



Powering innovation

**SYERSTON
NICKEL COBALT SCANDIUM
PROJECT**

THE FUTURE OF
ELECTRIC METALS

ROBERT FRIEDLAND, CO-CHAIRMAN
February 2017

(ASX:CLQ)

DISCLAIMER

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Please refer to the back of this presentation for information concerning the calculation of reserves and resources referred to herein, and the consents provide the respective Competent Persons.

For further details on the content of this presentation, please refer to the ASX releases on the Company's website.

AN ELECTRIC REVOLUTION IS COMING



1990



2010



SHANGHAI
1990 POPULATION: 13M
2010 POPULATION: 23M

DEMOGRAPHIC TRENDS ARE CLEAR

URBANISATION – THE GREATEST CHALLENGE OF OUR TIME

Our planet gains approximately **83 million** people every year

By 2030 Earth will have a projected 8.5 billion people, of which **5 billion will live in urban areas**

That is **1 billion more urban residents** than we have today, resulting in massive **social and environmental challenges**

Source: United Nations

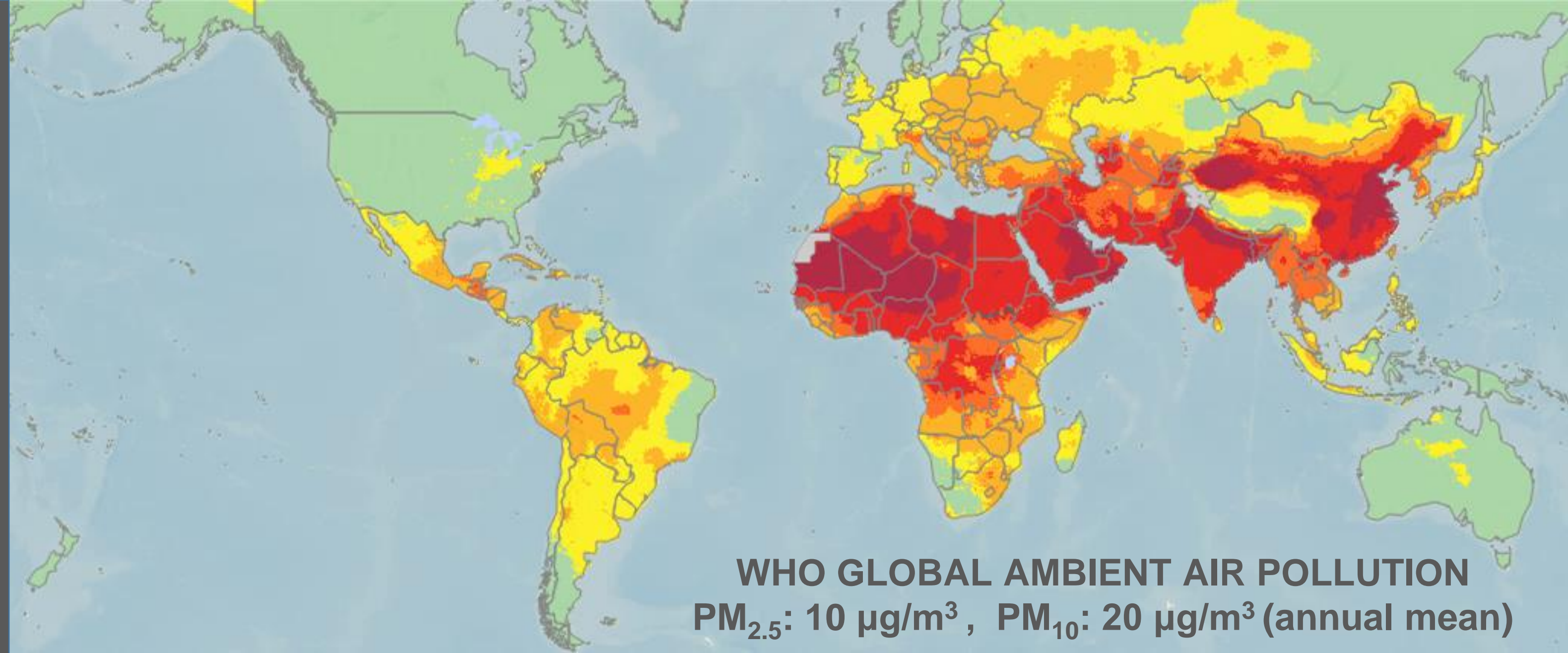


Air pollution is now the world's largest single environmental health risk

“Some 3 million deaths a year are linked to exposure to outdoor air pollution... Nearly 90% of air-pollution-related deaths occur in low- and middle-income countries...”

