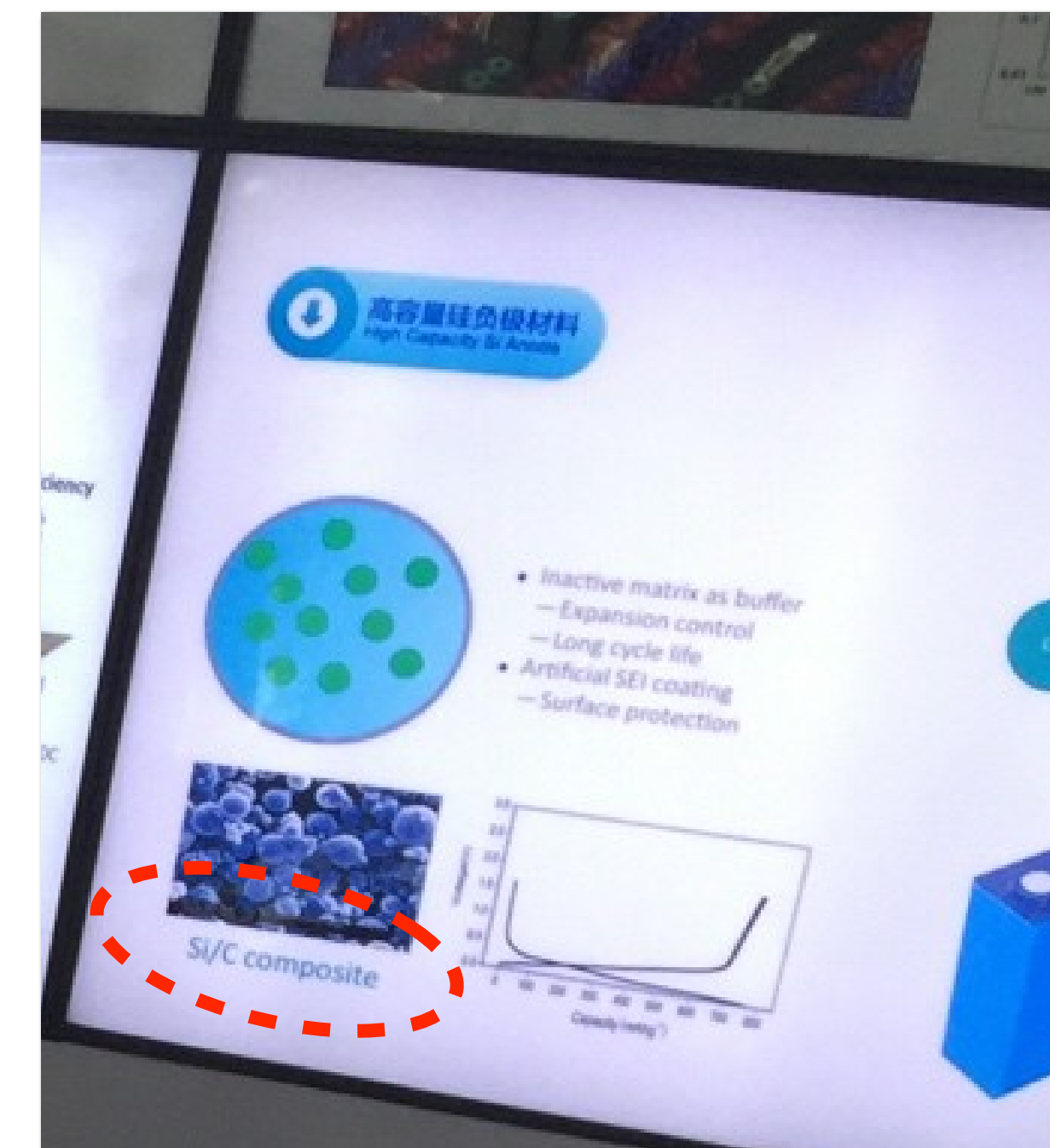
*Talga Li-ion battery test material preparation*



- ▶ Talga can produce graphite for Li-ion battery anodes: **No** grinding, micronising and shaping costs
- ▶ Recent tests support previous **breakthrough results** (ASX:TLG 17 Feb 2016)
- ▶ Results show **excellent stability** and greater than 99.7% efficiency without capacity fade
- ▶ Tests underway on **larger scale** programs at EIC Warwick UK and with battery manufacturer in USA
- ▶ Data supports commencing **industrial** Li-ion '**pouch**' cell testwork and commercial-style **roll to roll** anode formulations

- ▶ Major battery makers are testing and preparing the **next generation** battery technologies
- ▶ Some will **not** use spherical graphite anodes, forming 'technology traps'
- ▶ Graphene has been shown to suit current **and** emerging battery technologies:
  - *Silicon-graphene in Li-ion*
  - *Li-Sulphur*
  - *Li-Aluminium*
  - *Li-Air*
  - *Flow batteries*
  - *Printable batteries*
- ▶ Talga's ore has natural characteristics that may be exploited for new battery materials

