

NOVONIX

Quarterly Activity & Update Report

*Accelerating adoption of battery technologies
for a cleaner energy future*

31 July 2018



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- Company overview
- Highlights – last quarter to date
- PUREgraphite progress & next steps
- BTS progress and next steps
- Recent announcements
- Growing tier 1 customer base
- Board and management
- Assets and market
- Summary investment highlights
- Appendix

CORPORATE INFORMATION

STOCK INFORMATION

ASX Code	NVX
ASX Share Price @27 July 2018	A\$0.68
52 Week Low - High	A\$0.57 – A\$1.93
Shares on issue	123m
Market Capitalisation	A\$83m

CASH POSITION

Cash available to PUREgraphite JV at 30 June	A\$3.57m
Cash available (excluding PUREgraphite JV) at 30 June	A\$0.37m
Total cash available for operations at 30 June	A\$3.94m
Cash inflow forecast Q1FY19 (excl PUREgraphite)	+A\$6.99m
	A\$10.93m
Cash outflow forecast Q1FY19 (excl PUREgraphite) pre CAPEX	-A\$0.98m
Cash outflow forecast Q1FY19 for PUREgraphite pre CAPEX	-A\$0.59m
	-A\$1.57m

SHAREHOLDINGS

	(m)	%
Board and KMP – ordinary shares	49.55	40%

Appendix 5B (30 June 2018) - Cash on hand	\$365k
PUREgraphite (not reported in Appendix 5B as 50/50 JV, equity accounted) at 30 June 2018	\$3.57m
Total cash available for operations at 30 June 2018	\$3.94m
Net cash inflow for Q1FY19 (excluding PUREgraphite)	+\$6.99m
	\$10.93m
Net cash outflow for Q1FY19 (excluding PUREgraphite) is forecast \$370k CAPEX and \$984k OPEX	\$1.35m
Net cash outflow for Q1FY19 for PUREgraphite is forecast \$1.114m CAPEX and \$594k OPEX	\$1.71m
	\$3.06m

Commentary

Appendix 5B (30 June) – YTD (12 months) reported Staff Costs of \$3m which is abnormally high by >50% as it includes one-off/non-recurring payments of \$1m in aggregate in sign-on bonuses for the founders of NVX BTS and \$0.6m payment to the group Managing Director (MD) in lieu of performance shares (noting the MD reinvested the \$0.6m payment in NVX via the exercise of NVX options).

The Appendix 5B reports “Estimated cash outflows for next quarter” however it is not formatted to allow NVX to report “Estimated cash inflows for the next quarter” **as the ASX reporting format is intended for an exploration company with no income.** The Appendix 5B (30 June) reported an estimated cash outflow for the next quarter of \$1.354m of which \$1.1m relates to BTS comprising \$370k for capital equipment. Given NVX is an operating business with existing sales revenue and financing capability, we note our forecast cash inflows for the Q1FY19 quarter is \$1.496m comprising \$843k in sales revenue from BTS and \$650k from government funding for BTS. NVX will also receive \$5.5m from convertible loan notes to provide additional working capital to transition the PUREgraphite business into production bringing in the total cash inflow forecast for the Q1FY19 quarter to \$6.99m.



- **Battery technology company**
- **Makes battery anode material that extends battery life >30%**
- **Makes battery tech that cuts R&D time to weeks from years**
- **Owner of a World-Class Natural Graphite Deposit (18%TGC)**
- **Leading brand used by battery & OEM multinationals**
- **Based in USA, Canada and sales in fourteen countries**
- **Infrastructure in place, scaling business and sales**
- **Board experienced in building billion dollar businesses**



Photo: Professor Mark Obrovac of Dalhousie University and Dr Chris Burns COO NOVONIX inspecting the electrode coating line at the NOVONIX battery cell pilot line facility

PUREgraphite (anode material production)

- production equipment trials completed
- feedstock trials completed
- customer trials well advanced
- production equipment ordered
- on track for production and sales in Q1CY19

Battery Technology Solutions (BTS)

- 35% growth in sales including 10 “*Fortune 500*” customers
- battery cell pilot line and electrolyte program operational
- battery materials partnership with Dalhousie University

Mt Dromedary Battery Materials Upstream Project

- scaling Mt Dromedary Graphite Project study to 200ktpa
- surface copper samples assayed (up to 16.85% Cu) – further fieldwork imminent

PUREgraphite anode material: timeline – milestones achieved



H1 2017 – JV formation

- NVX forms 50:50 PUREgraphite joint venture with Coulometrics in March 2017
- Commenced operations in April 2017 in PUREgraphite Tennessee, USA facility

H2 2017 – Product development, process development, pilot plant engineering, and pilot plant delivery

- Tested conventional graphitization furnace production materials from continuous large particle furnaces, continuous crucible-type, and conventional batch type furnaces
- Optimized next generation graphitization furnace designs specifically engineered for graphite anode production
- Completed the testing of a wide selection of precursor materials optimized for performance in cylindrical LIBs and cost
- Down-selection of promising feedstock materials

H1 2018 – Equipment trials and selection, plant engineering

- Graphitization furnace trials conducted with equipment vendors
- Pilot system order and delivered in Q4 2017
- 250-500 tpy production scale equipment selection completed
- Particle shaping and grinding technologies developed and vendor trials completed
- Particle coating and carbonization equipment selection completed

Activity

PUREgraphite timeline – transition to commercial production



	H2 2018	H1 2019	H2 2019	2020-2022
Activity	<ul style="list-style-type: none"> Initial production of graphite for LIBs for beachhead customers already identified and working closely with PUREgraphite (all U.S.A. based) Procurement and installation of first production equipment in current facility in Tennessee (250-500tpa) Continued product development with emphasis on new requirements from automakers related to: <ul style="list-style-type: none"> Extreme Fast Charging (XFC) Longer life Improved stability and safety Environmentally friendly processes that are non green-house gas emitting 	<ul style="list-style-type: none"> First sales to beachhead customers Ramp internal production to 1,000 tpa, plant procurement and installation Continued development with beachhead customers to emphasize improved performance of PUREgraphite materials and associated performance enhancement of LIBs 	<ul style="list-style-type: none"> Internal production, plant procurement, and installation Continued continuous graphitization furnace development Ramp internal production to >1,000 tpa including additional equipment procurement and installation Continued product development with core customer base 	<ul style="list-style-type: none"> Continued ramp of production to customer demand – target of 25,000tpa by end 2022 <ul style="list-style-type: none"> Subject to a range of factors including customer demand and competition Funding above self-funded organic growth expected to include debt

BTS - accomplishments since acquisition in June 2017

Strong growth

- 35% YOY growth in sales including ten “Fortune 500” companies placing orders
- Launched our second larger HPC product (20A) with strong early sales
- Moved to a facility 5X larger and expanded the team 3X to support growth
- Tooled-up for electrolyte and battery development including a battery cell pilot line

Government backing

- \$500k CAD Gov loan (interest free) to support marketing/growth (Aug 2017)
- \$480k CAD Gov grant for labor for electrolyte R&D (Approved July 18)
- \$500k CAD Gov loan (interest free) for R&D equipment (pending Sept 18)

Capabilities and IP for future growth

- Appointed battery expert Ken Broom, Ex-COO of 5th largest Chinese battery maker
- Patent application for DTA technology, improving prototype and building IP base
- Low cost charger model in final trials will provide access to wider market

M&A opportunities

- JV opportunity with European battery testing co for North America & Europe
- R&D opportunity with Dalhousie University on silicon and new battery tech
- EV/HPC R&D opportunity with strategic partners

BTS looking forward – expanding sales, service and R&D

H2 2018

2019-2022

Activity

- Continue 30%+ YOY organic growth of equipment sales
 - Ramp up sales of newly introduced product – 20A HPC
 - US\$50m addressable market, 3-year revenue goal: \$3m
 - Establish EV battery testing service business in USA possibly, with strategic European partner
 - US\$500m addressable market, 3-year revenue goal: \$5m
 - Expand electrolyte, silicon and new materials R&D and 2yr sponsorship with Dalhousie University
 - \$10b addressable market
- Organically grow equipment sales and grow services in North America with strategic partner
 - Develop and commercialize new testing and battery material IP and other technologies (e.g. electrolyte and silicon additives)
 - Consider strategic M&A opportunities with alignment and synergies
 - BTS targeting 30%+ YOY growth and possible step growth with M&A

BTS battery cell pilot line now operational



Photo: Professor Jeff Dahn of Dalhousie University with Dr Chris Burns NOVONIX COO inspecting the electrode slitting operation at the NOVONIX battery cell manufacturing facility

- **100% NOVONIX-owned battery cell pilot line now operational in our Halifax battery manufacturing facility**
- **Our proprietary battery cell line will support in-house development activities and the provision of commercial battery development services to OEMs and other third-parties**

Partnership

- **NOVONIX will have first rights to IP developed from the research**
- **The aim is to facilitate development of valuable battery IP that can be commercialized**
- NOVONIX will sponsor the Mark Obrovac Battery Research Group
- The sponsorship agreement is for an initial two years with opportunity to renew in five year increments
- The Research Group comprises approximately 12 postdocs, PhD and MSc graduate at any one time

Dalhousie

- Dalhousie University is a world leader in battery innovation and has **researchers working with such groups as TESLA and 3M Corporation**
- **Professor Mark Obrovac is a leading battery materials innovator having authored over 75 peer reviewed journal articles, fifteen issued patents with a further seven patents pending in the field of battery science covering anodes, cathode, electrolyte and binder materials.**

Focus

- The research will be focused on developing advanced Li-ion and next-generation battery materials
- It will leverage Professor Obrovac's significant experience in silicon materials, anode and cathode materials, liquid and solid electrolytes and binder materials.
- Short term synergies with PUREgraphite re silicon additives for graphite anode materials

Covering the whole lithium anode market

	Artificial graphite	Natural graphite	Graphite w/silicon <small>additive</small>	Silicon alloy
Application	<ul style="list-style-type: none"> • Best for long life applications • xEV and Grid 	<ul style="list-style-type: none"> • Best for low cost applications • Portable electronics 	<ul style="list-style-type: none"> • Commercial application limited 3% - 10% 	<ul style="list-style-type: none"> • Very limited application
Energy	More energy			
Life	Better cycle life			
Other factors	<ul style="list-style-type: none"> • High energy use and associated cost 	<ul style="list-style-type: none"> • High chemical use or higher energy cost 	<ul style="list-style-type: none"> • Low cycle life • High expansion • Low efficiency 	<ul style="list-style-type: none"> • Very low cycle life • Extreme expansion • Very low efficiency
Solutions	<ul style="list-style-type: none"> • Surface coatings • Particle morphology • Blending • Additives • Technology 	<ul style="list-style-type: none"> • Surface coatings • Particle morphology • Blending • Additives • Technology 	<ul style="list-style-type: none"> • Surface coatings • Particle morphology • Limit % silicon • Limit voltage • Technology 	<ul style="list-style-type: none"> • Work in progress

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CDN\$487,693 Government of Canada support awarded

Highlights

- **The National Research Council of Canada Industrial Research Assistance Program supports NOVONIX's R&D efforts with advisory services and a contribution of up to \$487,693 CDN alongside investment by NOVONIX**
- **The projects will be run out of NOVONIX pilot manufacturing and research facility in Bedford (near Halifax) in Nova Scotia**
- The funding will help NOVONIX expand its team of scientists, engineers and technicians working on developing new battery materials

Project

- This project, entitled 'Development of Advanced Novel Materials for Improved Lithium Ion Battery Performance', will support work by NOVONIX in development and testing of electrolyte and silicon based anode materials for use in lithium ion batteries.



