



Graphite for Advanced Materials: A new breed of graphite mine

Mark Thompson, Managing Director
TALGA RESOURCES LTD

AUSTRALIAN
GRAPHITE
CONFERENCE

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Executive Summary

- ▶ Talga is an advanced materials company with a scalable and cost effective process to liberate graphene and its intermediates from its large high quality graphite ore deposits
- ▶ Owns five 100% owned graphite mineral projects (including the world's highest grade graphite JORC/NI43-101 mineral resource[#])
- ▶ Processing IP to produce graphene and micrographite direct from raw graphite ore which provides unique economic advantages compared to global peers. Removal of cost and volume barriers to enable widespread industrial uptake in material markets worth over \$700Bn
- ▶ Growing team in Australia & Europe as development status advances - scoping study, trial mining, pilot test-work & commercial collaborations underway
- ▶ Technology minerals manufacturer with strategy to partner with industry to address large volume, short path to market products across additives sector (inc. construction, energy, coatings and composites)

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

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- ▶ Products enhanced with graphene & micrographite are upon us (not distant possibility) - Large scale production will catalyse growth
 - ▶ Products and specs developed with industry via pilot scale test-work facility - Process optimised and upscaled same time as mine permitting and feasibility work occurs in background
 - ▶ Methodical validation of financial assumptions*
~A\$0.5B NPV and ~A\$30M capex
 - ▶ Real world products with addressable markets being defined now pilot scale processing and industry feedback is in place
 - ▶ Aim to be largest and highest margin graphene and micrographite raw material producer with very valuable mining assets and IP - keep door open to diversified financial models beyond raw material sales

Upcoming in 2016

- ▶ Increase industry/end user engagement from technical tests to commercial commitments - closer ties with partners
- ▶ Increase scale at pilot test work facility & enable product developments in industry
- ▶ Define key markets and products for next stage test-work delivery
- ▶ Trial in products/third party validation
- ▶ Test retail sales and value added product potential - Add value to all parts of ore
- ▶ ***Drive Talga value towards scoping study NPV result***



High Grade Graphite Pipeline

- ▶ **100% ownership** of **five** graphite projects in Sweden containing **multiple deposits**
- ▶ Full range of graphite flake sizes from **graphene**, **micrographite** to **jumbo and larger**
- ▶ **Three JORC resources**¹ plus additional **136-250Mt @ 18-25%Cg** exploration targets¹



Vittangi

JORC Resource Total **7.6Mt @ 24.4% Cg**

Jalkunen

JORC Resource Total **31.5Mt @ 14.9% Cg**

Raitajärvi

JORC Resource Total **4.3Mt @ 7.1% Cg**

Pajala

Drilled flake sizes **<75µm to >400µm**

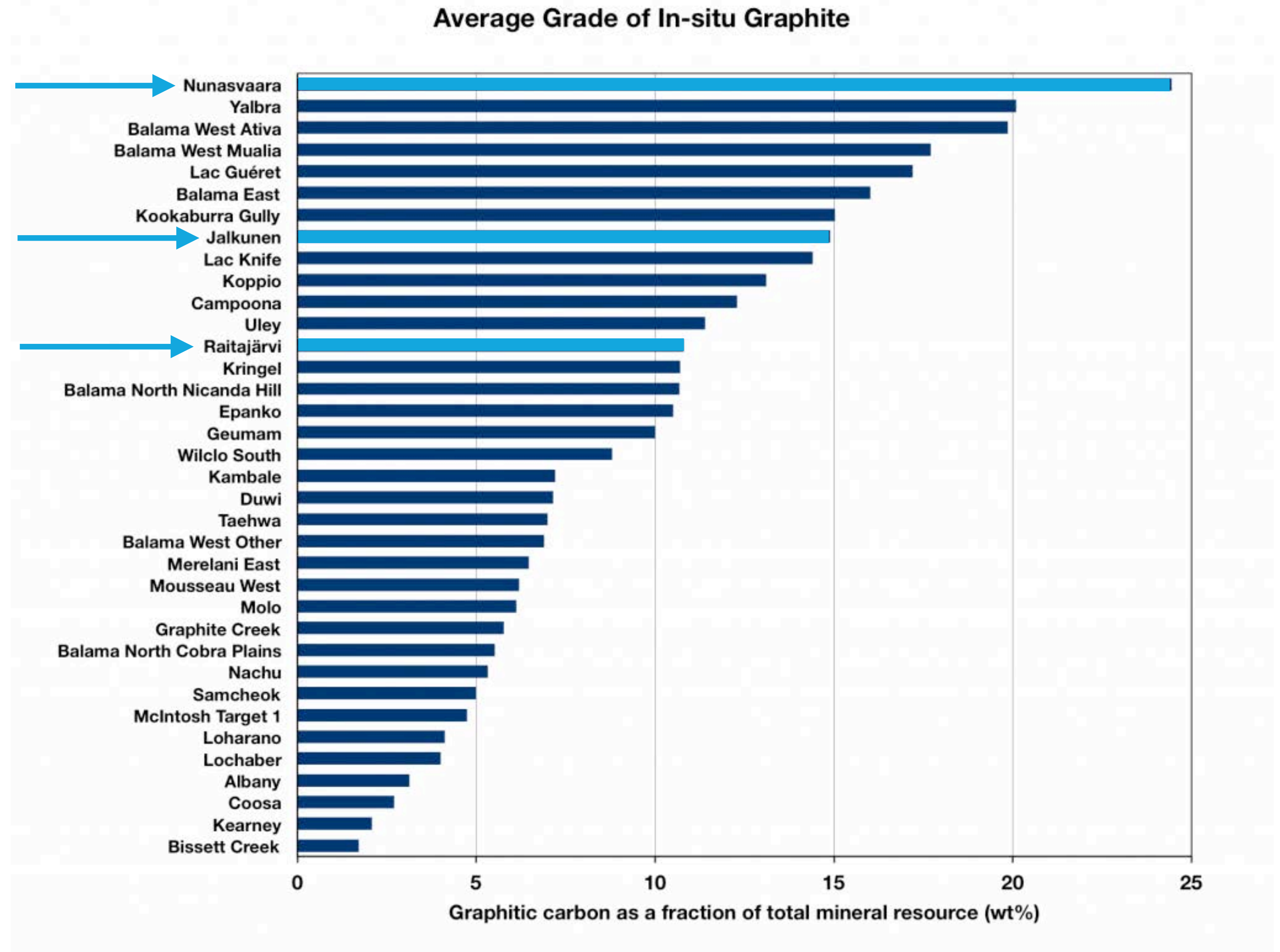
Piteå

Drilled flake sizes **80% >300µm**

¹See Appendix 2 for JORC mineral resource and exploration target details.

Global JORC/NI43-101 Graphite Resources by Grade

- ▶ 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





Advantages of Sweden

- ▶ Established quality **infrastructure**
- ▶ **Low cost** power supply with **high renewable** energy content:
 - Hydro **67 TWh**
 - Wind **12 TWh**
 - Solar **79 MWh**
- ▶ **Low CO₂** emission person/year:
 - Sweden **5.1t**
 - EU **7.9t**
 - USA **19.1t**
- ▶ **Low risk long term stable investment jurisdiction** with low emission benefits in supply chain
- ▶ Rail and road **connection** to EU markets
- ▶ Mineral Production tax **0.2%**
Corporate tax rate **22%**