Live-in factory facilities of global leading Li-ion battery manufacturer, China

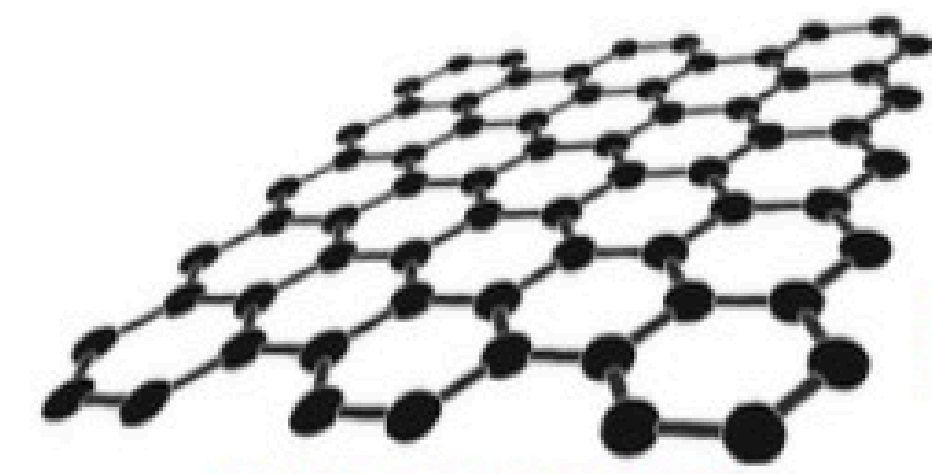


Silicon-graphene anode technology advertised as part of development

# Product - Energy, Coatings, Conductives

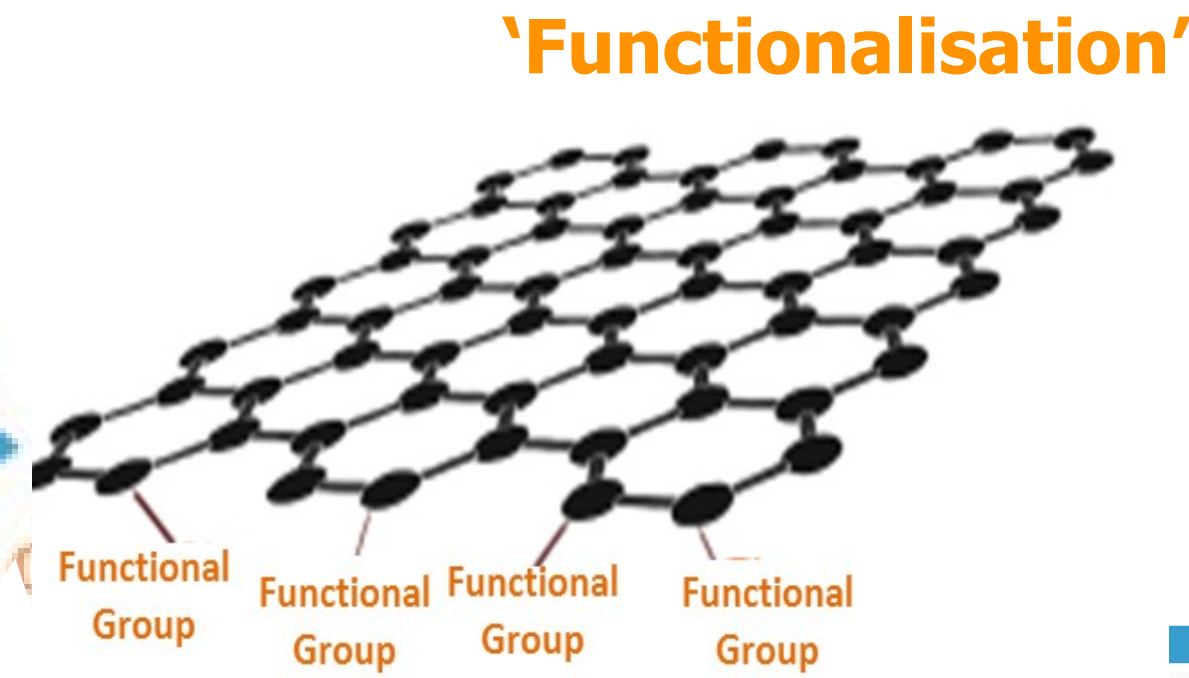
- ▶ Graphene produces opportunity to deploy our products more widely than just batteries
- ▶ Lighter components increase range and decrease emissions/km travelled