Government
of Canada

Gouvernement
du Canada

Canada

Focus

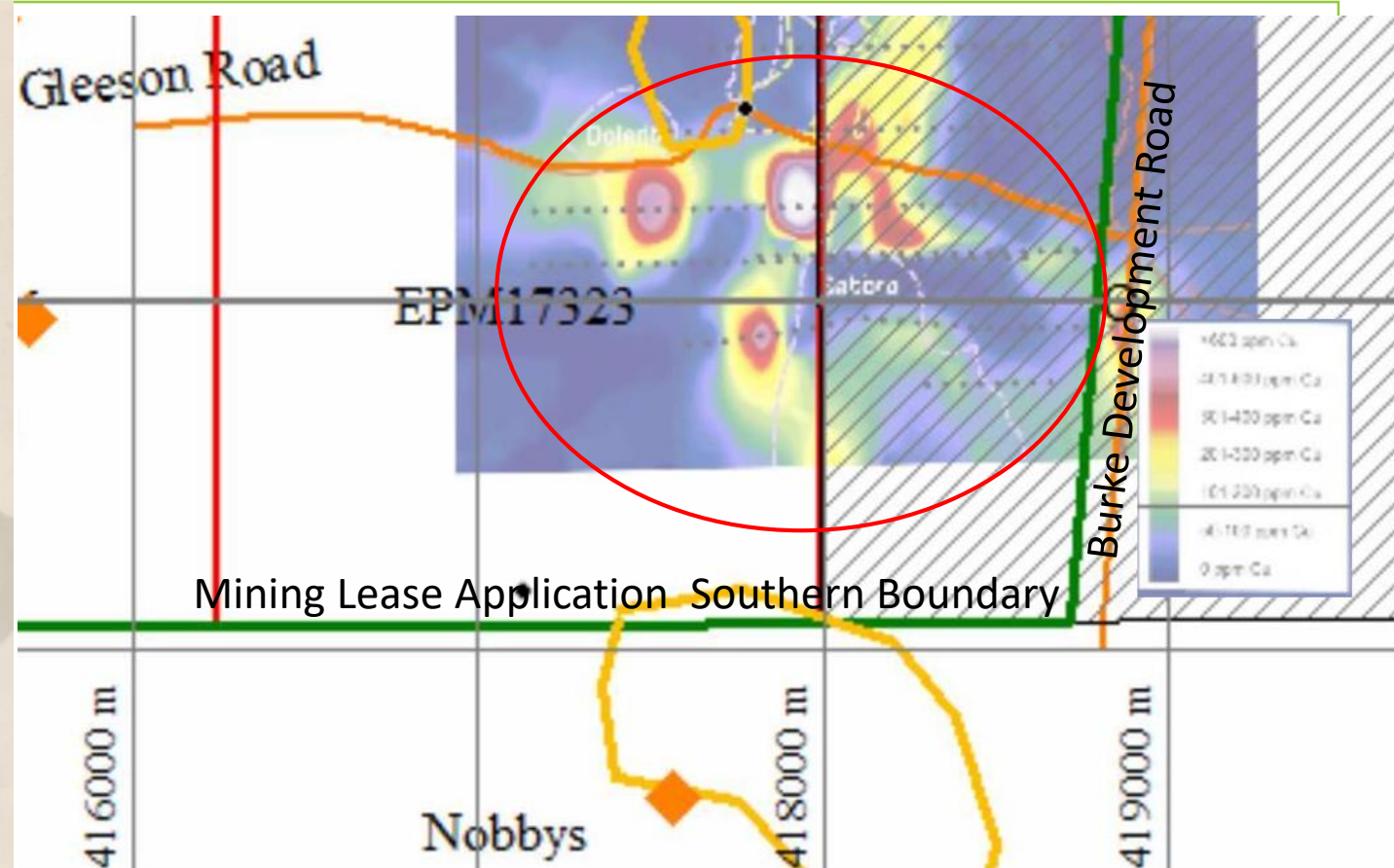
- The primary research focus will be materials development and cell designs for improved battery performance with a focus in electrolytes and silicon/graphite anode materials
- The primary goals of the project are to work on commercially scalable materials that can improve the energy density, lifetime and power capabilities of Lithium ion batteries relative to today's industrial standards and benchmarks

High-grade copper find at Mount Dromedary Project

graphitePROJECT

Malachite sample from Mount Dromedary Mining Lease Area grading **16.85% Cu***

(sample prep. courtesy of Geological Survey of Queensland)



Above: Historical Cu soil sampling Results within southern portion of Mount Dromedary Mining Lease Area

* **Source:** Australian Laboratory Services Pty Ltd (ALS), 26 July 2018

Adding more global tier 1 customers every quarter



Multiple global auto makers - confidential

Multiple global consumer electronics companies - confidential

For confidentiality reasons there are a number of major global automakers, battery makers, medical device and electronics companies that are customers but cannot be named.

Chairman
Tony Bellas



Managing Director
Philip St Baker



Executive Director
Greg Baynton



Non-Executive Director
Admiral Robert J. Natter



Non-Executive Director
Andrew N. Liveris AO



Non-Executive Director
Robert Cooper



Highly experienced Executive Team

Managing Director
Philip St Baker



Executive Director
Greg Baynton



CEO PUREgraphite Joint Venture
Dr Edward Buie



CEO NOVONIX BTS
Dr Chris Burns



CTO NOVONIX BTS
Dr David Stevens



VP Business Development
Nick Liveris






Mt Dromedary GM
Steve Hadwen



CFO NOVONIX Group
Suzanne Yeates



3 Strategic business units/assets

Business / asset	Ownership stake	Business description
	<p>50% (with right to increase to 75% of first 1,000TPA and 100% above 1,000TPA)</p>	<ul style="list-style-type: none"> • Makes battery anode material that extends battery life >30% • 50/50 joint venture with Coulometrics • Currently building Phase 1 production capacity • Based in USA; Established in 2017
	<p>100%</p>	<ul style="list-style-type: none"> • Makes battery tech that cuts R&D time to weeks from years • Provides battery development services to OEMs • R&D programs for electrolyte, silicon & new materials • Based in Canada with growing sales in 14 countries • Established in 2013
<p>MOUNT DROMEDARY</p> 	<p>100%</p>	<ul style="list-style-type: none"> • Large, world-class high-grade (18% TGC) natural graphite deposit located in Australia • Pending mining approval for 50KTPA base case • Opportunity to scale project up to 200ktpa • Considering partner/divestment opportunities

Innovative products for fast growing battery market

NOVONIX business	LIB segment	Market size	2017	2030	2040
	Anode Materials	Revenue:	\$1.4b	\$10b	\$20b
		Tons:	130kt	1.3mt	3.1mt
	Electrolyte Materials	Revenue:	\$1.8b	\$10b	\$20b
		Tons:	140kt	1.4mt	3.4mt
	Other Lithium-ion Battery Materials	Revenue:	\$8.7b	\$50b	\$100b
	Battery Testing Equipment and Services	Revenue:	\$0.2b	\$1b	\$2b
<small>2030 and 2040 Data Source: NVX estimate derived from independent (Bloomberg) forecast of growth in lithium-ion battery market and other internal NVX analysis 2017 Data Source for Anode, Electrolyte and Other Battery Materials is AVICEENE ENERGY 2018</small>		Revenue:	\$12b	\$71b	\$142b

Established brand in the rechargeable lithium-ion battery industry

- NOVONIX is an established brand name known for making the most accurate battery cell test equipment in the world

Global footprint of blue-chip customers and sales in 14 countries

- Our battery cell test equipment now used by leading battery, auto and equipment makers and researchers including PANASONIC, CATL, BOSCH, 3M

Innovative new products and process being commercialised in large growing market

- Developing and commercialising new innovations in battery anode materials and battery cell test equipment and undertaking R&D in electrolytes

Large world-class high grade (18%TGC) natural graphite resource in Australia

- Considering strategic partners to progress the Mt Dromedary Battery Materials Project

Backed by a board experienced in building and running billion dollar businesses

- Extensive experience in BD, resources, energy, advanced materials, battery industry, project financing, project delivery, operations and scaling

Highly-incentivised Board and Management

- The Board and Management hold ~40% of the equity in the company

Opportunity to position at an early stage in a global market with exponential growth

- Exponential demand for rechargeable lithium-ion batteries being driven by EV and energy storage demand growth

Corporate contact information

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Battery Technology Solutions (BTS) facility



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Email: chris@novonixgroup.com

177 Bluewater Road, Bedford, NS B4B 1H1, Canada

PUREgraphite battery materials development facility



Chattanooga, Tennessee, USA

1084 Duncan Avenue, Chattanooga, TN, 37404, USA

Appendix



PURE graphite
Anode Materials

Summary – battery anode market opportunity

- **PUREgraphite has developed materials** that compete on performance and cost against best-in-class materials
- **Beachhead customers in place**, building commercial production plant, sales f/cast to commence Q1CY19
- **~USD\$1.4B market f/cast to go to \$10b in 10yrs**
- There are **very few suppliers** who can make high quality long life EV grade anode materials
- **Almost 100% of supply is from China** or based on China graphite feedstock
- **US tariff on graphite from China imposed 10 July 2018** – all forms of natural and artificial graphite