Hydroelectric power source in north Sweden



Established Operations Near Markets/Customers



Research, Development and Analytics

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

Local Industry/Potential End users

- ▶ Use research as interface



German Operations

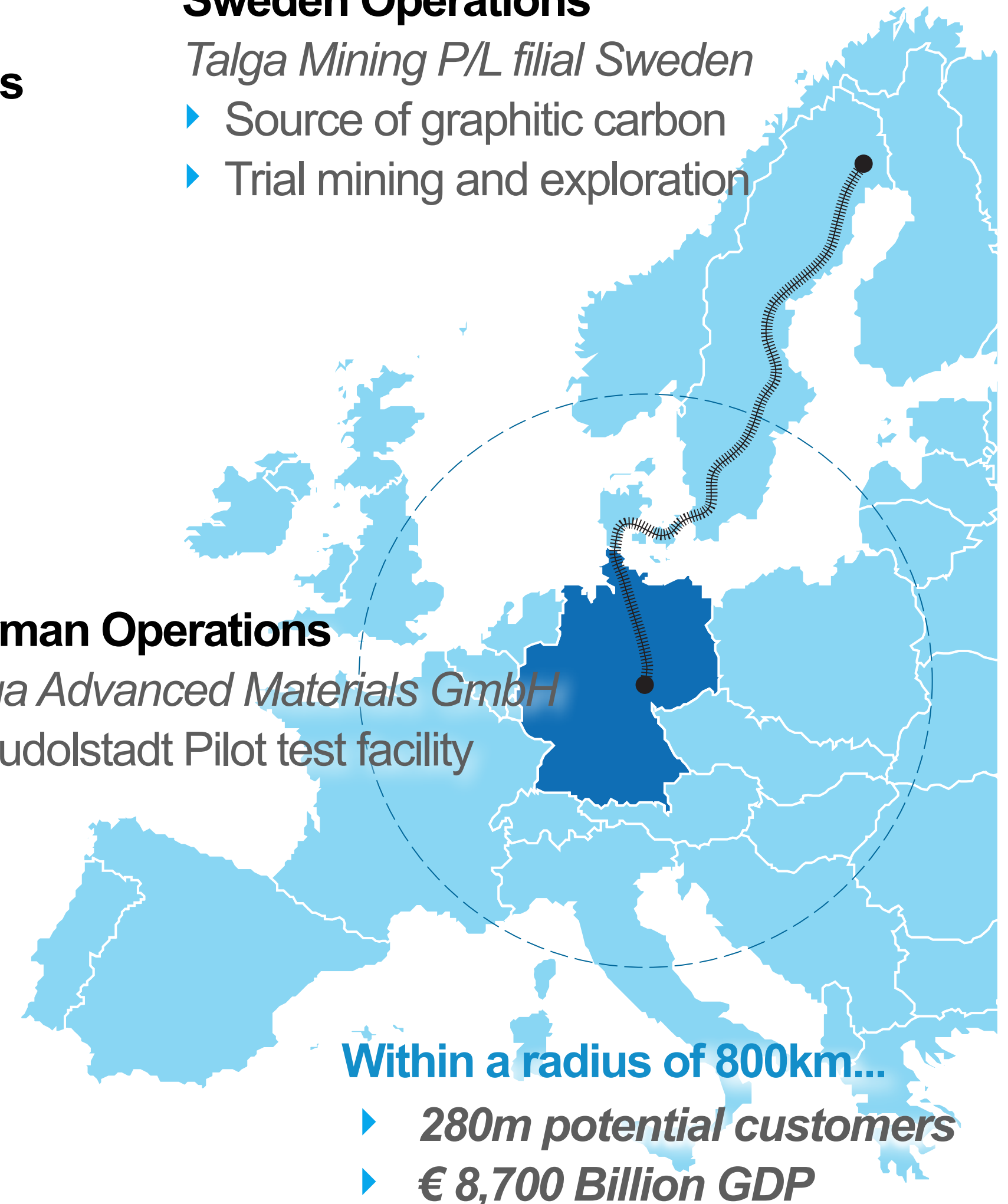
Talga Advanced Materials GmbH

- ▶ Rudolstadt Pilot test facility

Sweden Operations

Talga Mining P/L filial Sweden

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

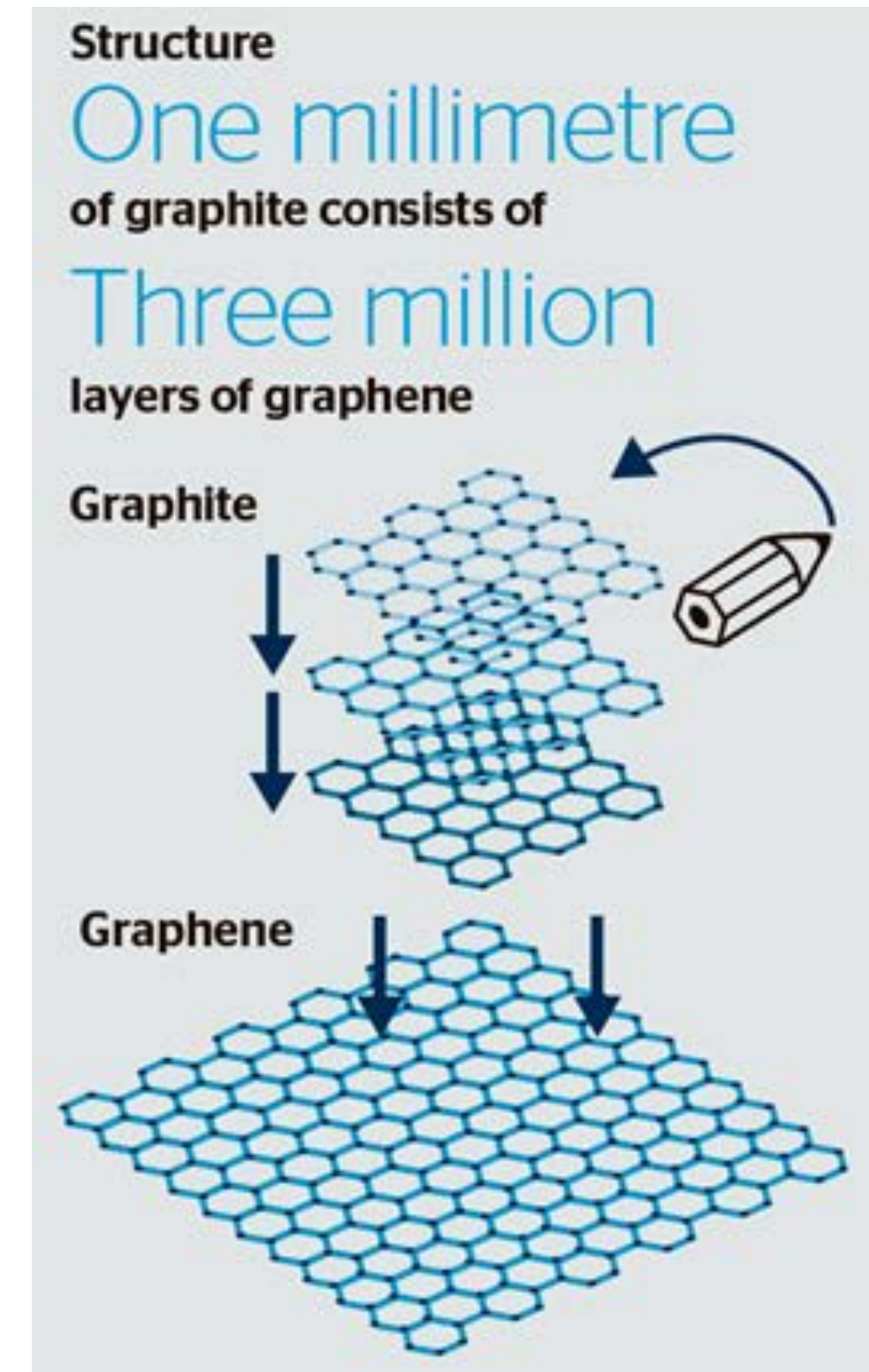


Consultants

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

Graphite vs Graphene?