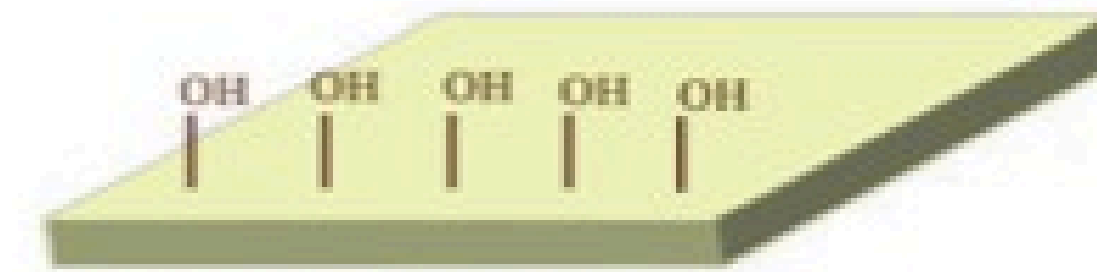


Talga Few layer Graphene

Chemical  
Modification

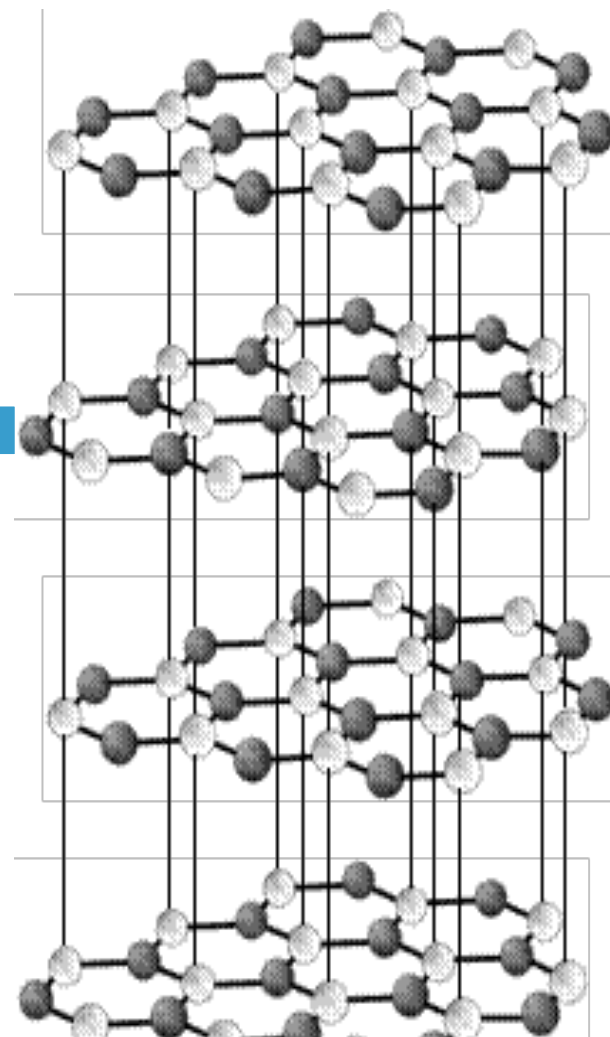


Surface Interaction/Adhesion

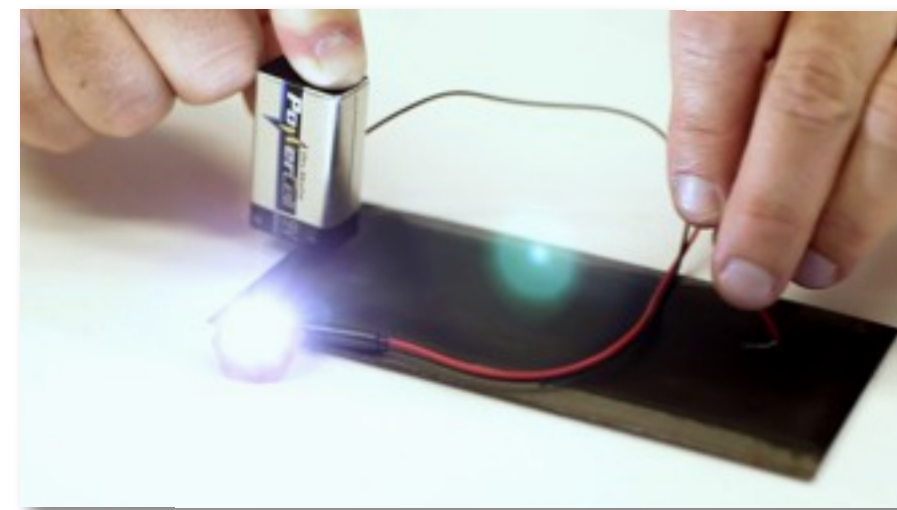


Metal substrate

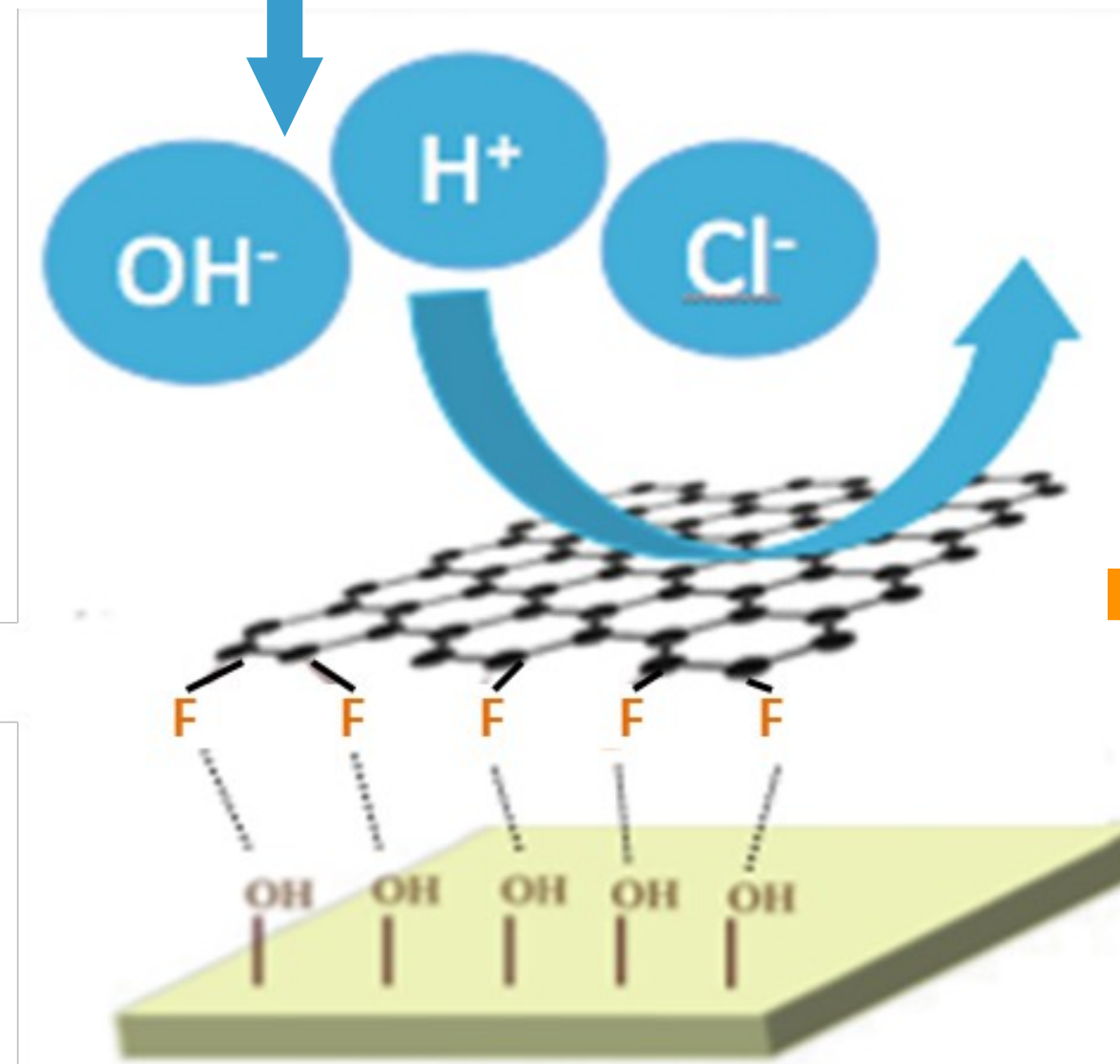
Talga Novel  
Exfoliation  
Process



Talga Raw Graphite Ore



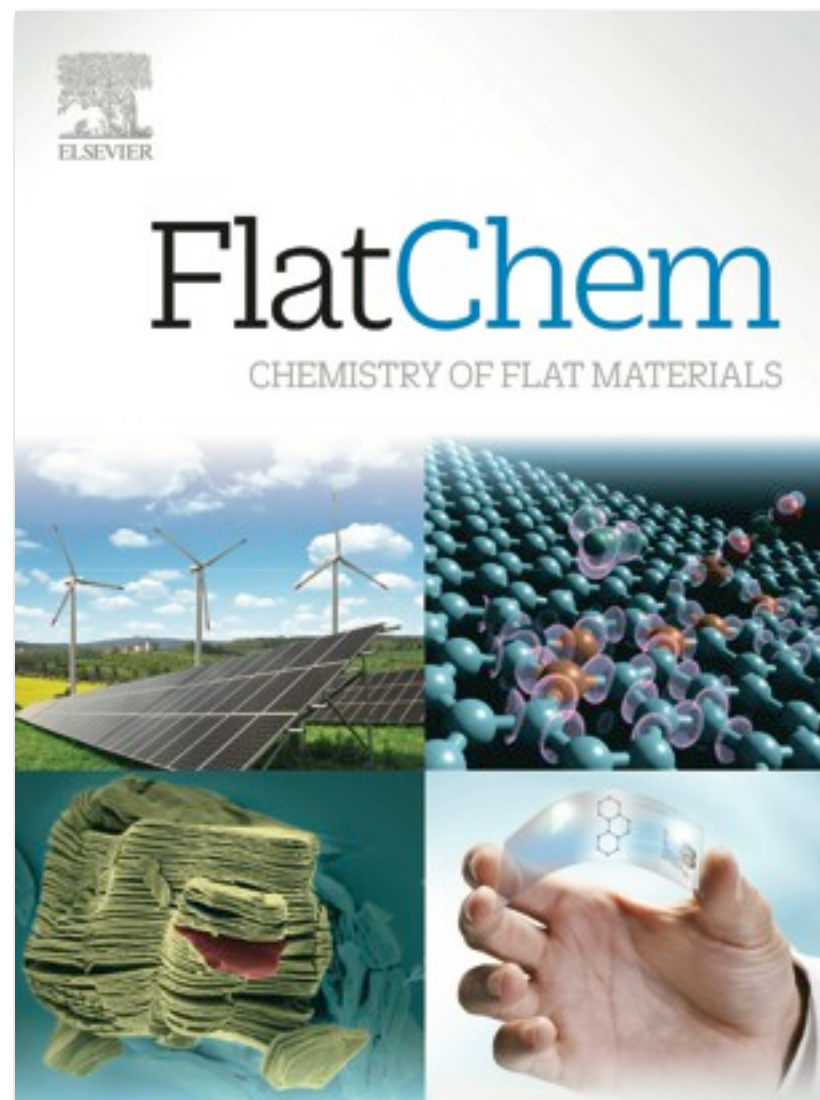
Talga Few Layer Graphene  
Coated Metal



Barrier and other  
properties



- ▶ Talphene™ enhanced coating corrosion evaluation results show 74% less water permeation and great anti-corrosion results on mild steel
- ▶ Validates global potential of Talga product for giant volume coatings sector



*Salt immersion tests show Talga's graphene significantly reduces corrosion over time*