Customers, Production, Revenue Potential

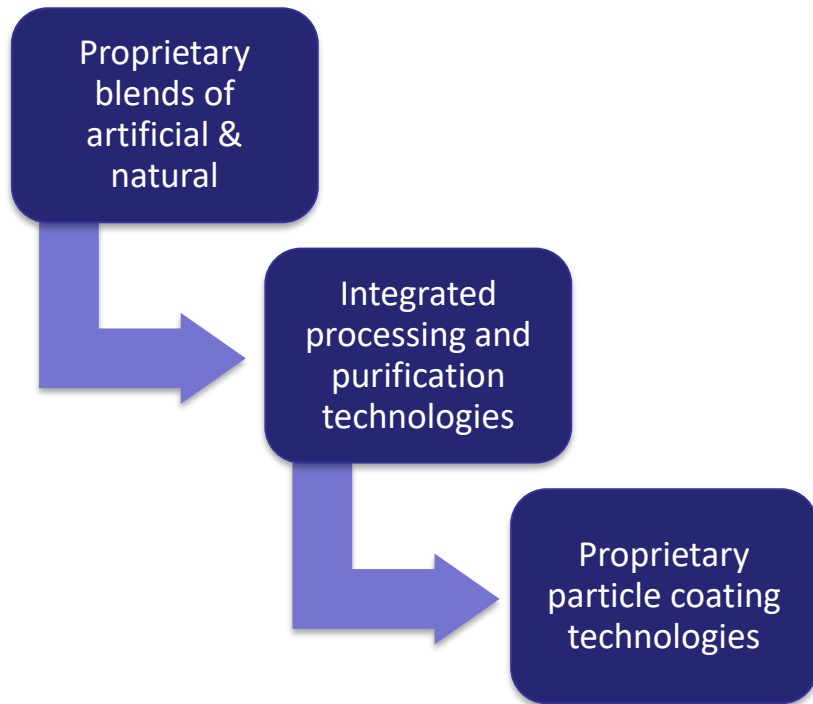
Customers

- Currently we are working with **US based beachhead customers** to optimize design
- **NDA's in place with several interested large global battery makers** with early discussions and information exchange moving to product trials after we start commercial production

Ramp up plan

	2017	2019	2023	2030
Production plan		1ktpa	25ktpa+	75-100 ktpa
Revenue potential		\$10m - \$20m	\$250m - \$500m	\$750m - \$2,000m
Market forecast	130kt	150kt	300kt	1,300kt

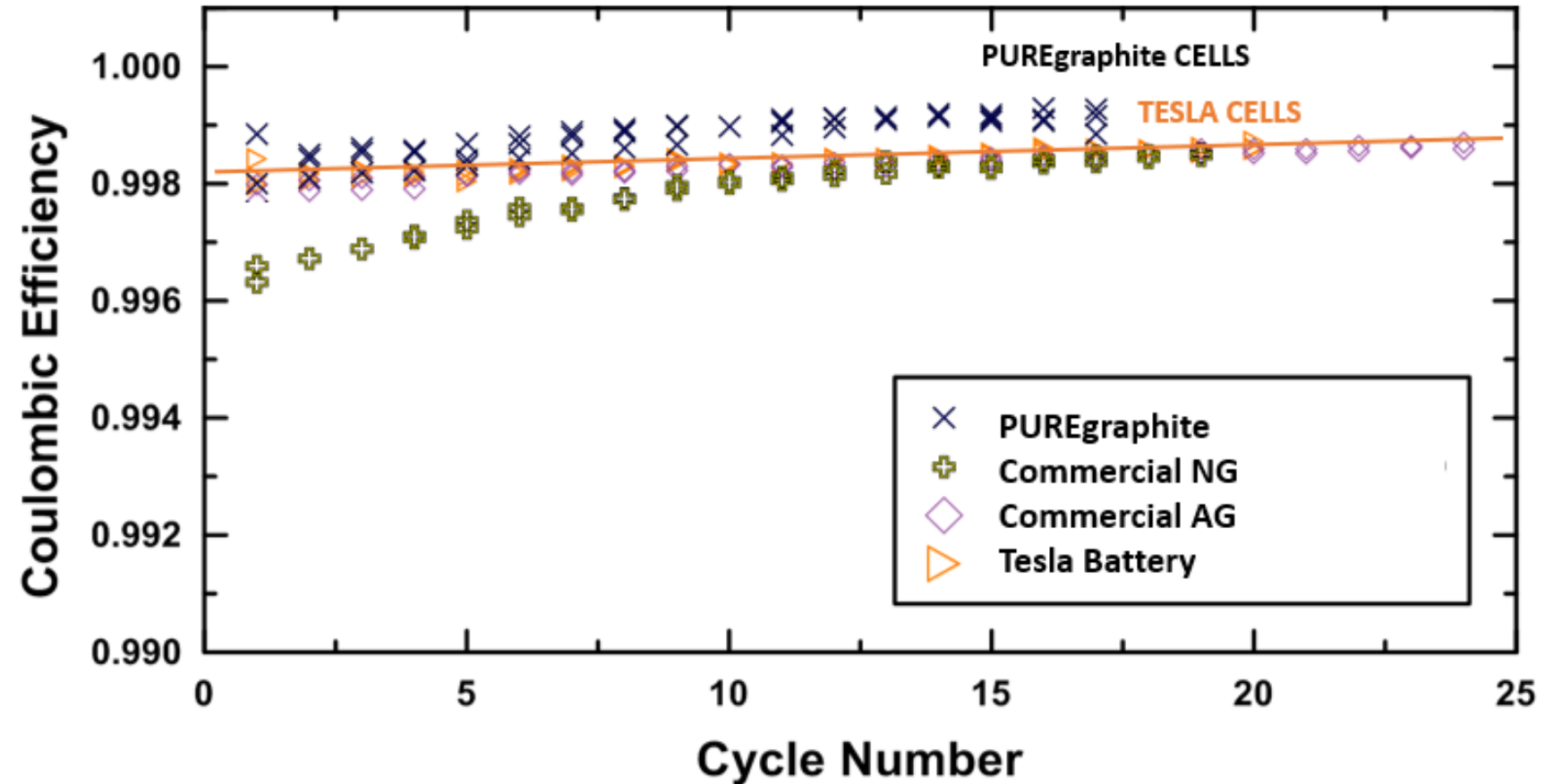
Internal NVX Forecasts



- **Secure supply**, made in the USA
- **Better performance** and cost over imports
 - Battery life improvement over 30%
- **Based on**
 - Proprietary blends of artificial and natural graphite
 - Integrated processing and purification technologies
 - Proprietary particle coating technologies
 - Low cost and low emission energy sources
 - Secure and sustainable supply chain
 - No chemical purification using HCL/HF

The PUREgraphite product advantage

- PUREgraphite's high-performance anode material:
 - Estimated to deliver 30%+ longer life than the best-in-class commercial EV cells
 - Consistently demonstrates very high coulombic efficiency performance against industry benchmarks

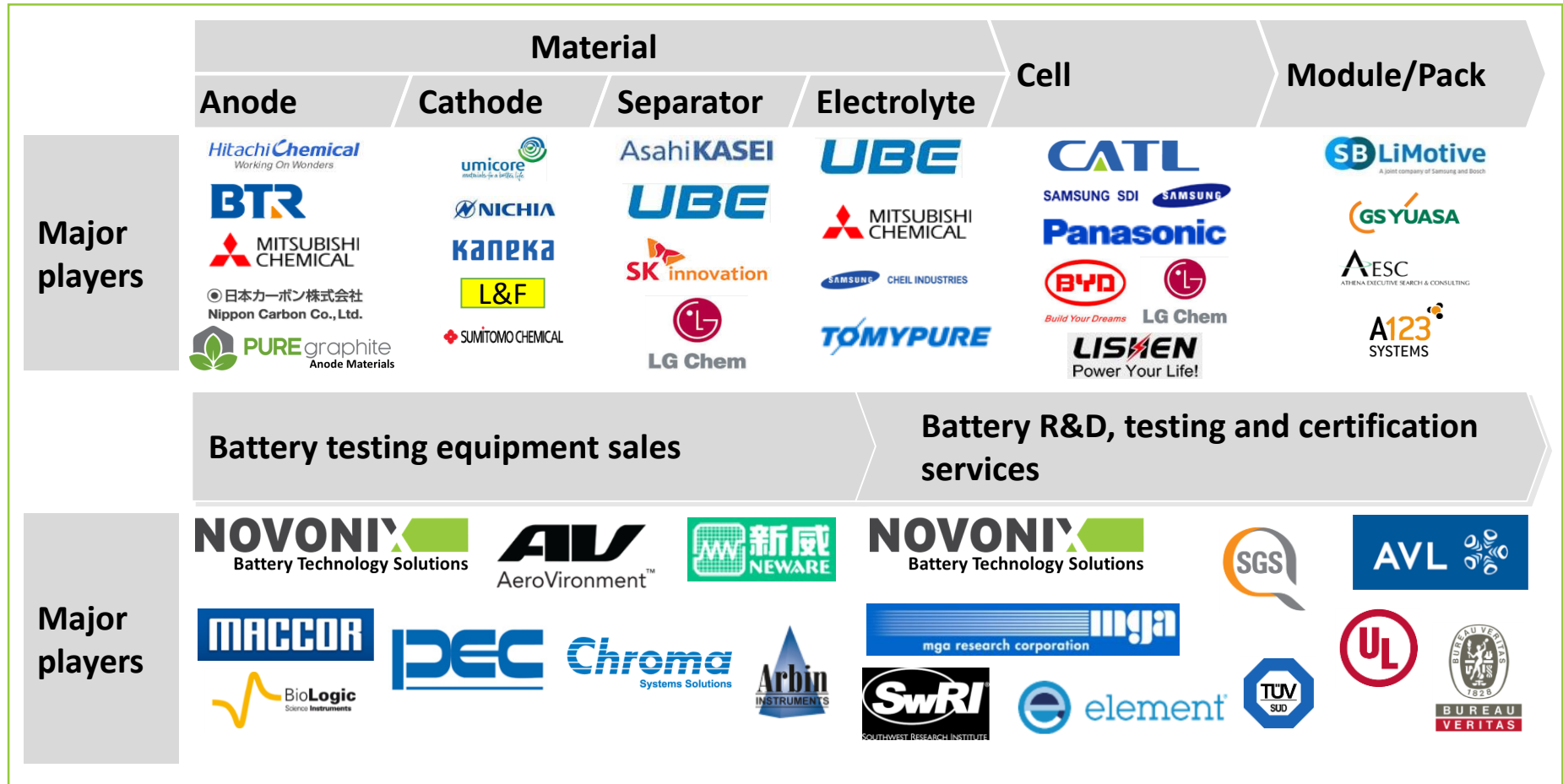


The higher the coulombic efficiency the longer the battery cell life



NOVONIX – Battery value chain opportunity

- NOVONIX Battery Technology Services is strategically aligned with and supports the entire battery value chain
- Growing this business allows us to
 - Pin our success to the growth of the entire value chain and not just one piece
 - Be a data driven company... We are able to collect and leverage data across the entire battery ecosystem



Battery testing services is a major growth industry following the proliferation of batteries in nearly every device being made today and the need for performance, safety and quality

Products, Customers, Sales

Products

- Equipment
 - 2A HPC Chargers
 - 20A HPC Chargers
 - Thermal Chambers
- Services
 - HPC Testing Services
 - Materials Testing Services
 - DTA Testing Services
 - ISV Testing Services
 - Cell Making Services
 - Design Services

Customers

- Sales in 14 countries
- Battery makers (most)
 - Panasonic, CATL, Murata, Samsung, BAK Battery
- Auto makers (most)
 - Honda
- Phone/tablet makers (most)
 - Huawei
- Cordless equip makers (many)
 - Dyson, Bosch