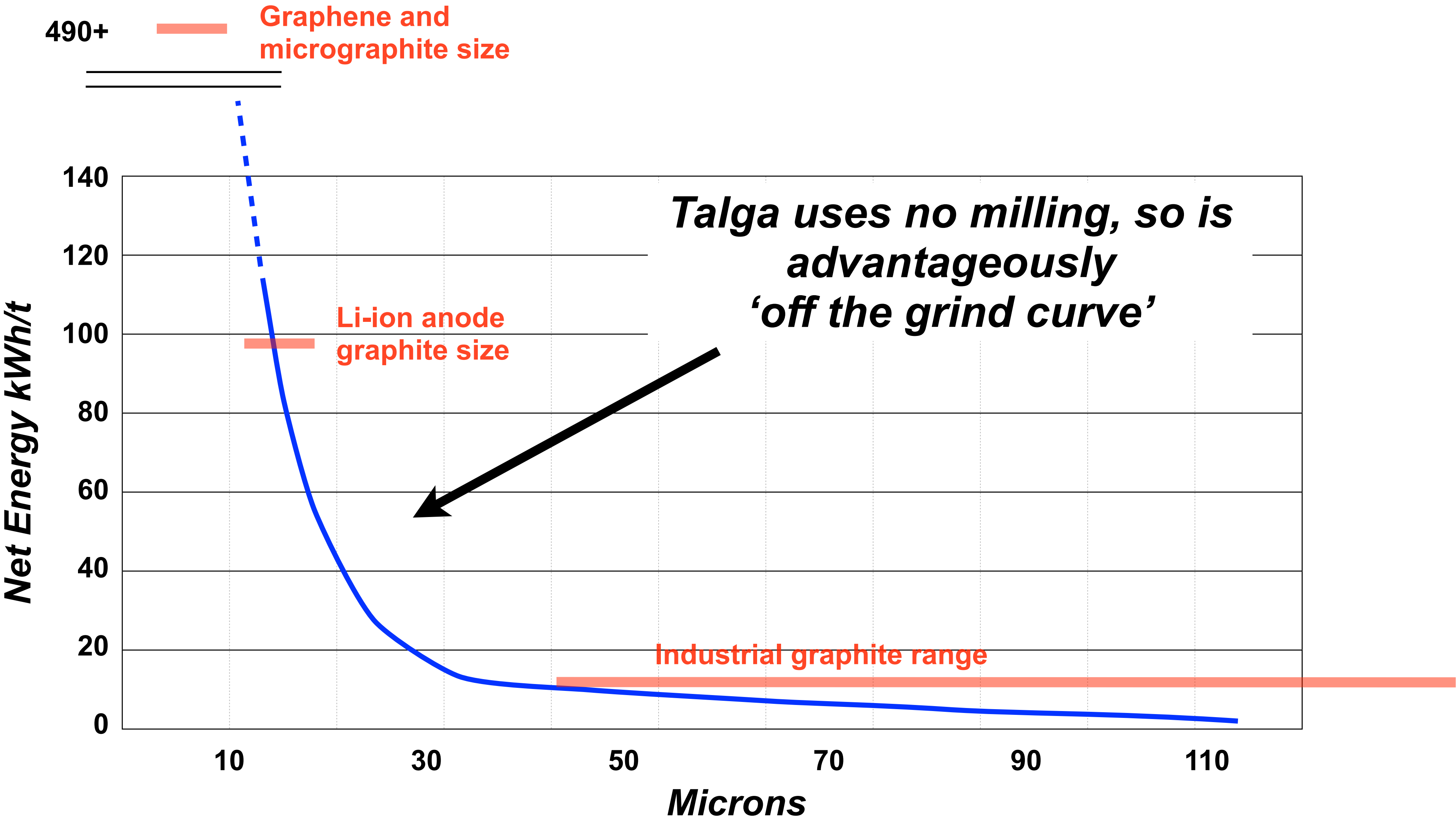
- ▶ **Graphite** (as a natural mineral) is crystalline carbon, arranged in stacked layers.
- ▶ **1mm** of graphite contains **~3 million** layers one atom thin layers, called **graphene**.
- ▶ **Graphene** was produced for the first time 10 years ago and it is the thinnest, strongest, most impermeable and conductive known material.
- ▶ Natural graphite therefore is **already made** of graphene, but to separate graphite to graphene is very **expensive** and **hard to scale** up.
- ▶ Thus graphite can be processed into 'galaxy' of materials - with a range of properties, more extraordinary the closer you are to single layer (graphene), suiting variety of applications/markets.



Graphite vs Micrographite?

- ▶ Perception large flake is only valuable market
- ▶ Micro graphite (<40um) critical for range of bulk markets including lubricants, alkaline batteries, building materials, coatings, plastics etc
- ▶ Premium pricing comes into play at smaller sizes as traditional milling is replaced with specialist ultrafine grind methods with high energy demands
- ▶ Current market for 'micro' to 'nano' particles >110ktpa*
- ▶ Can have minimum pricing >\$1,500t in bulk and current grades >\$75,000t retail for smaller quantities due to exponential cost increase for micronisation to ~2um and sub micron
- ▶ Vittangi project flake natural range 0.5-10 micron in situ but highly crystalline flakes - not amorphous. Processing method preserves thin state without requiring milling energy
- ▶ Potential in multitude large industrial markets not previously challenged eg, carbon black

Grinding costs increase exponentially with size



Ball mill grind to 80% passing size (microns). 9mm ball media. West Australian mine data.

Graphite and Graphene: do you know the cost?

- ▶ Usually graphite ores require drill/blast mining, crushing, milling, flotation and purification stages to produce a graphite concentrate, **prior** to the start of making expanded graphite and ultimately graphene
- ▶ Each stage induces an environmental footprint from the energy, dust, chemicals and waste
- ▶ The **ideal** is a method that does not require so many steps and has a smaller energy, social, environmental and economic cost. Synthetic or expanded graphite is very expensive
- ▶ Largest end users prefer 'clean' supply chains, from long-term stable jurisdictions