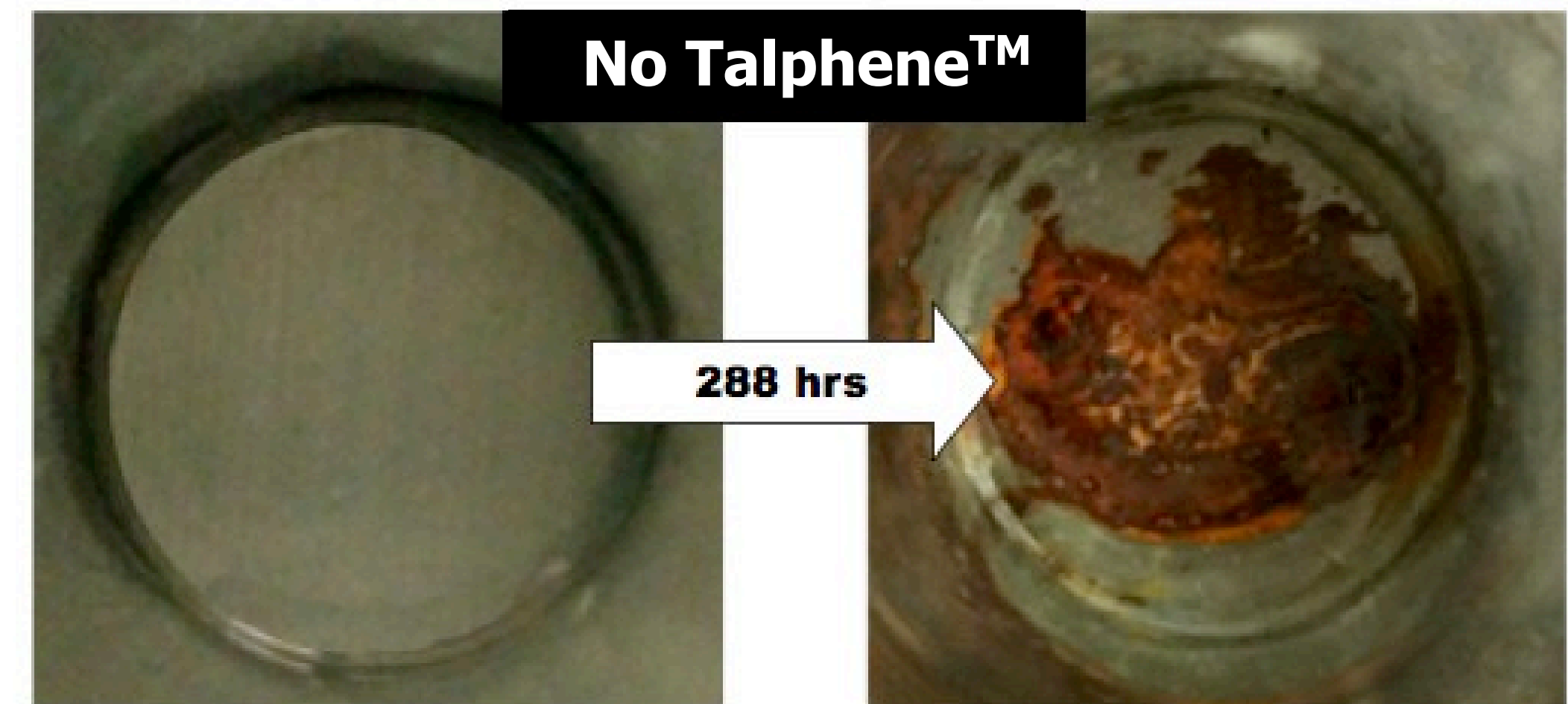
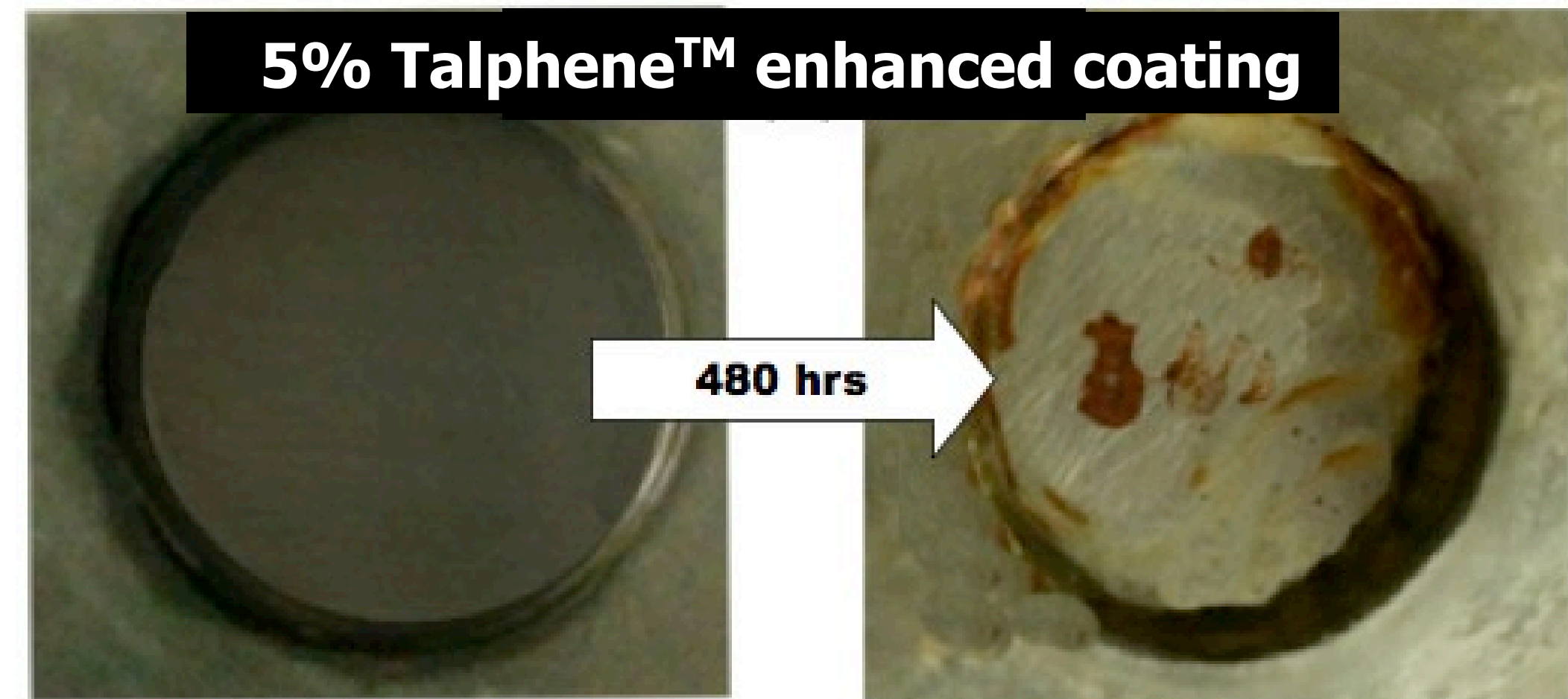
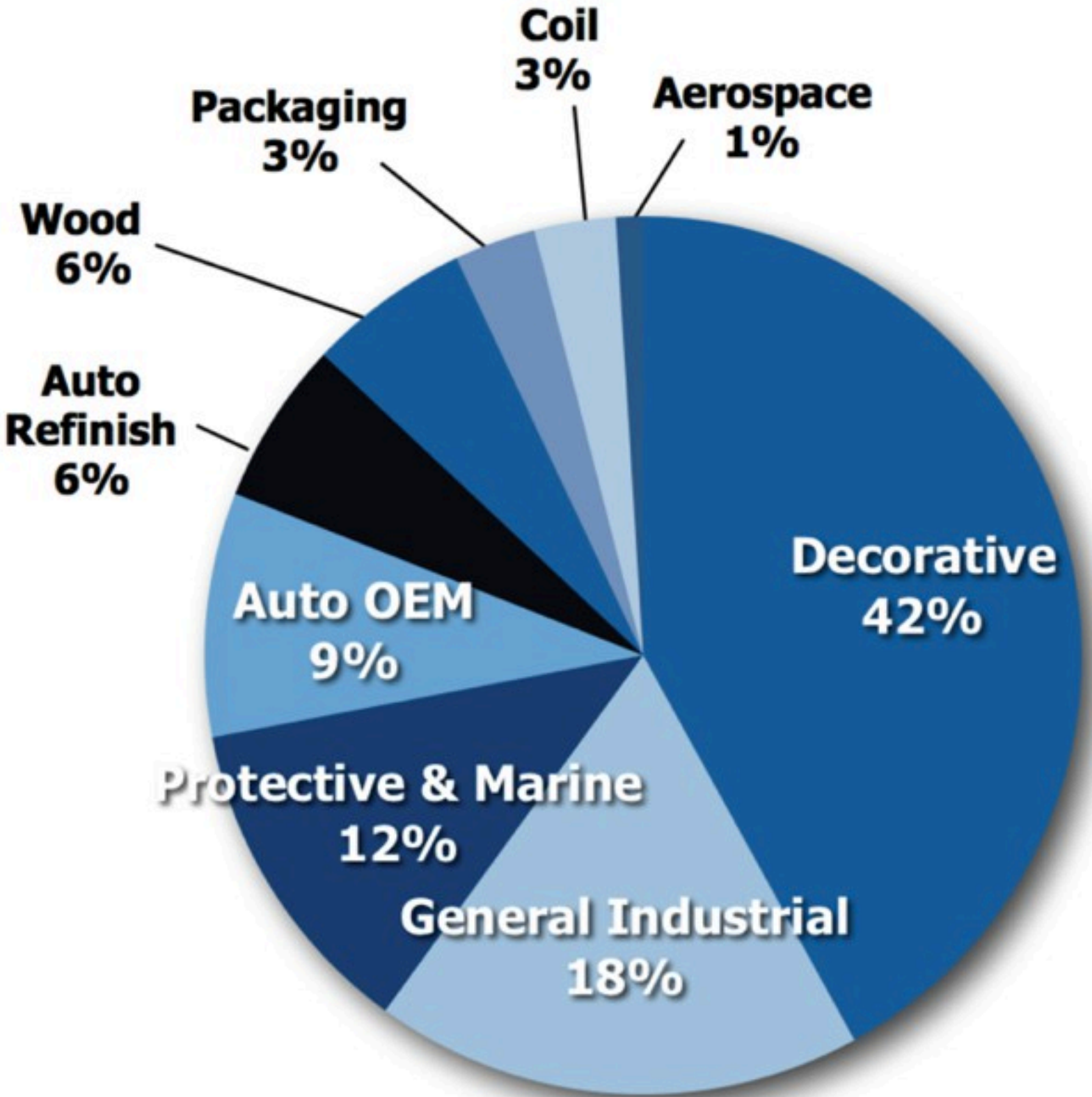


Fig 1. Paints and Coatings Global Market US\$/annum.