Sales history and aspirations

	2014	2015	2016	2017
Sales history	\$0.35m	\$1.40m	\$1.55m	\$2.15m
<hr style="border-top: 1px dashed #ccc;"/>				
	2018	2020	2023	2030
Forward looking sales targets	\$3m	\$5m	\$10m	\$50m

Internal NVX Forecasts

BTS opportunity to expand into new products and markets

NOVONIX market positioning overview

- NOVONIX BTS currently is a **tier-1 provider of 2A HPC cyclers** (\$50M market)
- **Sales of 20A HPC cycler commenced 2018** (\$50M market)
- **Further opportunity** to leverage brand and enter into
 - 50A, 200A, >1000A market (\$150M) and
 - Production scale cycler market (\$1BN market)

Testing equipment and services markets

- | Testing equipment and services markets | Size (\$M) |
|---|--------------|
| • Lab and R&D cyclers (including HPC) | 250 |
| • Production scale cyclers | 1,000 |
| • Battery analyzers | |
| • Nail penetration & safety | |
| • Thermal cyclers | |
| • Calibration tools | |
| • Chambers | |
| • Test equipment for transport of dangerous goods (UN 38.3) | |
| • Test equipment for international compliance (IEC 62133) | |
| • Test equipment for US end device standards (UL 2054) | |

NVX OPPORTUNITY

Lab and R&D cyclers – competitor and product landscape

Company	<5A	20A	50A	200A	>1000A
Arbin	✓	✓	✓	✓	✓
Biologic	✓	✓			
Maccor	✓	✓	✓	✓	✓
Neware	✓	✓	✓	✓	✓
NOVONIX	✓	✓	NVX OPPORTUNITY		

2018 Market (\$M):	50	50	50	50	50
2030 Market (\$M):	200	200	200	200	200

Internal NVX Forecasts

Accelerated R&D cycle

- Manufacturer of the most accurate battery cell test equipment in the world
- Allows researchers to predict battery life in weeks rather than years

Breadth of R&D capabilities

- Expertise from battery chemistry to battery cell mass production
- Electrolyte development program

Tier 1 customer relationships

- Products used by leading battery makers, researchers and OEMs

Strategic partnerships

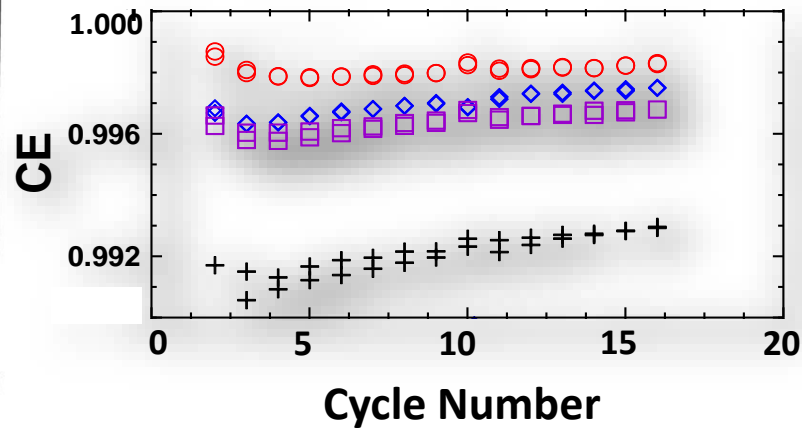
- Supported by Canadian government and promoted as a “success story”
- Active R&D collaboration with Dalhousie University
- Active R&D collaboration with strategic partners

Measuring battery performance with high precision coulometry (HPC)

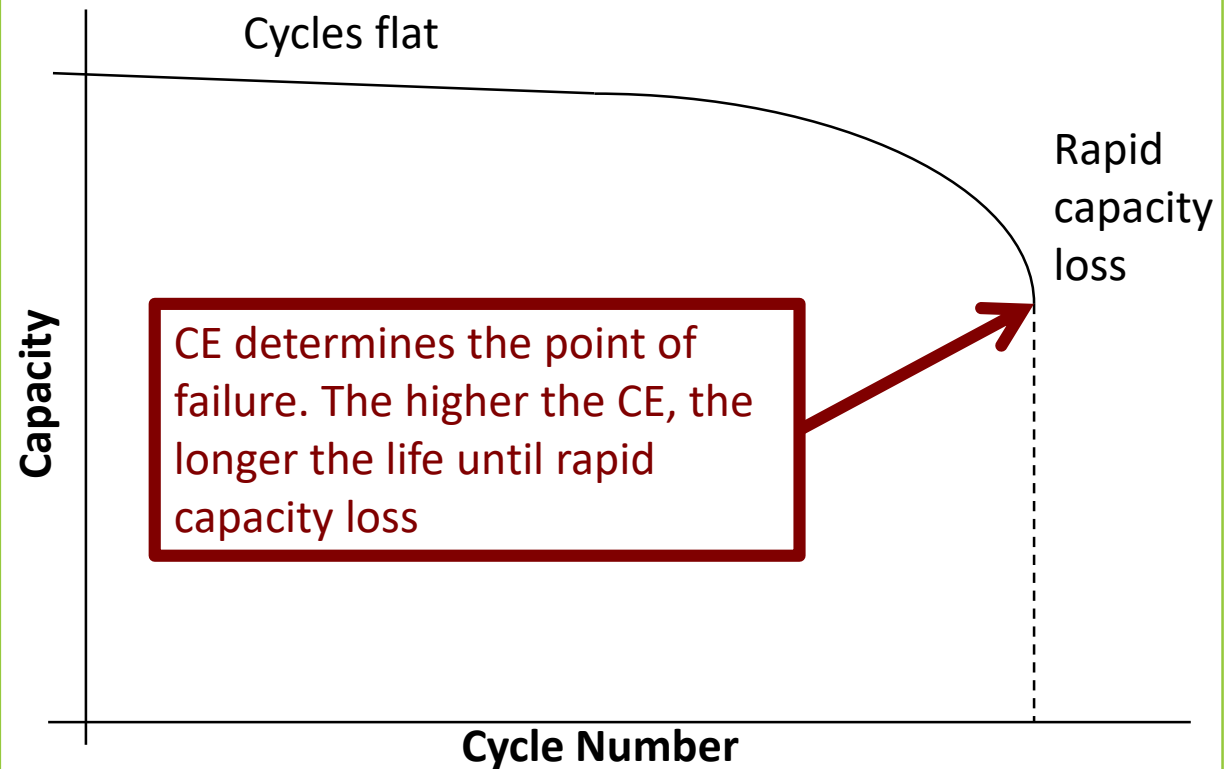
NOVONIX has developed industry leading high precision cyclers measuring LIB coulombic efficiency



- High Precision Coulometry allows you to measure the coulombic efficiency (CE) of a battery (i.e. loss of electrons per cycle due to oxidation/reduction of the electrolyte)



Coulombic Efficiency is the fastest and most reliable read on battery life



MOUNT DROMEDARY

graphitePROJECT

Background: Existing world-class, extensive, **high-grade (18%+)** graphite deposit in an established mining province near Cloncurry in North West Queensland - Mining Lease Application underway

Latest results: New copper assay results received today from ALS - surface sampling within the existing Mining Lease Area has confirmed **high-grade copper** occurrences of up to **16.85% Cu**

Strategic value: High-grade Copper ore, if extensive within the Mount Dromedary project, may be of strategic interest in the battery materials and EV market supply strategy

Next steps:

1. Consider strategic partners for Mt Dromedary Battery Materials Project.
2. Continue investigations for scaling up to 200Ktpa graphite concentrate.
3. Further Cu sampling and field-work to be conducted in the coming weeks to attempt to determine extent of the high-grade Cu ore

Mount Dromedary Battery Materials Project

Unique large scale resource

- World-class, high-grade (18%+) graphite deposit
- Large - 1.9Mt contained graphite from 20 – 30% of known and expected mineralization areas - potential for up to 200Ktpa
- Very low strip-ratio (outcropping over 3km)
- Potential for high-grade Copper (up to 16.85% Cu) within the existing Mining Lease Application area

Access to market and infrastructure

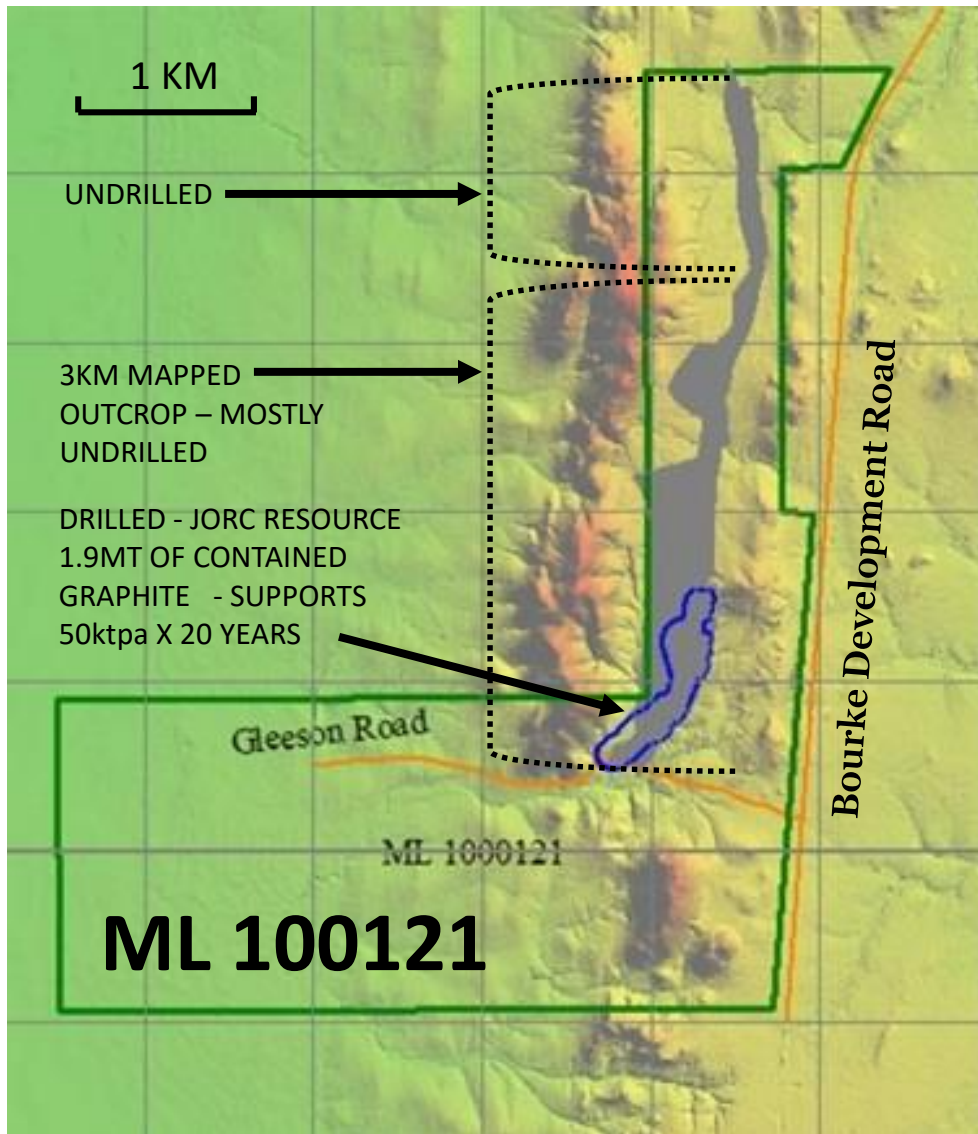
- Adjacent (<1km) to sealed highway connecting to multiple export ports
- Bulk and containerized export options
- Attractive back-haul and container transport capacity (road and ocean)