*Video of typical graphite
production facilities in China*

Talga Simplifies Processing Steps vs Others



GRAPHITE PRODUCTION

GRAPHENE PRODUCTION

Liberation

Concentration

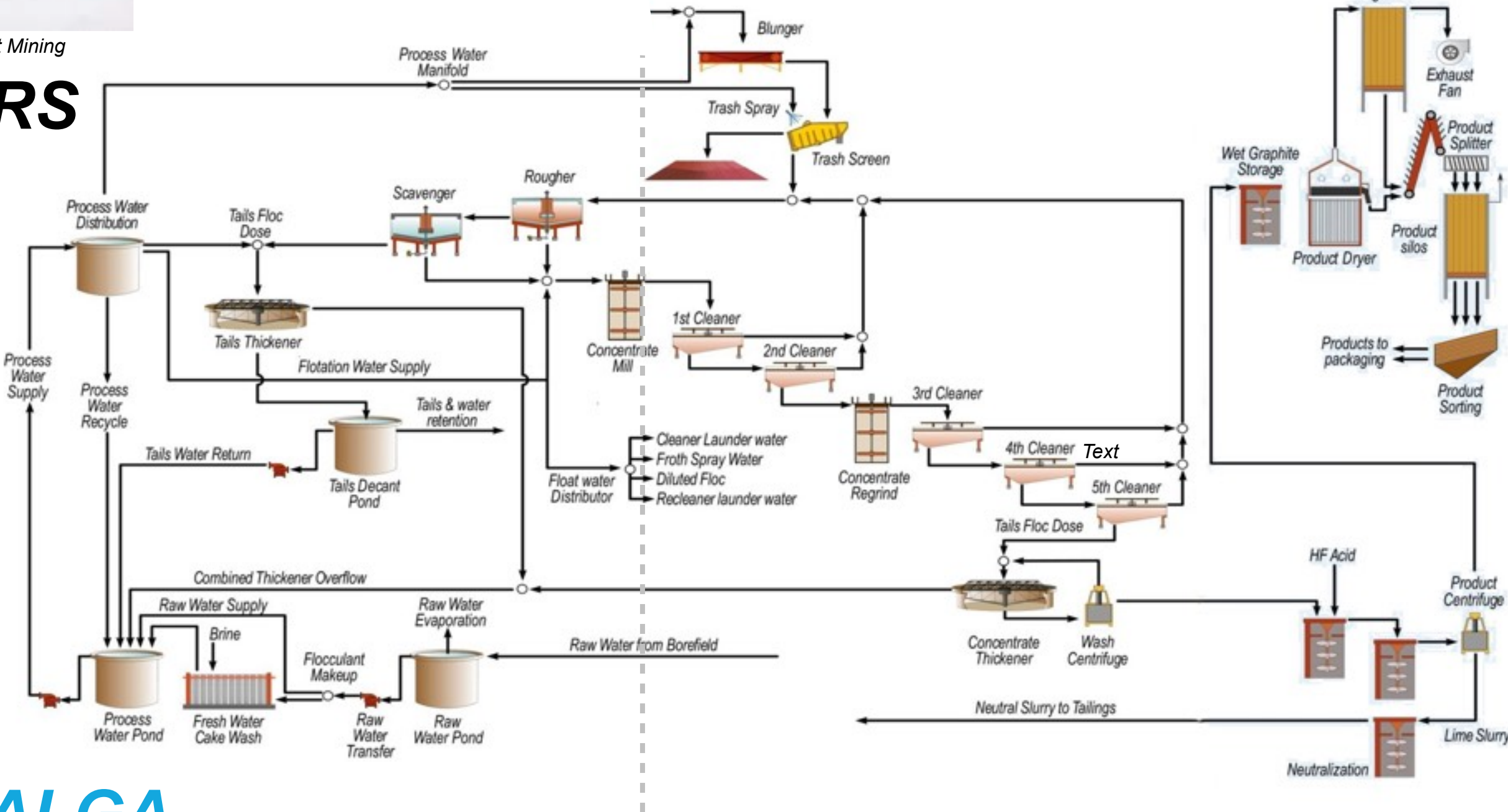
Liberation

Concentration



Drill and Blast Mining

OTHERS



TALGA



Block Extraction Mining/Shaping



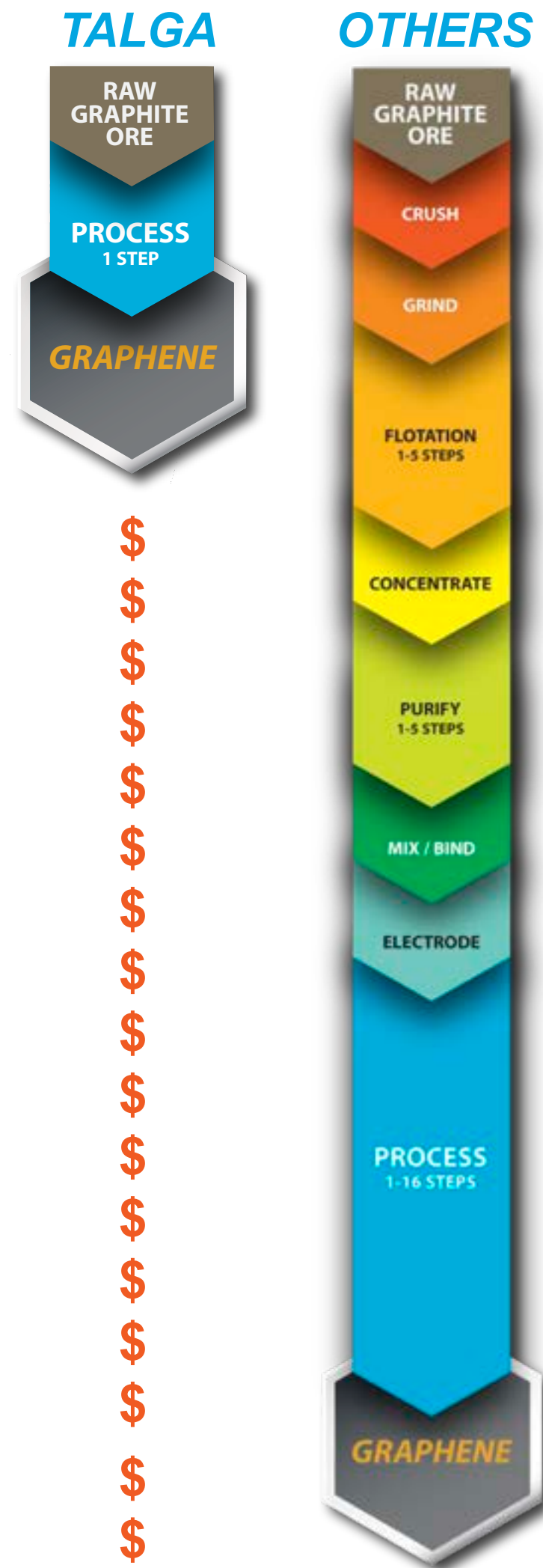
Block Transport to Mill



Stylised Graphene and Mico-Graphite Liberation and Concentration Plant

Product Packaging

Talga Economic Advantage



- ▶ Talga's patent pending technology uses **unprocessed raw graphite ore** directly as an **electrode** in an **electrochemical cell**.
- ▶ **The process drives molecules between the layers of graphite** to liberate pristine **graphene** in a **single stage**.
- ▶ Benefits are:
 - Industrial **Scalable**
 - **Economically** revolutionary
 - **Flexible** to produce range of products for broadest market
 - More environmentally sustainable
- ▶ Can incorporate **in-situ** functionalisation and product dispersion.

00:15

The black particles are graphene and graphite
exfoliating from the unprocessed raw ore



Successful Trial Mine

- ▶ 2015 trial mining confirms amenability of ore to be shaped and extracted to suit electrochemical conversion process to graphene.
- ▶ Further ore extraction permitted to 2018 before full scale permitting.



Trial Mine (Video)