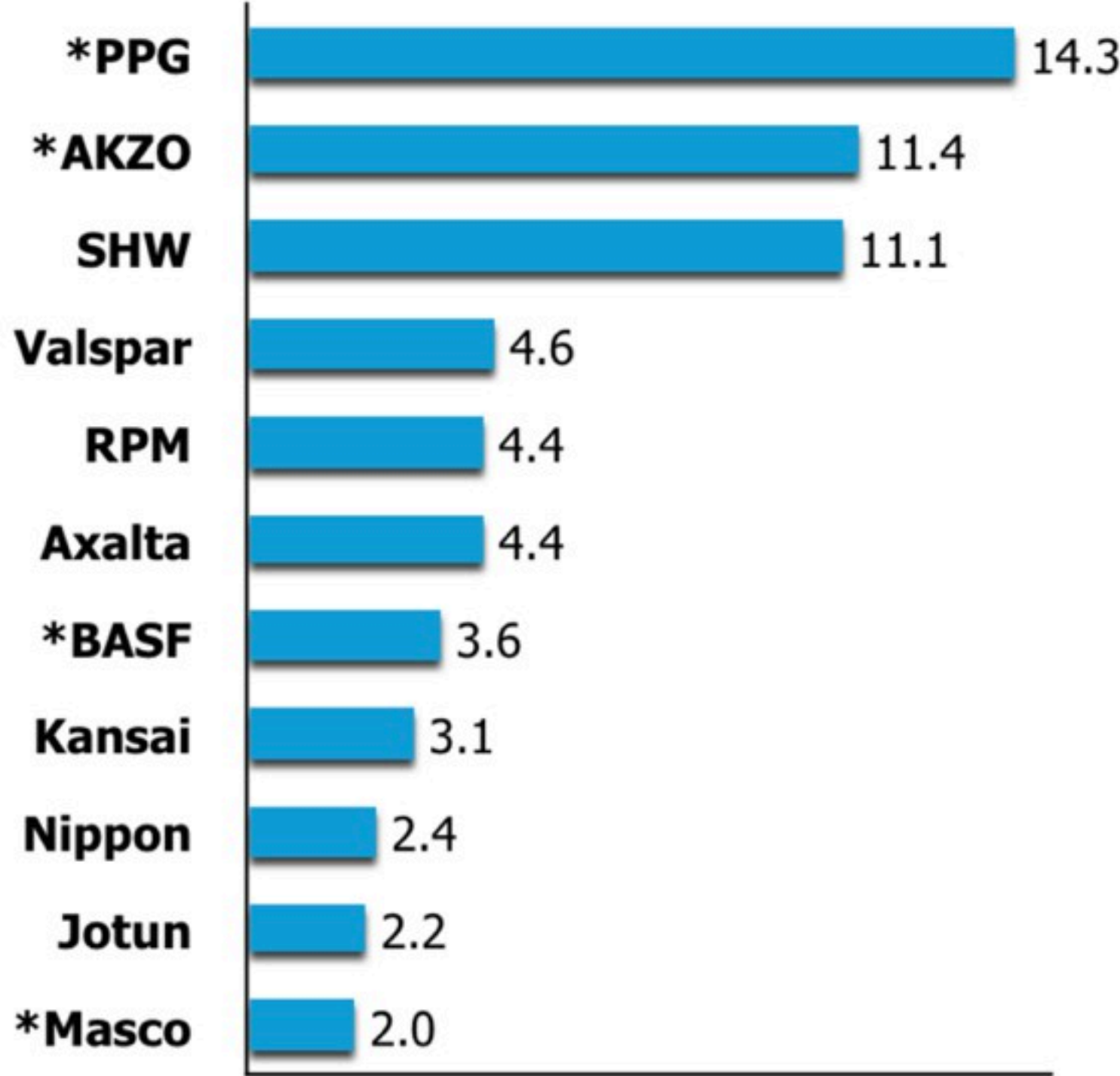
**Total Paints and Coatings Market : \$120 Billion**



Source: Jan 2016 Valspar Investor Presentation after 2013 Orr & Boss, Kusumgar, Nerlifi & Growney

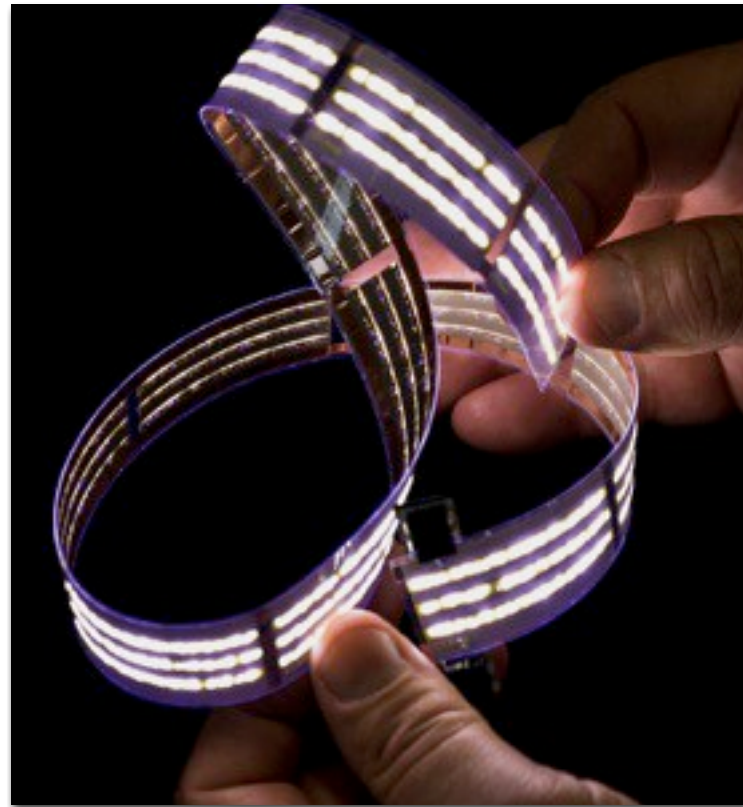
Fig 2. Paints and Coatings Market Leaders US\$/annum.