Concentration and purification expertise

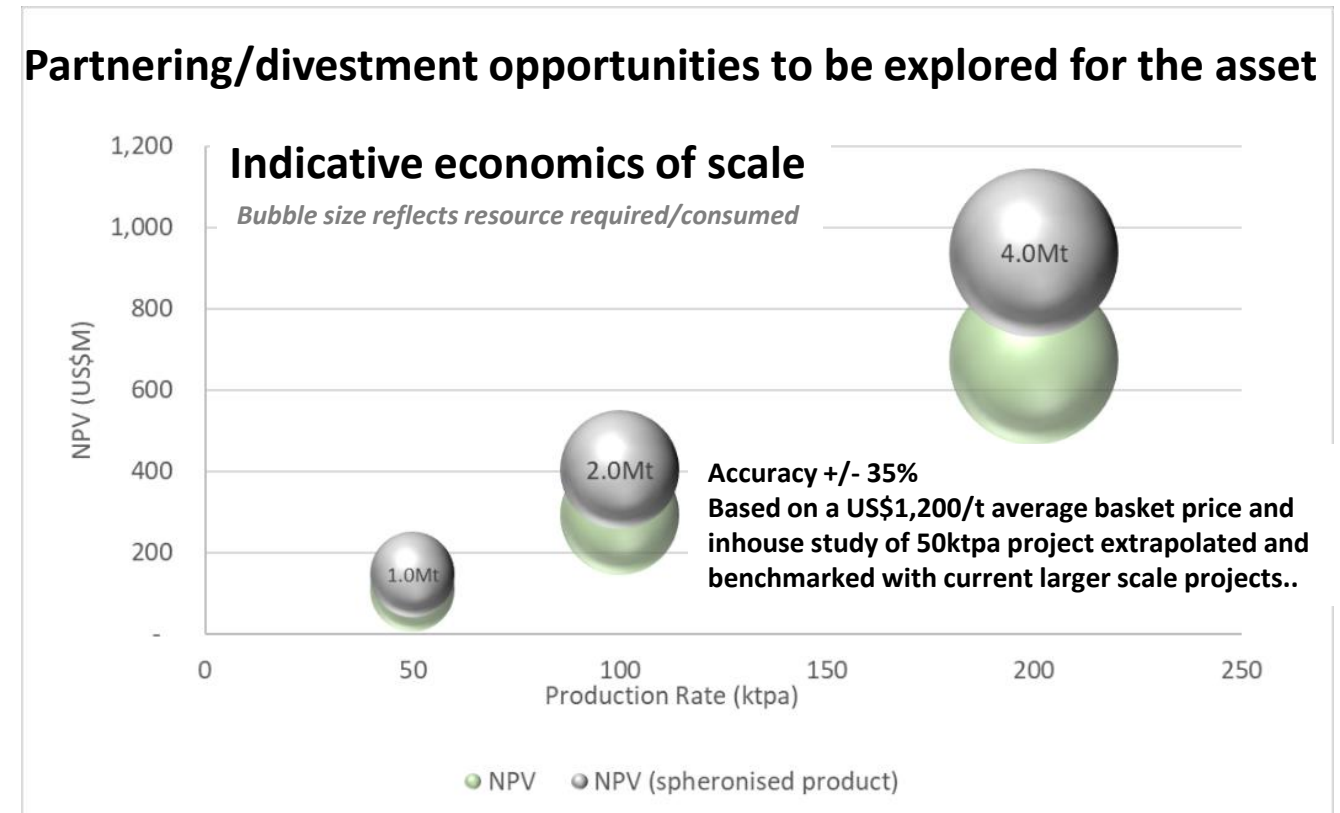
- Extensive metallurgical testing done to determine suitability for producing an export grade concentrate
- NOVONIX has undertaken both thermal and chemical purification trials upgrading the concentrate to lithium-ion battery grade

License to operate

- Well-established mining province
- Excellent local and state government relationships and support
- Local community support and encouragement



- One of the highest grade flake graphite deposits in the world
- Only 20 – 30% of the known/expected graphite mineralization drilled
- Indicates resource potential of >4.0 Mt of total contained graphite
- High-grade Cu (up to 16.85%) occurrences within the current ML area
- **Partnering/divestment opportunities to be explored for the asset**