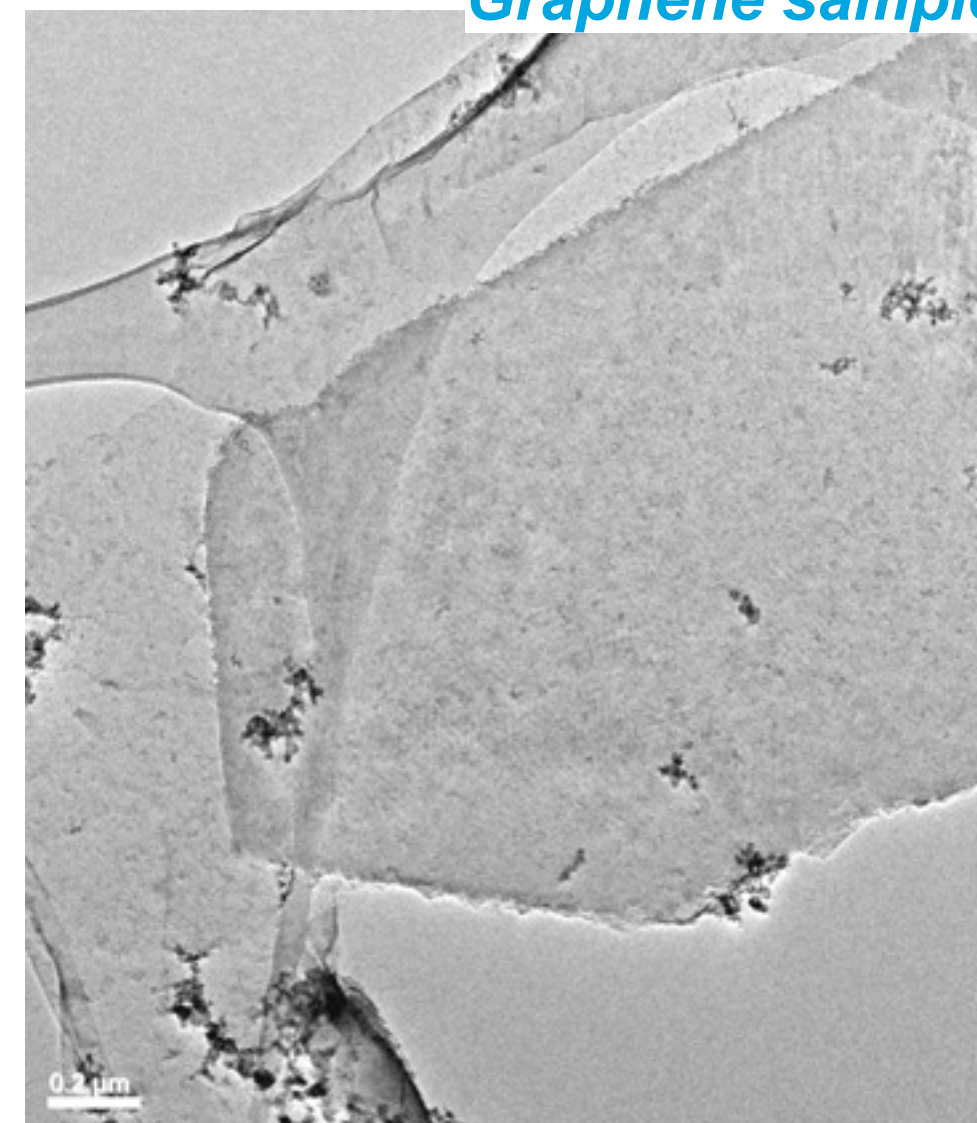


Development Underway

- ▶ 2015 **trial mining** complete - further campaigns up to 2018 permitted
- ▶ **Pilot test-work underway** in Talga's facility in Rudolstadt, Germany (8 employees)
- ▶ **3 phases** to upscaling process - first phase (10kg feed/cell) **underway**, second phase (multiple 50kg feed/cell) wet commissioning March 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 from Rudolstadt



Talga Advanced Materials GmbH

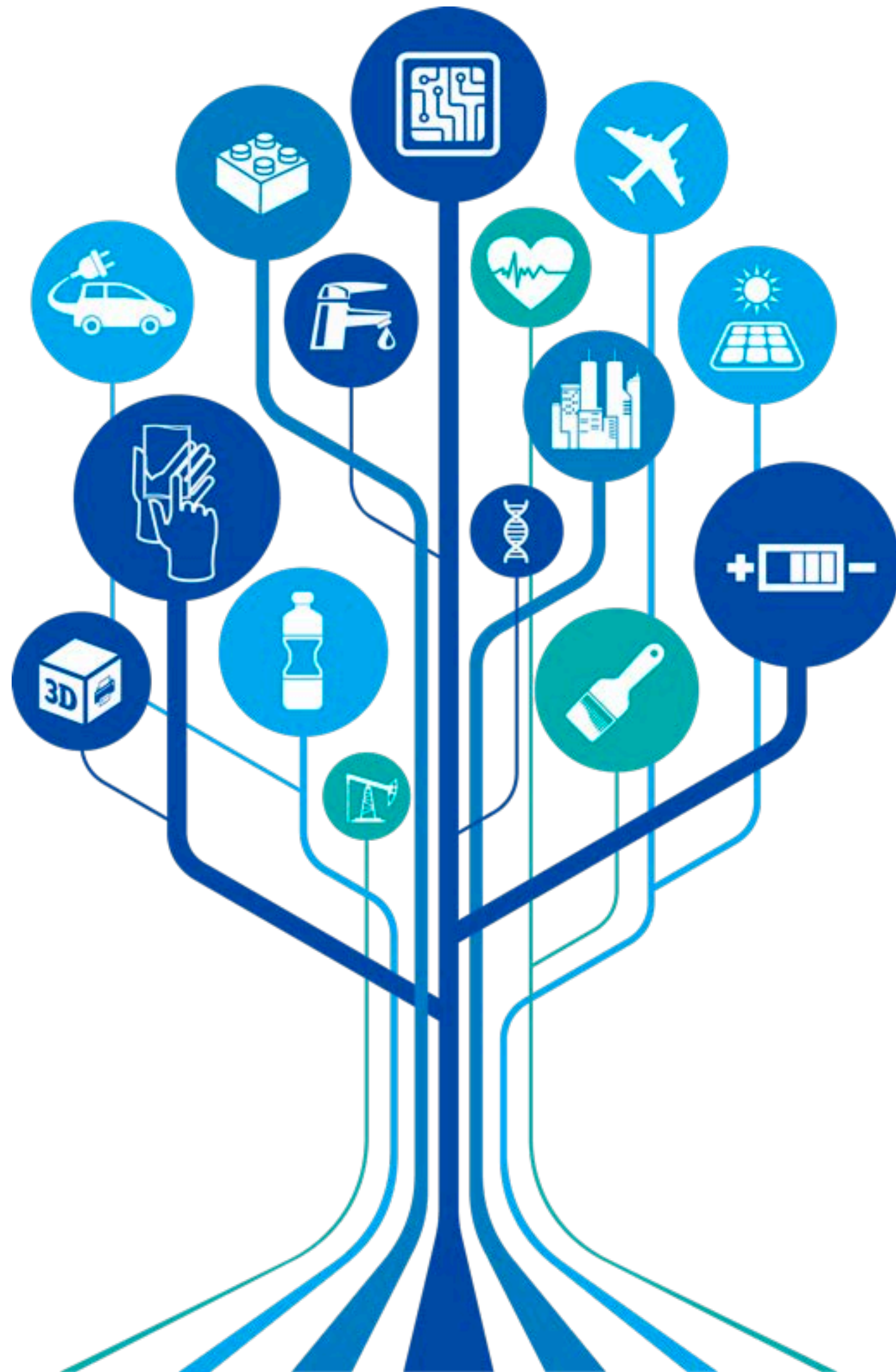
Rudolstadt, Germany.



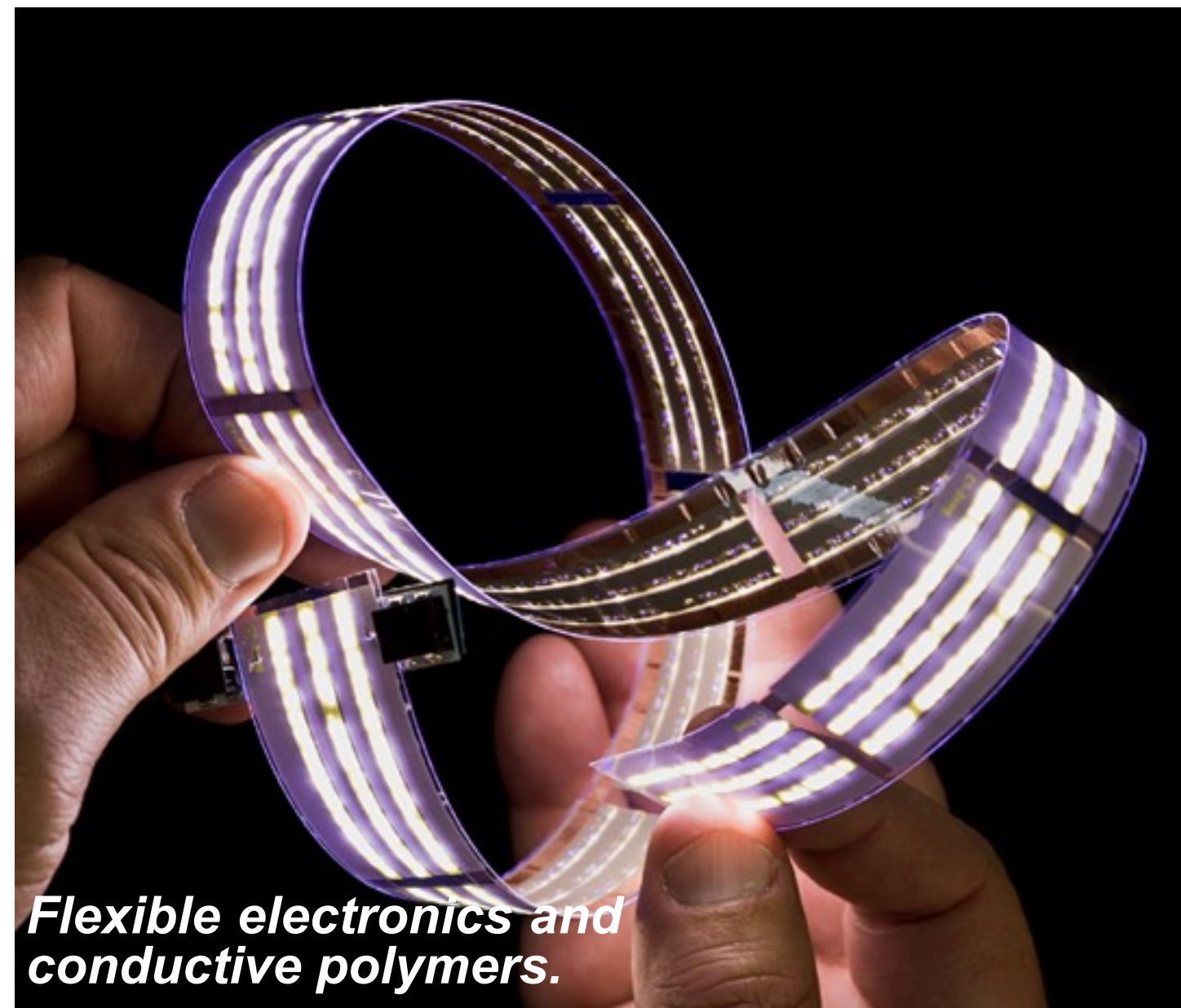
Ore Cut into Electrode Shapes for Process