**Global Leaders by Sales (\$Billion)**



Source: Jan 2016 Valspar Investor Presentation & Company reports. \* Excludes non-coating sales

Automotive



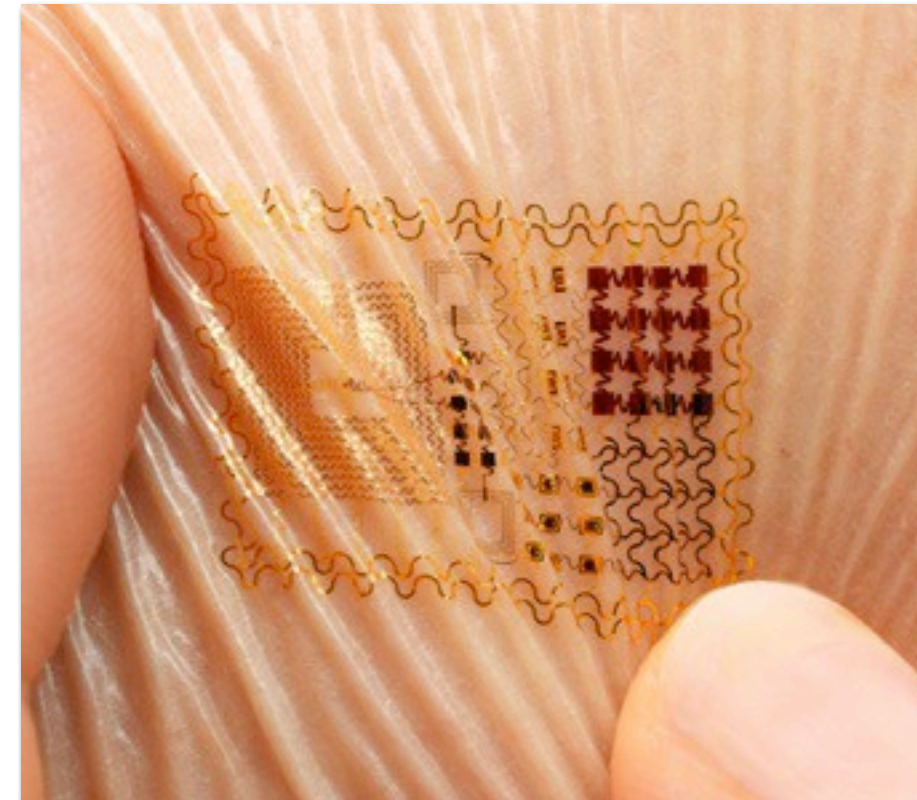
'Solar' Panels



Packaging/RFID



BioMed



- ▶ Graphene can make functional composite materials that are conductive, flexible, lightweight and non-corroding
- ▶ **Current markets** include RFID tags, printed packaging, copper-wire replacement and solar panels.
- ▶ **Emerging markets** in textiles, plastic and fibres for 'wearable' technologies, printable batteries & 3-D printing
- ▶ **Current** conductive ink market relies on high cost silver and carbon black but is **high growth**
- ▶ **78 million ounces** of silver used in solar panel industry in 2015, **up 23%** over 2014\*



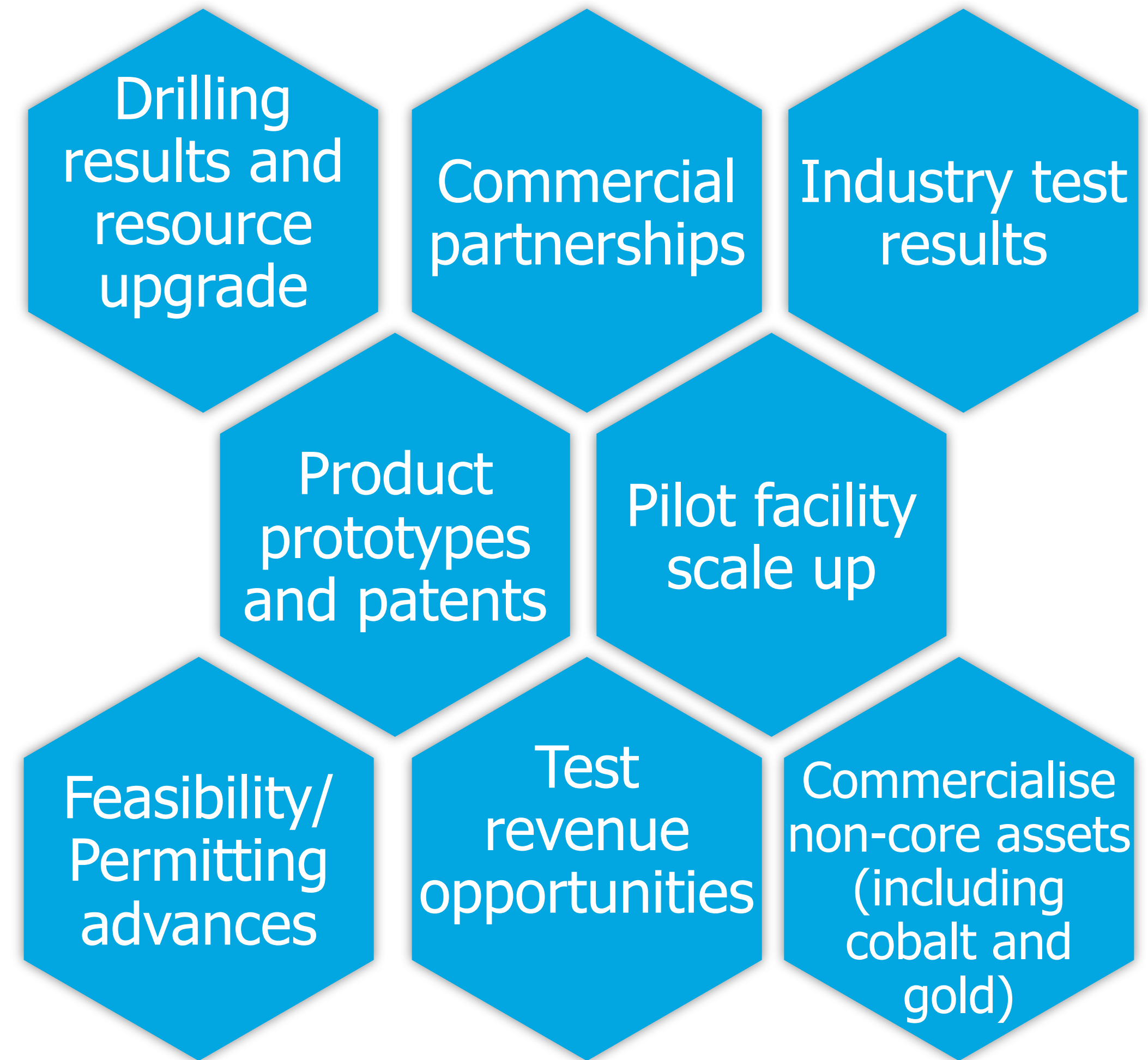
Snow-free driveway heating installation



Snow & ice-free road heating installation

- ▶ Graphene and graphite additives can make concrete electrically and thermally **conductive** for **ice & snow-free** roads, bridges, foot-paths, bike-paths, rail crossings, stairs, airport aprons as well as direct-heating house materials
- ▶ Electrically **warm** solid state material can use less energy and save installation and maintenance costs of pipes or Cu-wire
- ▶ Conductive cement useful for earthing of buildings, wind turbines and other lightning-prone structures
- ▶ Graphene also has ability to strengthen concrete similar to carbon nanotubes (eg, Edconcrete) but using lower cost graphene oxide