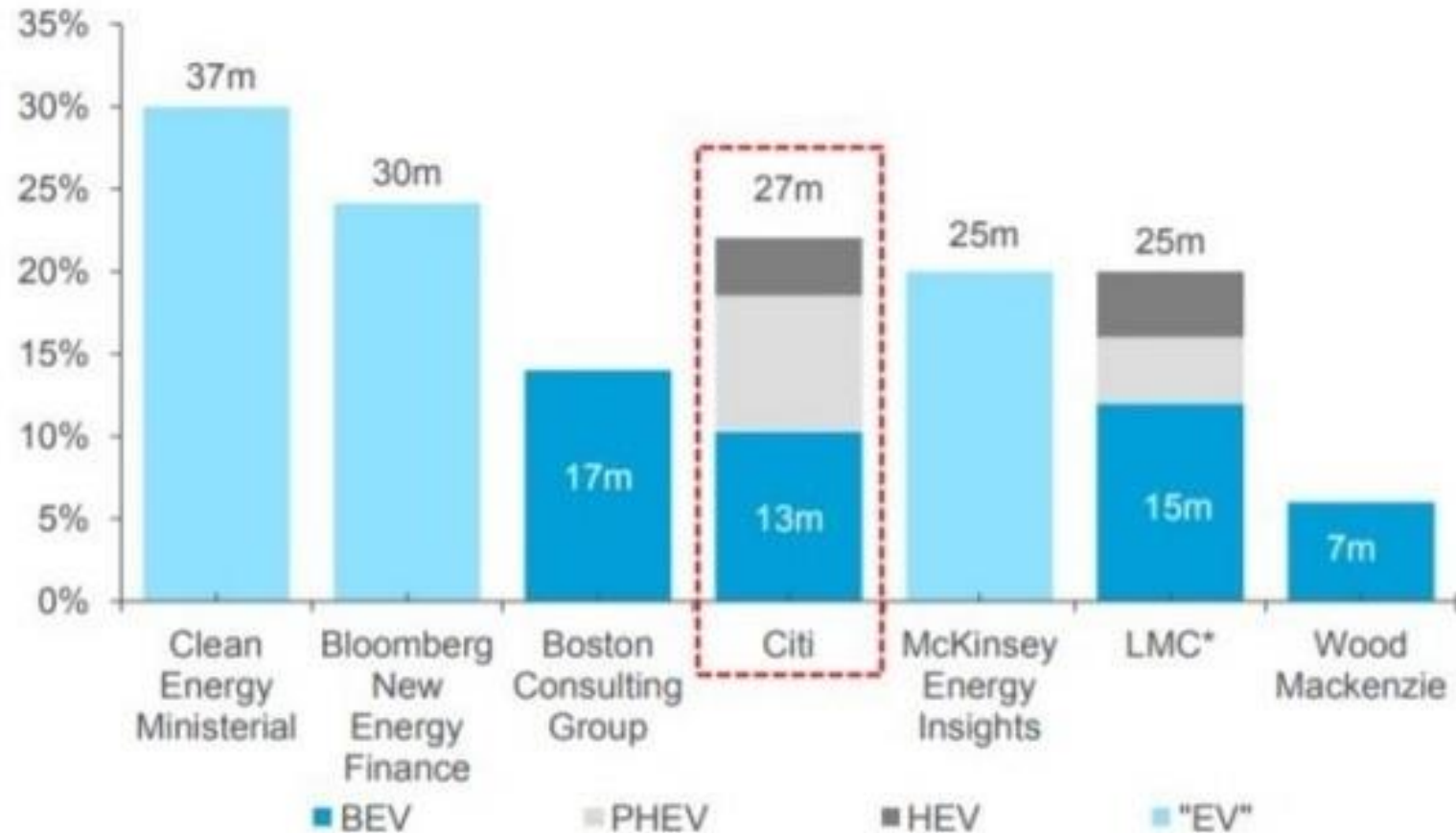


Appendix: Market background

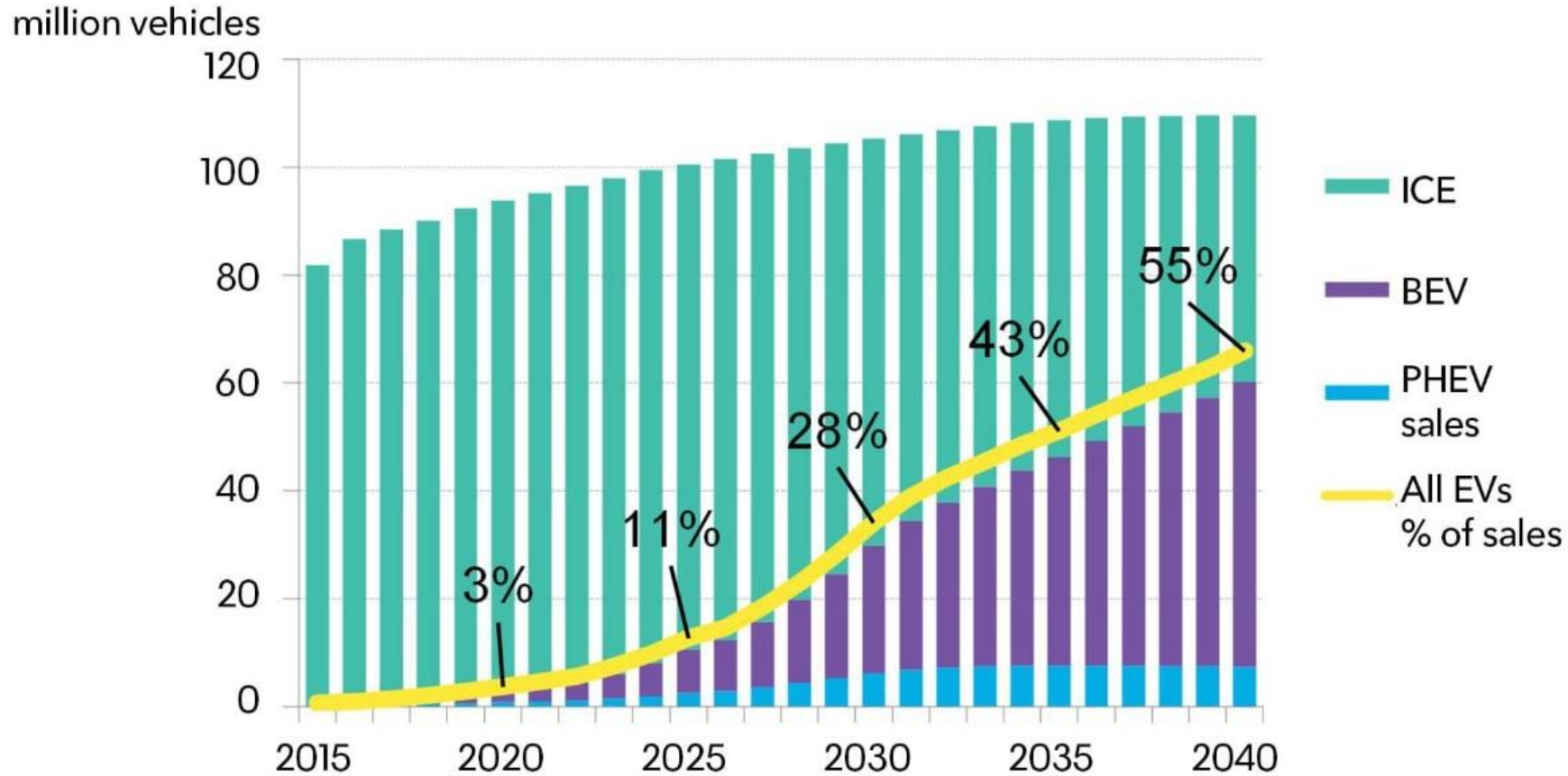
1.5% to 24%

- 2017 EV Penetration (% of New Car Sales) – ~1.5%
- Average 2030 EV Penetration Forecast in 2030 – 24%

EV penetration forecasts

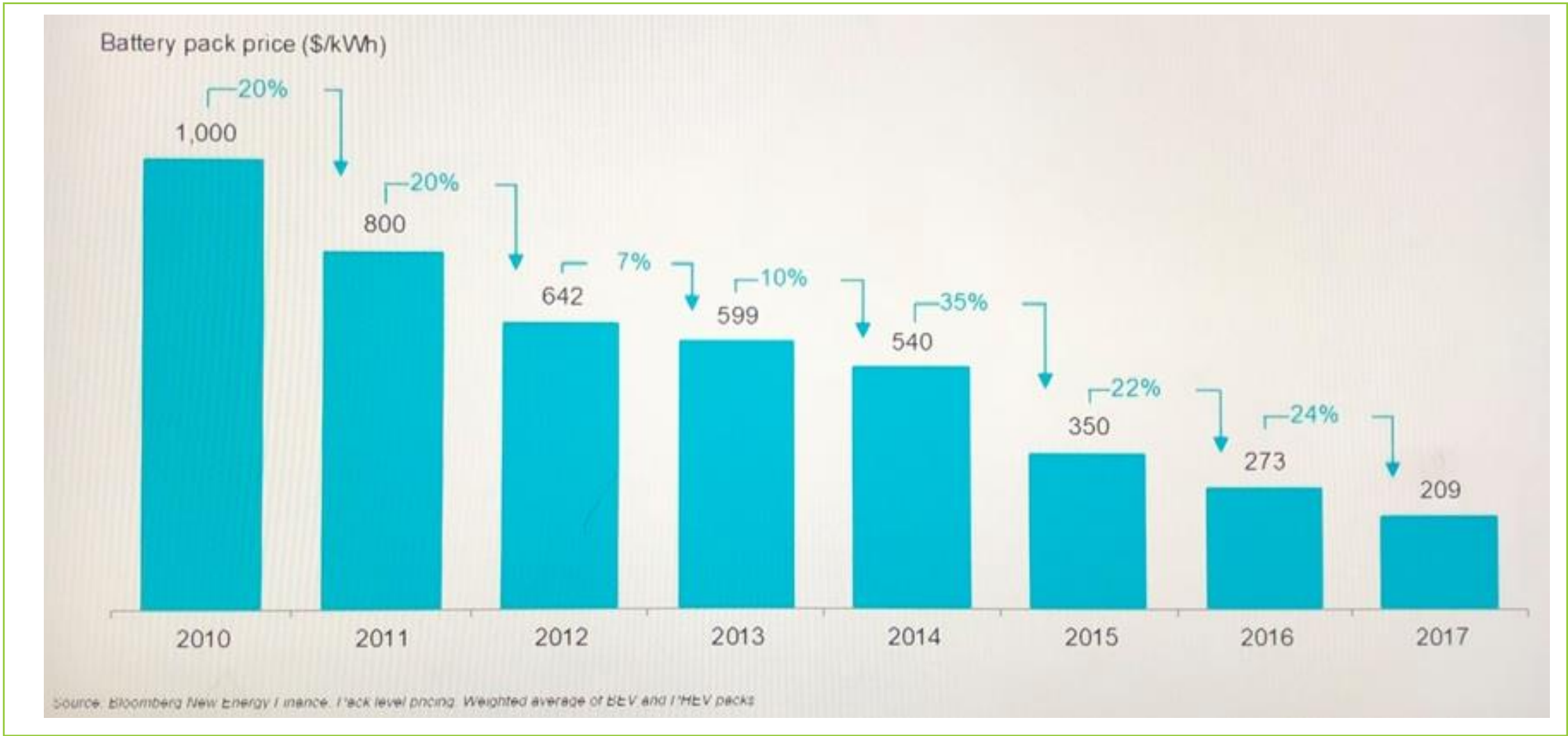


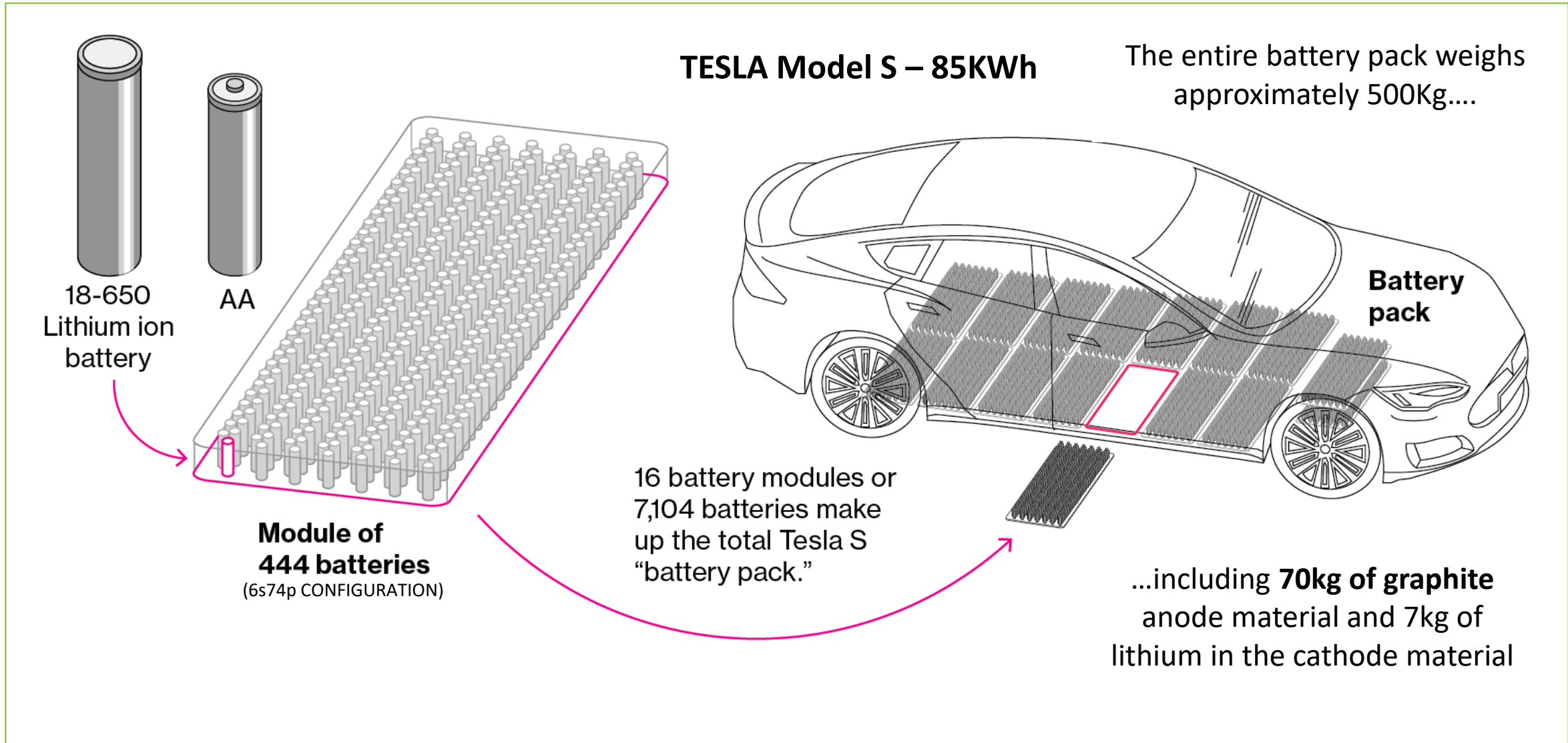
Annual global light duty vehicle sales



Source: Bloomberg New Energy Finance

Why? - It's all about the batteries – 80% price drop in 7 years **NOVONIX**







In January 2018 Reuters reported global automakers to invest US\$90b in batteries & electric cars in the coming years - US\$9b in the United States, US\$21b in China and US\$52b in Germany

Major EV announcements from global auto makers

- 11 July 18 - Tesla reaches agreement with Shanghai government to build a Chinese Gigafactory
- 9 July 18 – BMW signs €4B battery contract with CATL including €1.5B from German plant
- 5 June 18 – Fiat Chrysler announces 30 new EV models and US\$9b EV investment by 2022
- 18 May 18 – VW announces it will need > 150GWh of battery capacity annually by 2025
- 26 March 18 – Nissan announces a target of 1 million EV sales by 2022
- 15 January 18 – Ford plans US\$11 billion investment, 40 electrified vehicles by 2022
- 17 November 2017 – Daimler to invest €10B in expansion of electric fleet over next few years
- 2 October 17 – GM announces two more EV models and 20 more globally within six years
- 15 September 17 - VW announces plans to invest €50B in battery cells to support EV plans
- 5 July 17 - Volvo announced from 2019 all new Volvo cars will have electric or hybrid engines

Major EV related announcements from Governments

- 9 July 2018 - UK sets out more details on plan to ban petrol and diesel vehicle sales by 2040
- 9 September 17 - China flags a long-term plan to phase out vehicles powered by fossil fuels
- 6 July 17 - France announced that France will end sales of petrol and diesel vehicles by 2040
- China, UK, France and India all signalled plans to ban/limit sales of vehicles powered with gasoline or diesel fuels