Large Volume Additive Markets



- ▶ Graphene and micrographite can be used as additives to current applications and more advanced materials.
- ▶ At low loadings (less \$/tonne) can improve strength, electrical and/or thermal conductivity, impermeability and flexibility.
- ▶ Essentially things can become faster, lighter, stronger or functional (transmit or store energy).



Flexible electronics and conductive polymers.

Talga Graphene Target Markets

Coatings

- Replace chrome and zinc in anticorrosion & antifouling
- Electric and thermal conductive
- **Current** market 40Mt/a worth over \$150 billion/annum



Energy

- Li ion batteries
- Flow batteries
- Fuel cells
- Solar panels
- printable circuits



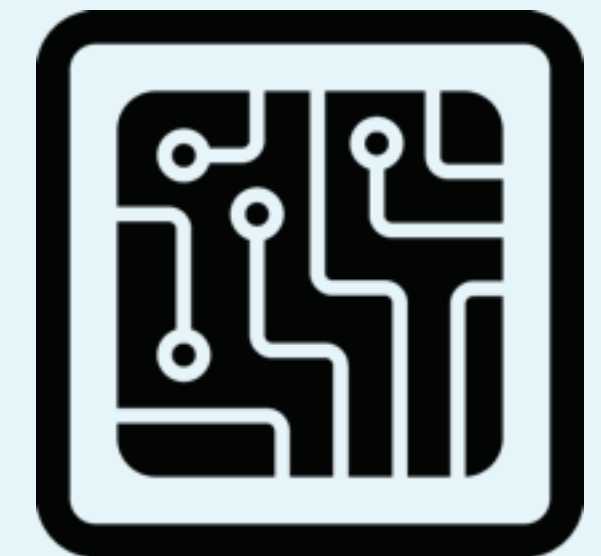
Construction

- insulation foam
- lighter, stronger cement (current cement additives market alone \$13.6 billion)
- functional glass



Composites

- stronger, lighter plastics
- 3D printing inks
- flexible conductive materials



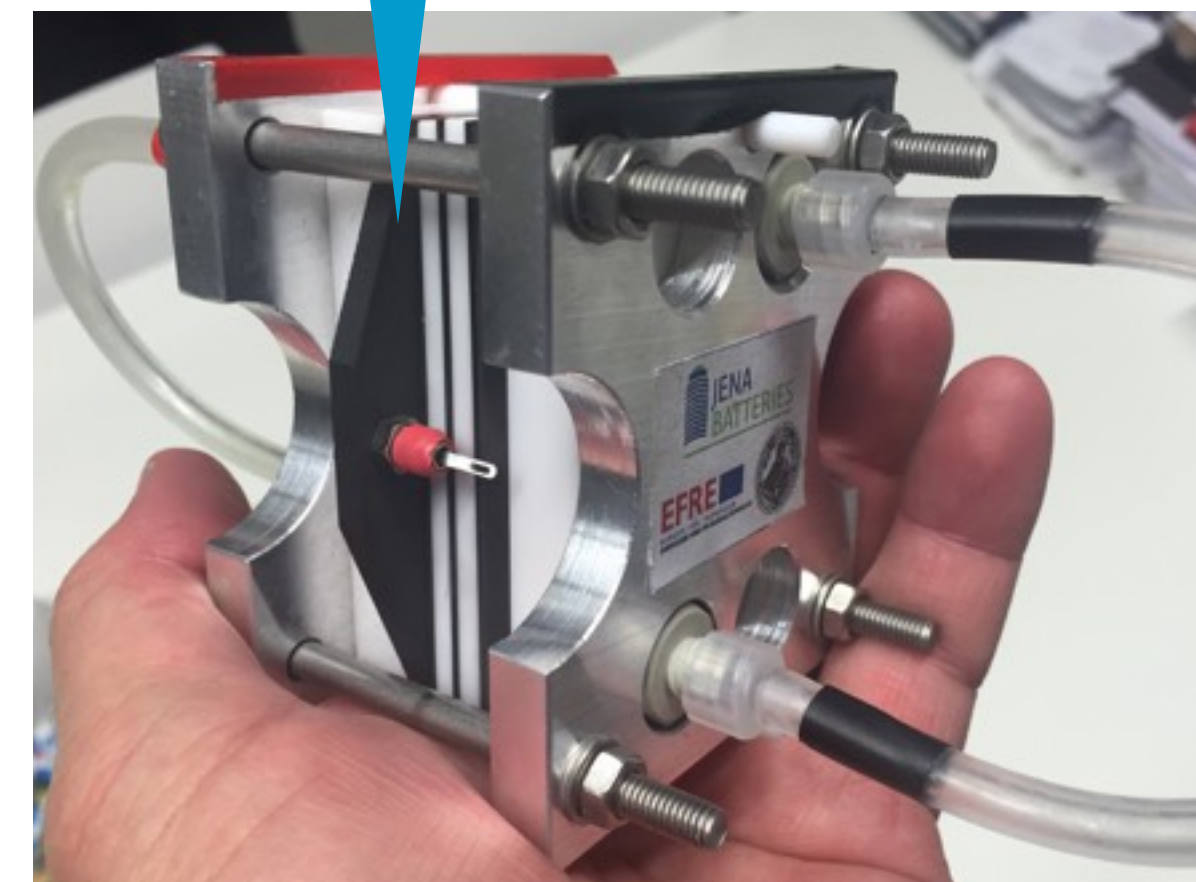
Energy - Storage (batteries)

- ▶ Talga produces graphite in the **same process** as the graphene
- ▶ Graphite is currently a significant component of **many types** of energy storage devices
- ▶ Commonly there is 10x more graphite than lithium in a Li-ion battery
- ▶ Global Li-ion demand worth over US\$50b with battery materials alone worth over US\$10b, up from US\$375m in 2011
- ▶ Advantage of Talga is less energy (**no grinding, micronising and spheronisation**) to produce sized graphite for Li-ion anodes. Positive first tests of Talga material at Max Planck Institute
- ▶ Talga product may also suit flow batteries and energy production units like fuel cells