# Underway! Upcoming Catalysts



## 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 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.

# Graphene to Graphite Market on a Slide



## 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 (3-10 sheets)**  
Functional coatings, Composites, Plastics

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

### GRAPHITE

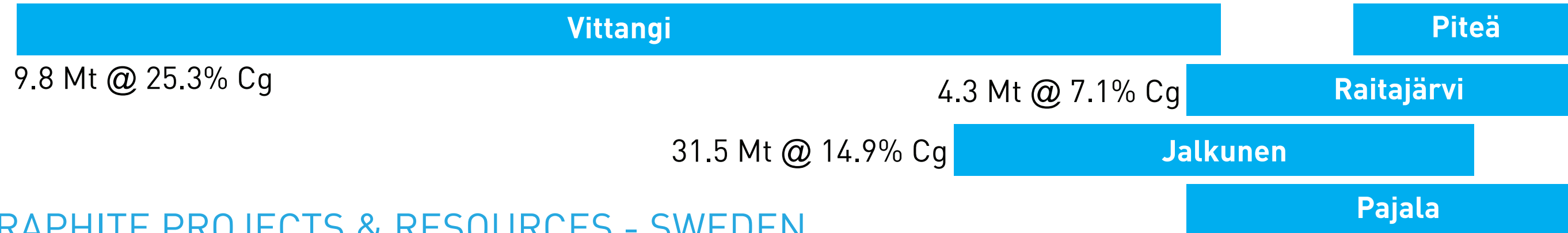
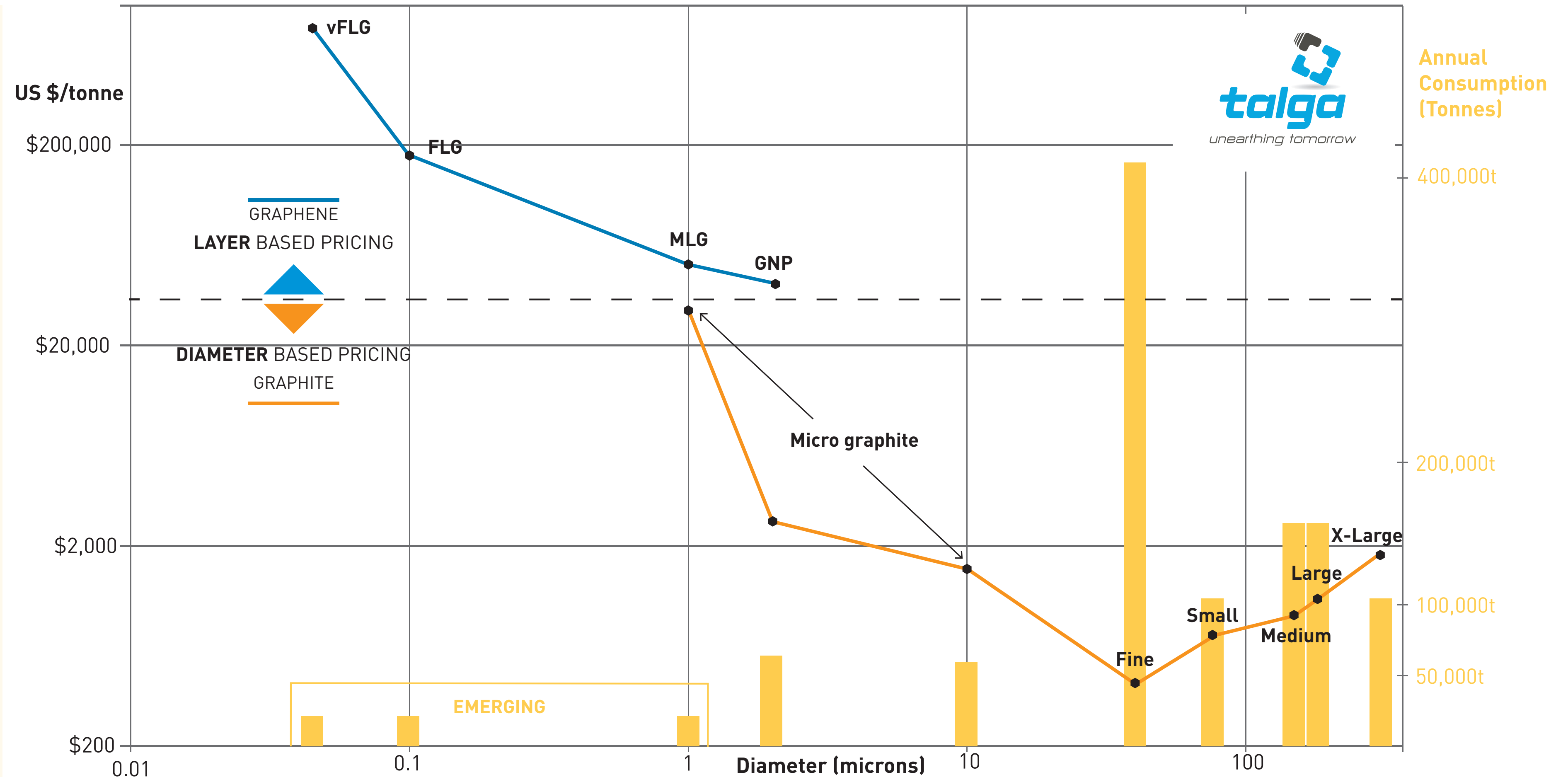
**Micro to X-Large = Flake graphite (>3,000 sheets)**

**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



## TALGA GRAPHITE PROJECTS & RESOURCES - SWEDEN

# Graphite JORC Resources and Exploration Targets



*Nunasvaara JORC (2012) Mineral Resource (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> 0-100m Depth*

| 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.*