Government targets

Country	Target	Time range
UK	Ban ICE sales	from 2040
	60% of car and van sales	by 2030
	100k EVs in London	by 2020
Germany	1 million by 2020	by 2020
	6 million by 2030	by 2030
	Ban ICE sales	from 2040
France	2mn EVs	by 2020
	400k EVs in Paris	by 2020
	7mn charging points	by 2030
Netherlands	200k EVs	by 2020
	1mn EVs	by 2025
	8% of sales	by 2018
China	5mn NEVs	by 2020
	7mn NEV sales p.a.	by 2025
	6-7mn NEV sales p.a. (as of 2015)	by 2020
India	100% EV sales	by 2030
	15.5% of sales	by 2025
Quebec (Canada)	15% of sales	by 2025
California (US)	15% of sales	by 2025

Source: IEA, Country governments, Goldman Sachs Global Investment Research

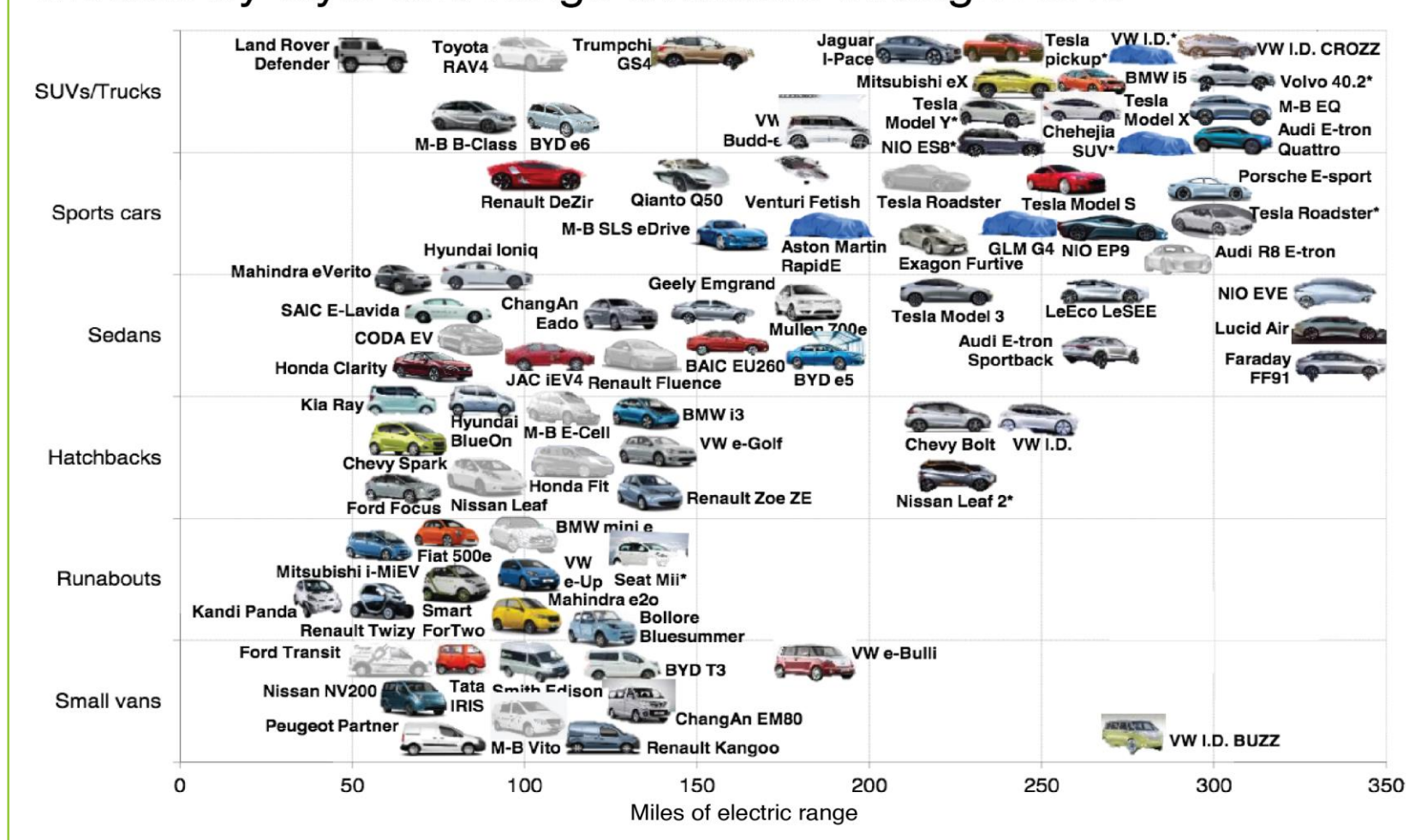
Automaker targets

Carmaker	Target	Time range
Tesla	500,000 vehicles sold p.a.	by 2018
	1 mn vehicles sold p.a.	by 2020
Volvo	1mn electrified cars (cumulative)	by 2025
VW	1mn EV sales p.a. (25% of total)	by 2025
	30 EV models	by 2025
BMW		2017
	15-25% of sales	by 2025
Daimler	10 new EV models	by 2022
Ford	40% of nameplates to have an electrified version	by 2020
	70% of sales in China to be electrified	by 2025
GM	2 new EV models	in 2018
	>18 additional EV/FCV models	by 2023
Nissan	20% of sales in Europe	by 2020
Chinese OEMs	4.52mn p.a. (in China)	by 2020

Source: ICCT, Company data, Goldman Sachs Global Investment Research

Electric-Car Boom

Models by style and range available through 2020



6X Growth in lithium ion battery mega-factories by 2020



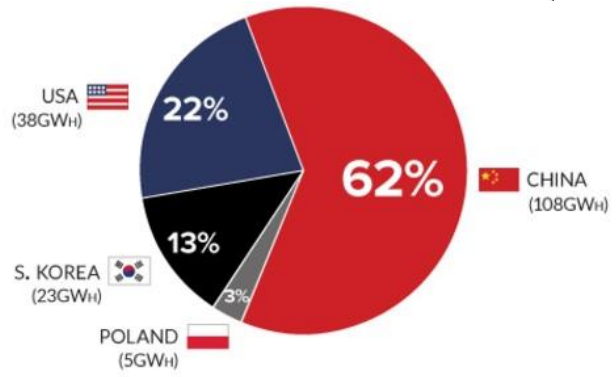
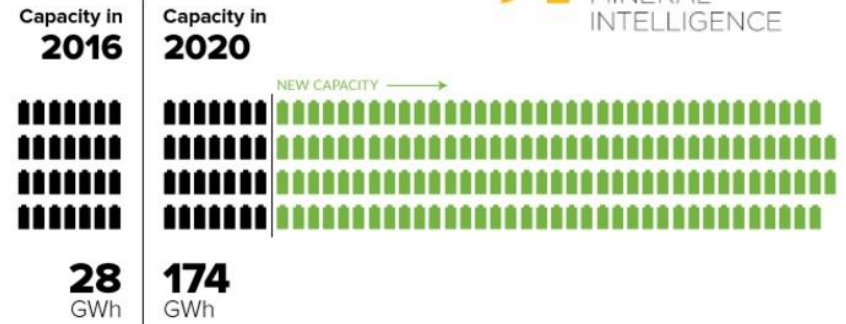
CHINA IS LEADING THE CHARGE

Lithium-ion megafactories in China to grow capacity 6X by 2020

Data by: **BENCHMARK MINERAL INTELLIGENCE**

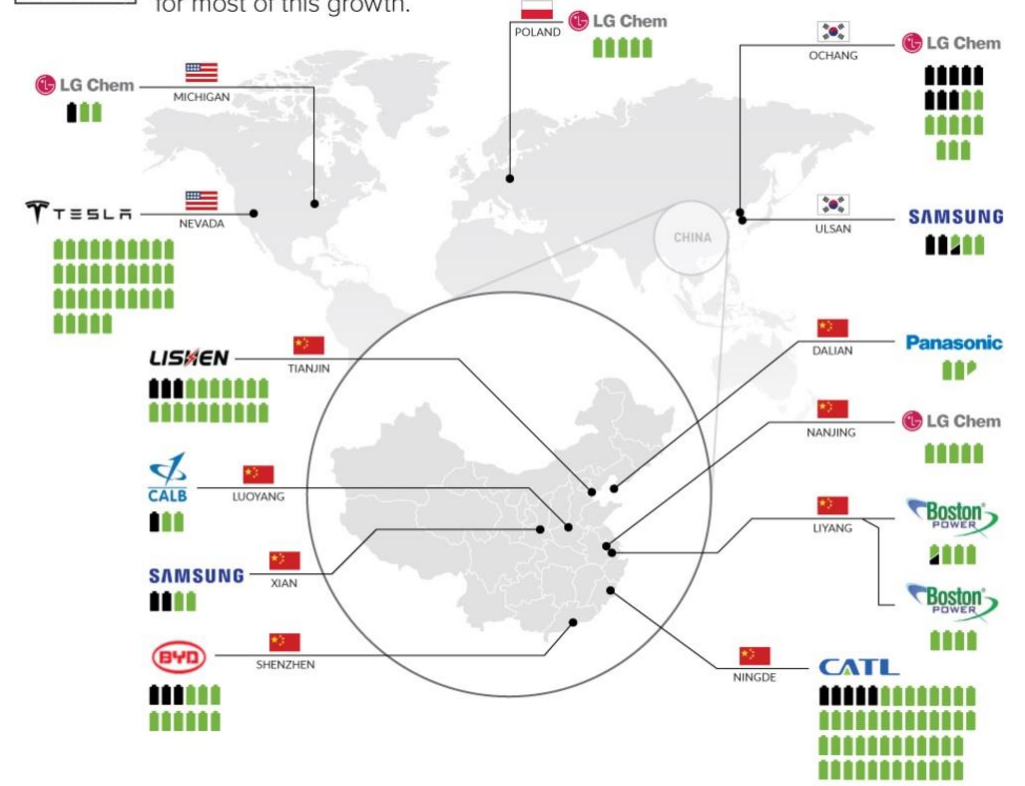


Global lithium-ion battery production capacity will increase by **521%** between 2016 and 2020.