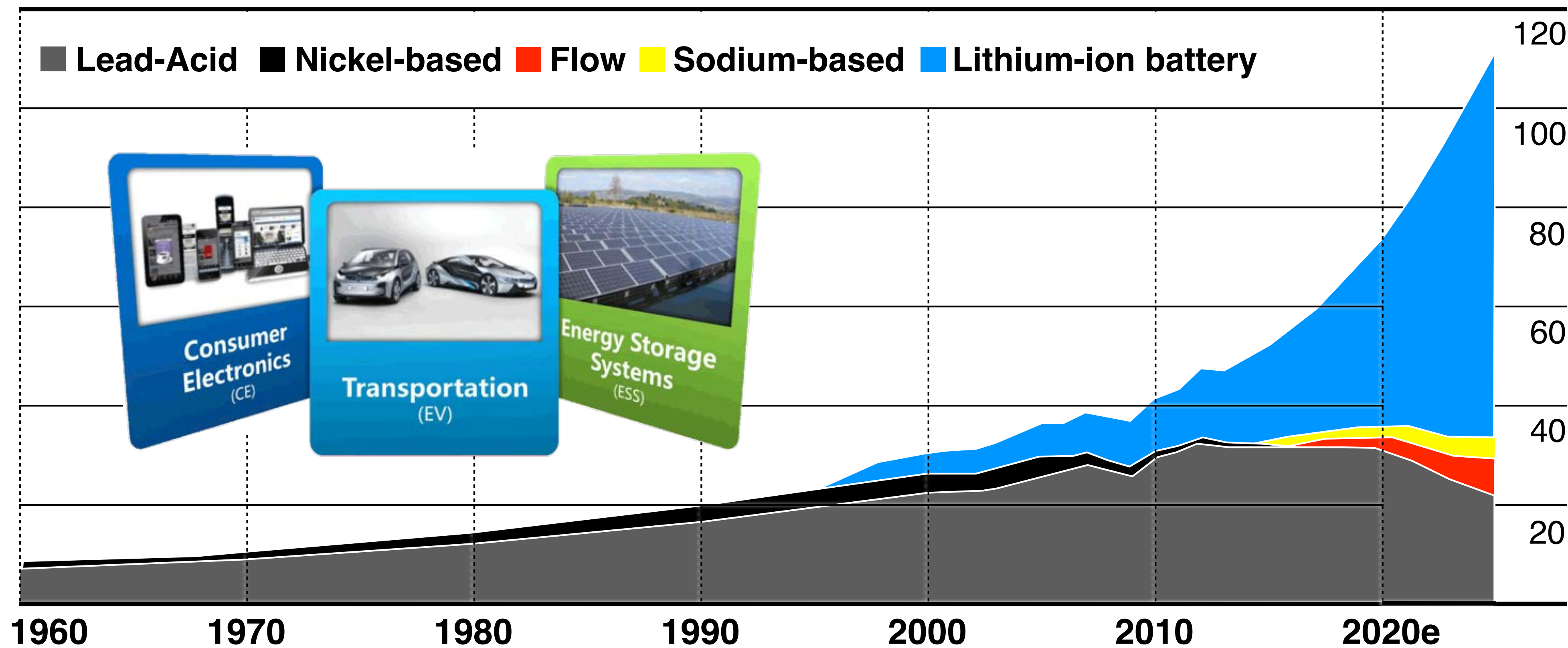
Graphite in Li-ion battery

Graphite in flow battery



Rare commodity - a growing demand

Global rechargeable battery market (\$USb)

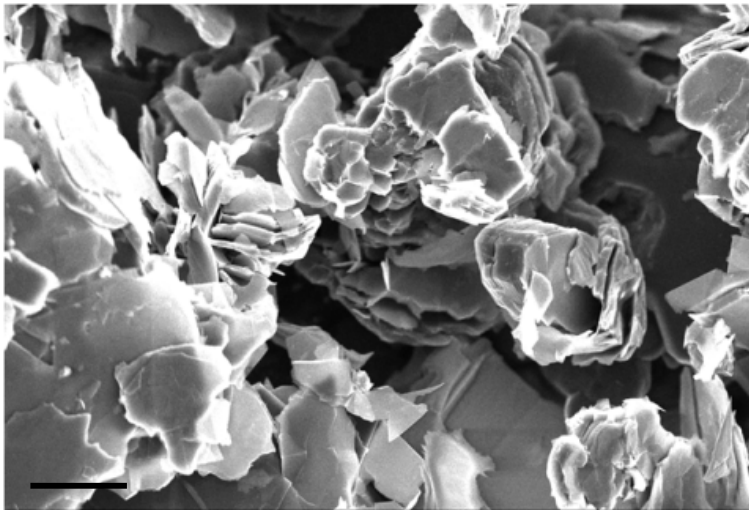


SOURCE: BERNSTEIN

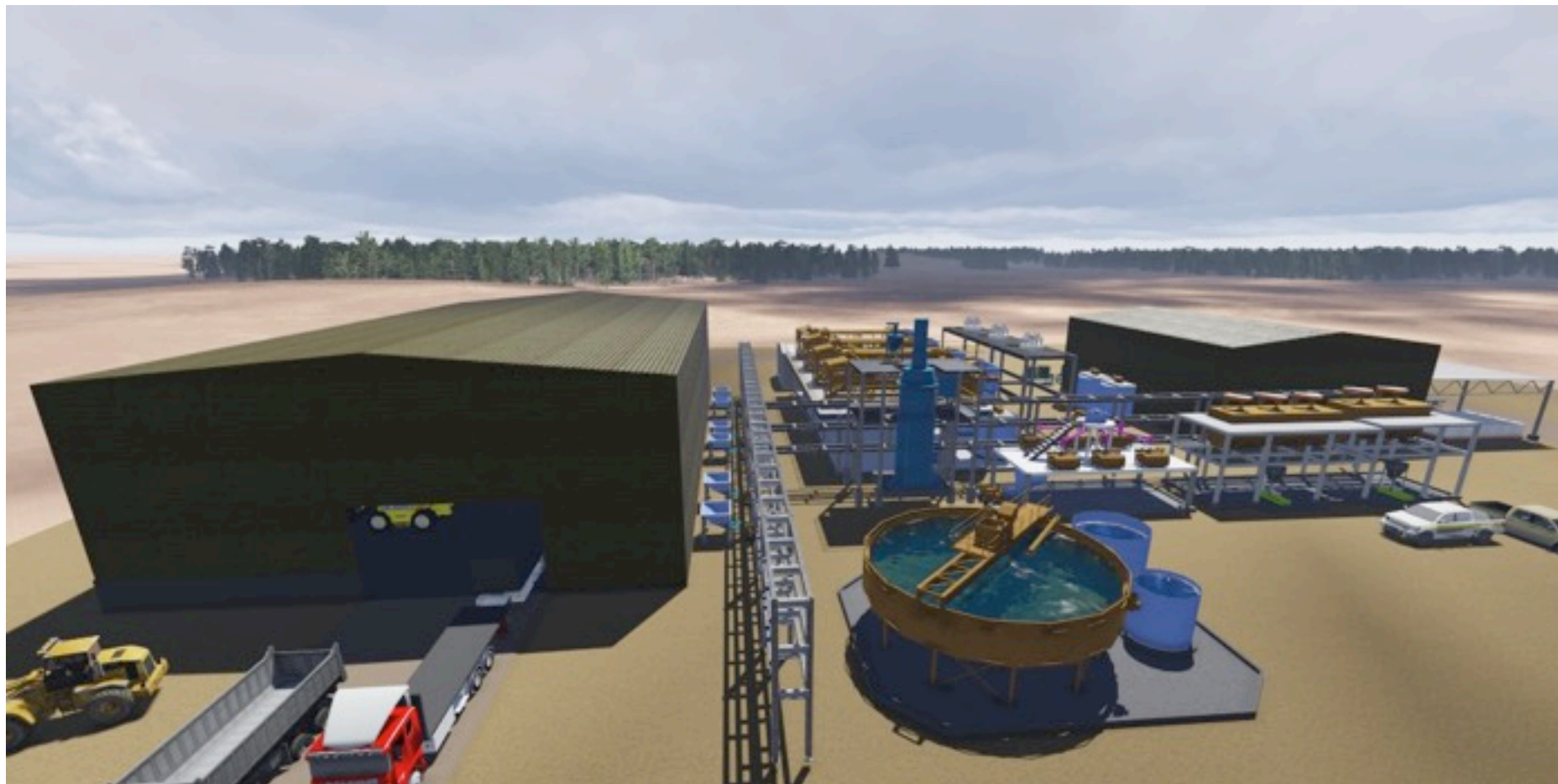
Talga micrographite in Li-ion anode

- ▶ Schematic highlighting process steps used by Talga compared to industry norms in achieving ~360mAh/g Li-ion battery anode graphite
- ▶ Further tests planned to investigate and optimise material



 Talga Graphite	
Talga Processing Steps	Spheronised Graphite Peer Processing Steps
Exfoliate	Crush
↓	Grind Stages
Concentrator single stage	Flotation stages
↓	Micronisation
	Purification (chemical/thermal)
	Shaping (spheronisation)
	Coating
Mix binder and dispersant	Mix binder and dispersant
	
Battery average capacity ~360 mAh/g	Battery average capacity ~360 mAh/g

Full Scale Production - Economic Model^a



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
- ▶ **Capital cost A\$29.3m** as no crushing/grinding circuit and ancillaries
- ▶ Net present value estimated **A\$490m** (12% discount rate)
- ▶ Does **not** require graphene to be financially robust
- ▶ Conservative assumptions - big revenue leverage in value-adding to graphite and micrographite streams

^a For details see Scoping Study released to ASX 9 October 2014. No material parameters have changed since that date.



Tata Steel (UK)

- ▶ Formal collaboration agreement to co-develop graphene products using Talga materials
- ▶ Tata Group >100 companies >580,000 staff. Targeting sales to quarter of global population by 2025
- ▶ Initial work focus on anti-corrosion and conductive coatings. Paint and coatings market > 40 Mt annum



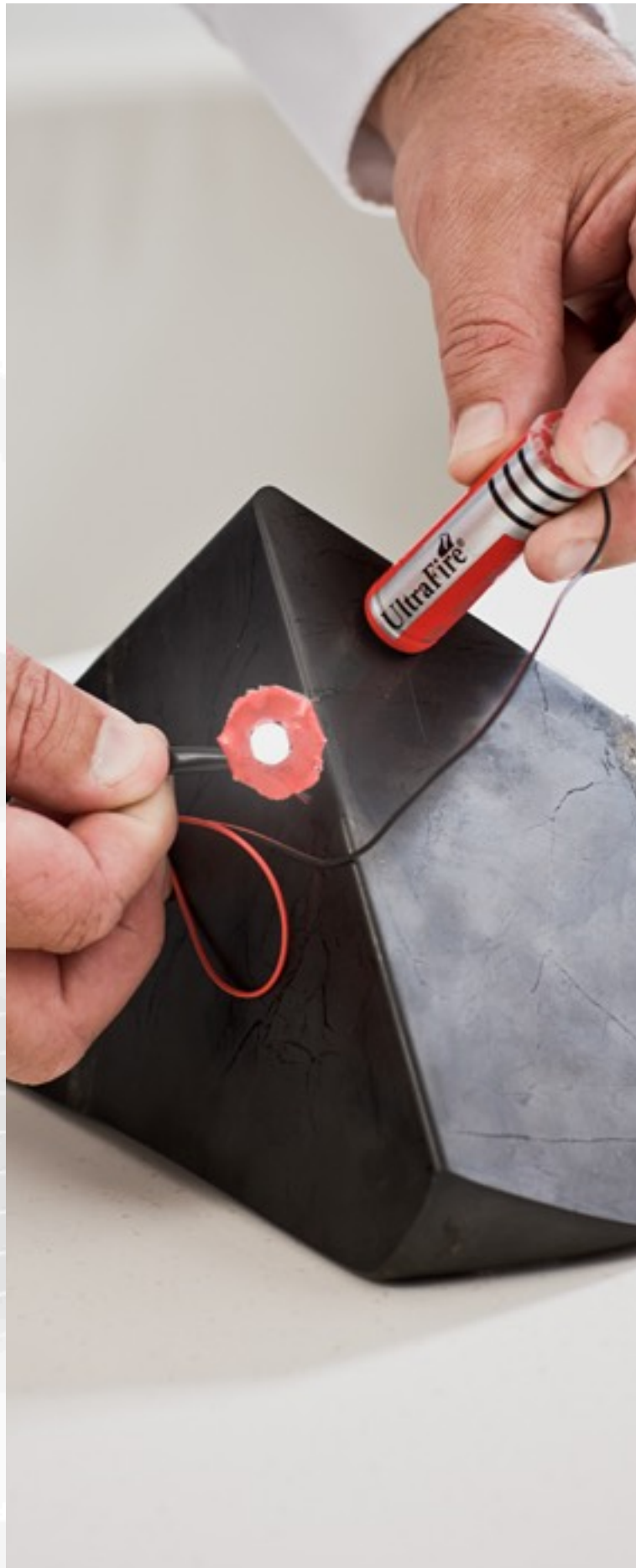
Haydale Graphene Industries PLC

- ▶ Nanomaterials treatment company with value add functionalisation process and growing customer base in polymers and composites

EU Graphene Flagship - Associate Member

- ▶ Fast track access to huge network of commercial and technology partners. Inducted alongside **Bosch** and **Lego**.





- ▶ World's **highest grade graphite** JORC or NI43-101 mineral resource - 100% owned
- ▶ World first **processing technology** and commercial graphene **scalability** not achievable by other methods or deposits
- ▶ High quality low risk **jurisdiction** - Sweden
- ▶ **Pilot test-work facility** scaling up in Germany to produce significant graphene and graphite for industry partnerships and product development
- ▶ Strong **end user partnerships & customer development** initiatives on path to commercialisation and full scale production in Sweden

Appendix 1 - Financial and Corporate Summary

Capitalisation Summary 21 March 2016 (AUD\$)

Shares on issue (TLG Ordinary)	146.3M
Unlisted Options ¹	21.3M
Market Capitalisation (undiluted @ \$0.295)	\$43M

Board

Managing Director - Mark Thompson

Chairman - Keith Coughlan

Non-Executive - Grant Mooney

Non-Executive - Stephen Lowe

Cash (end of Dec 2015) ~\$5 million. Nil Debt.

Top 5 Shareholders ²

Lateral Minerals Pty Ltd (M.D. Mark Thompson)	9.8%
Gregorach Pty Ltd and related entities	5.0%
Yandal Investments Pty Ltd	3.8%
HSBC Custody Nominees Australia Limited	4.5%
UBS Nominees Pty Ltd	3.1%

ASX: TLG 12 month Share Price



¹ Various expiry and strike prices with majority expiring December 2016 at 50-60c

² Holdings rounded to nearest decimal point

Appendix 2- JORC Resources and Targets

Nunasvaara JORC (2004) Mineral Resource¹ (10% Cg cut-off)

JORC 2004 Classification	Tonnes	Graphite (%Cg)
Indicated	5,600,000	24.6
Inferred	2,000,000	24.0
Total	7,600,000	24.4

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

JORC 2012 Classification	Tonnes	Graphite (%Cg)
Inferred	31,500,000	14.9

Raitajärvi JORC (2004) Mineral Resource¹ (5% Cg cut-off)

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

Talga Graphite Exploration Targets ²

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
Rounded Total		136,000,000	250,000,000	18	25

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.

Appendix 2 - Continued

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.