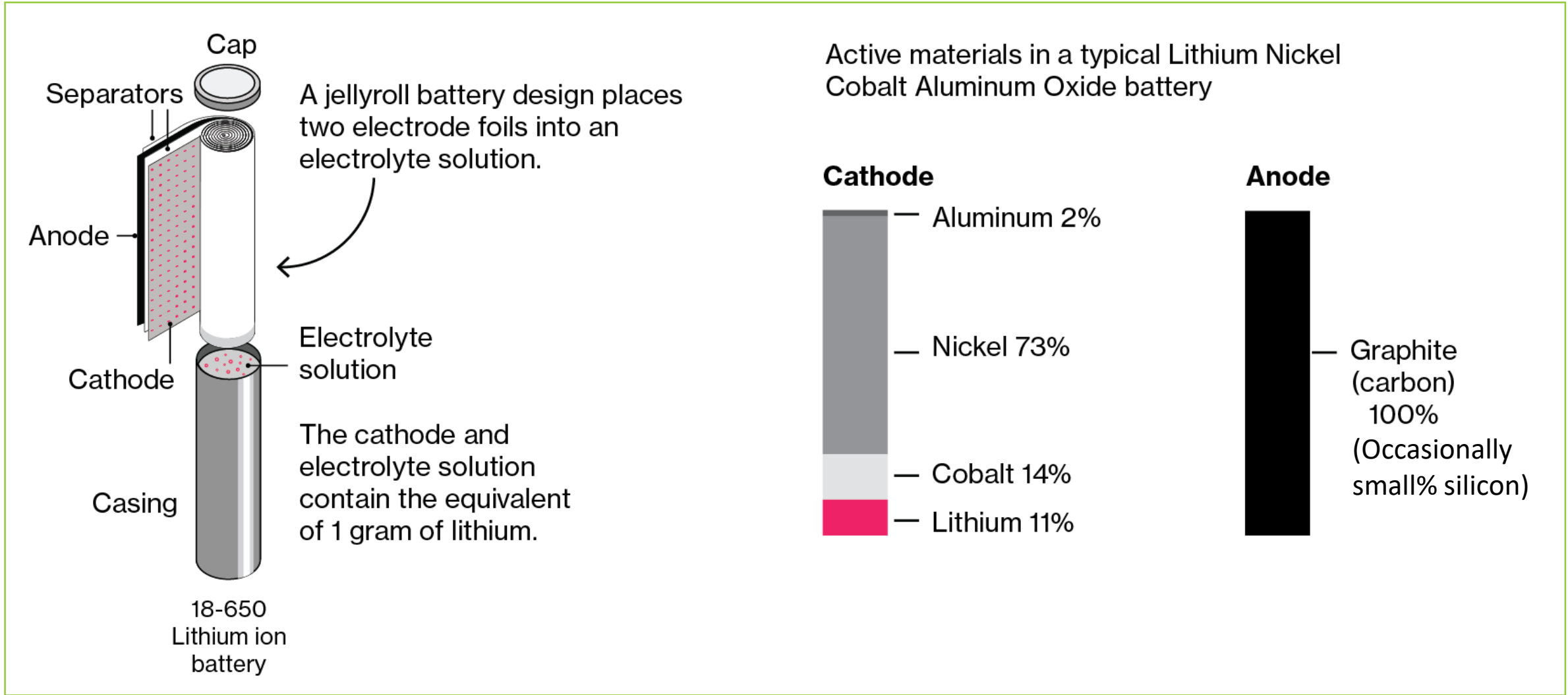


By 2020, mass production of lithium-ion batteries will still be concentrated in just **four countries**.

China's battery sector continues to be a hub for most of this growth.

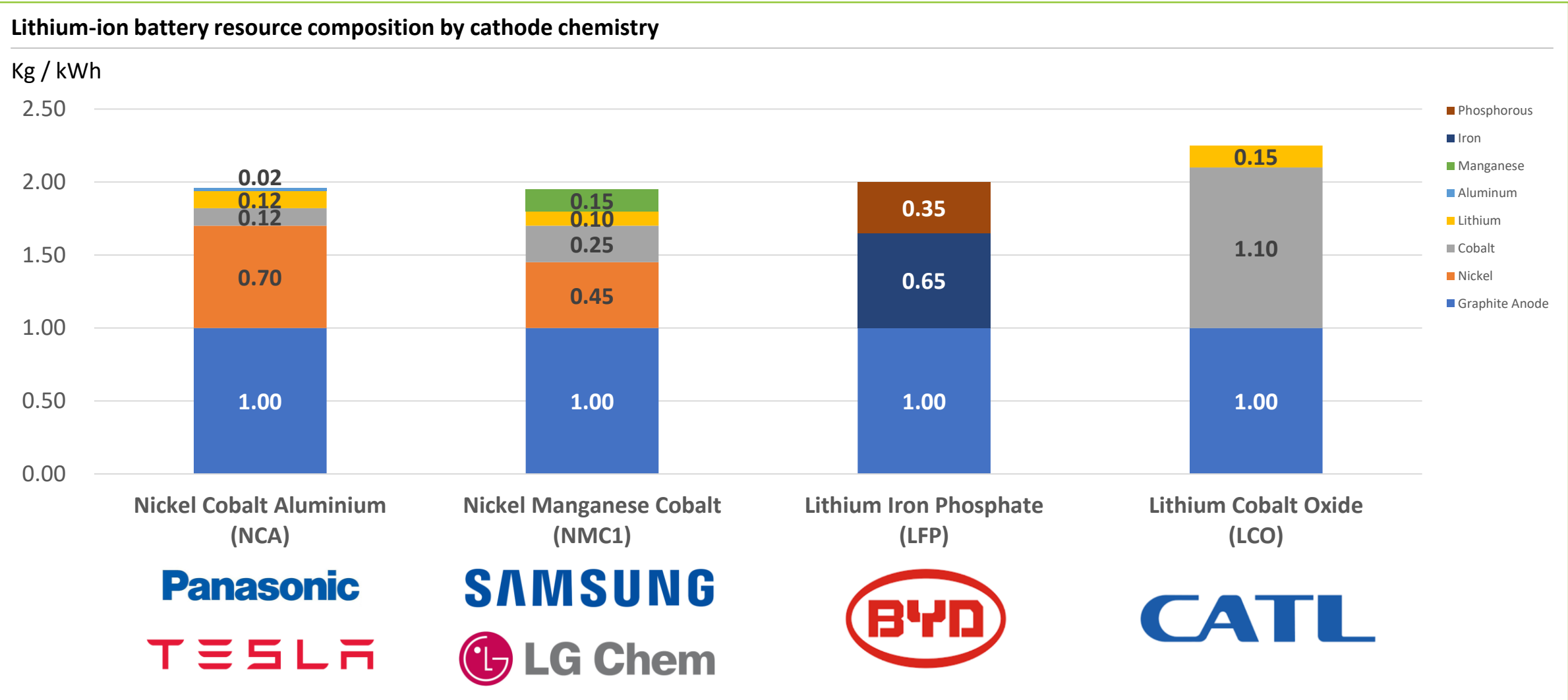


Graphite is a key component of a lithium ion battery






Note: Indicative and illustrative information with approximations applied

Regardless of LIB type, graphite anode is the most prevalent

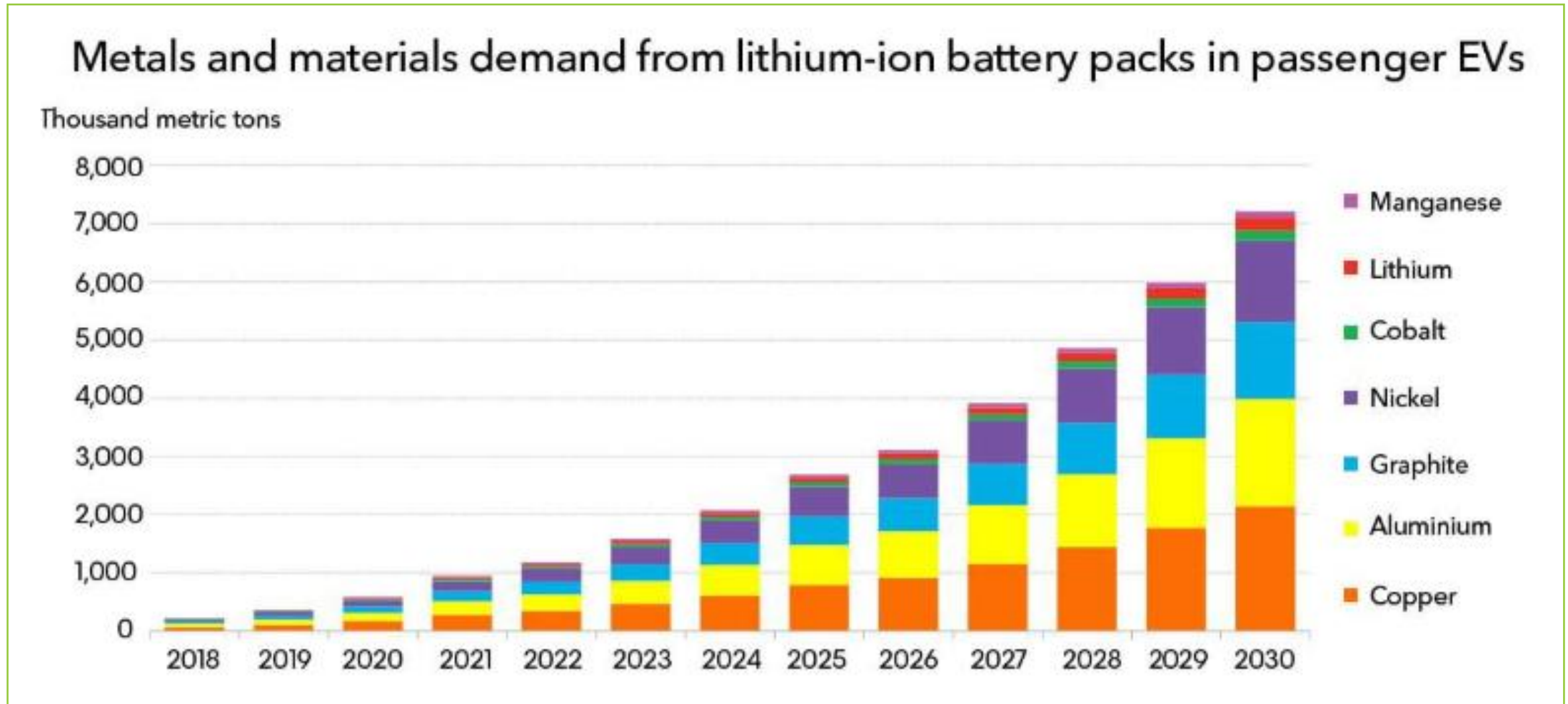


How much graphite anode material is inside?

Applications	Cylindrical battery cells	Anode material
Home storage 13.5 kWh (Av. home use 20 kWh/day)	~1,000 cells (18650 size)	~ 10kg ~ US \$100 (~20% of battery cell weight)
		
Electric vehicle 80 kWh (400km+ full charge range)	~7,000 cells (18650 size)	~ 70kg ~ US \$700
		
Grid storage 130 mWh (size announced for SA)	~9,000,000 cells (18650 size)	~ 90t ~ US \$900,000
		

Note: Indicative and illustrative information with approximations applied

Graphite demand to increase to over 1mt by 2030



Source: EV Outlook 2018, Bloomberg New Energy Finance

Note: Copper includes copper current collectors and pack wiring. Aluminium includes aluminium current collectors, cell and pack materials and aluminium in cathode active materials