PM_{2.5} includes pollutants such as sulfate, nitrates and black carbon, which penetrate deep into the lungs and in the cardiovascular system, posing the greatest risks to human health.”

- WHO Global Air Pollution Study, 2016



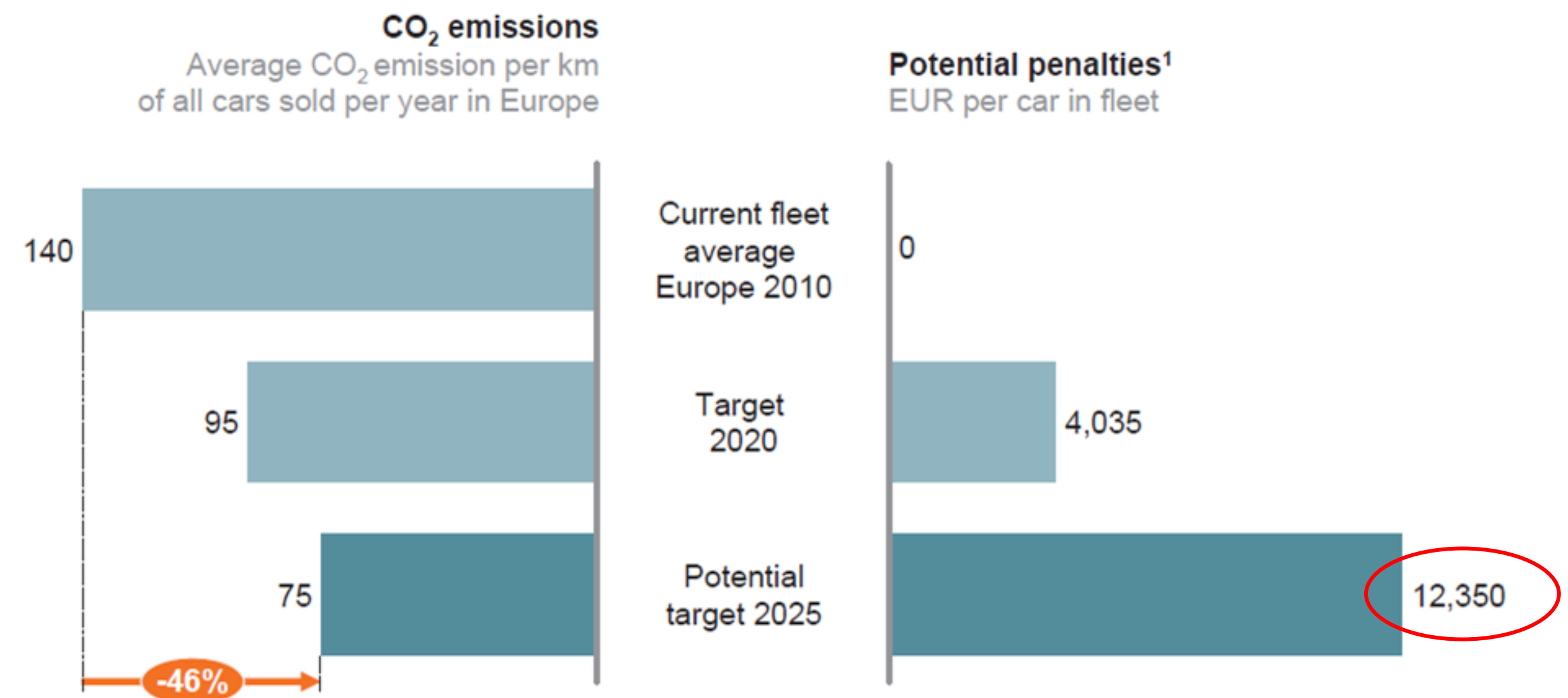
EU EMISSION LIMITS

THE GENESIS OF DIESELGATE

“Diesel was seen as a good thing because it produces less CO₂, so we gave people incentives to buy diesel cars.”

- Martin Williams, Former head of the UK Government’s Air Quality Science Unit

EU Regulations – CO₂ Emissions and Penalties



¹ Assumption: in comparison to today's average European CO₂ emission of 140 g CO₂ per km per car; penalties for exceeding CO₂ emissions in 2020: for 1st gram EUR 5, 2nd gram EUR 15, 3rd gram EUR 25, 4th gram and beyond EUR 95; penalties in 2025: EUR 190 for each gram

Source: McKinsey & Co, *Lightweight, Heavy Impact* (2012)

DIESELGATE

...BUT DIESEL CANNOT MEET NO_x / PM_{2.5} EMISSION LIMITS

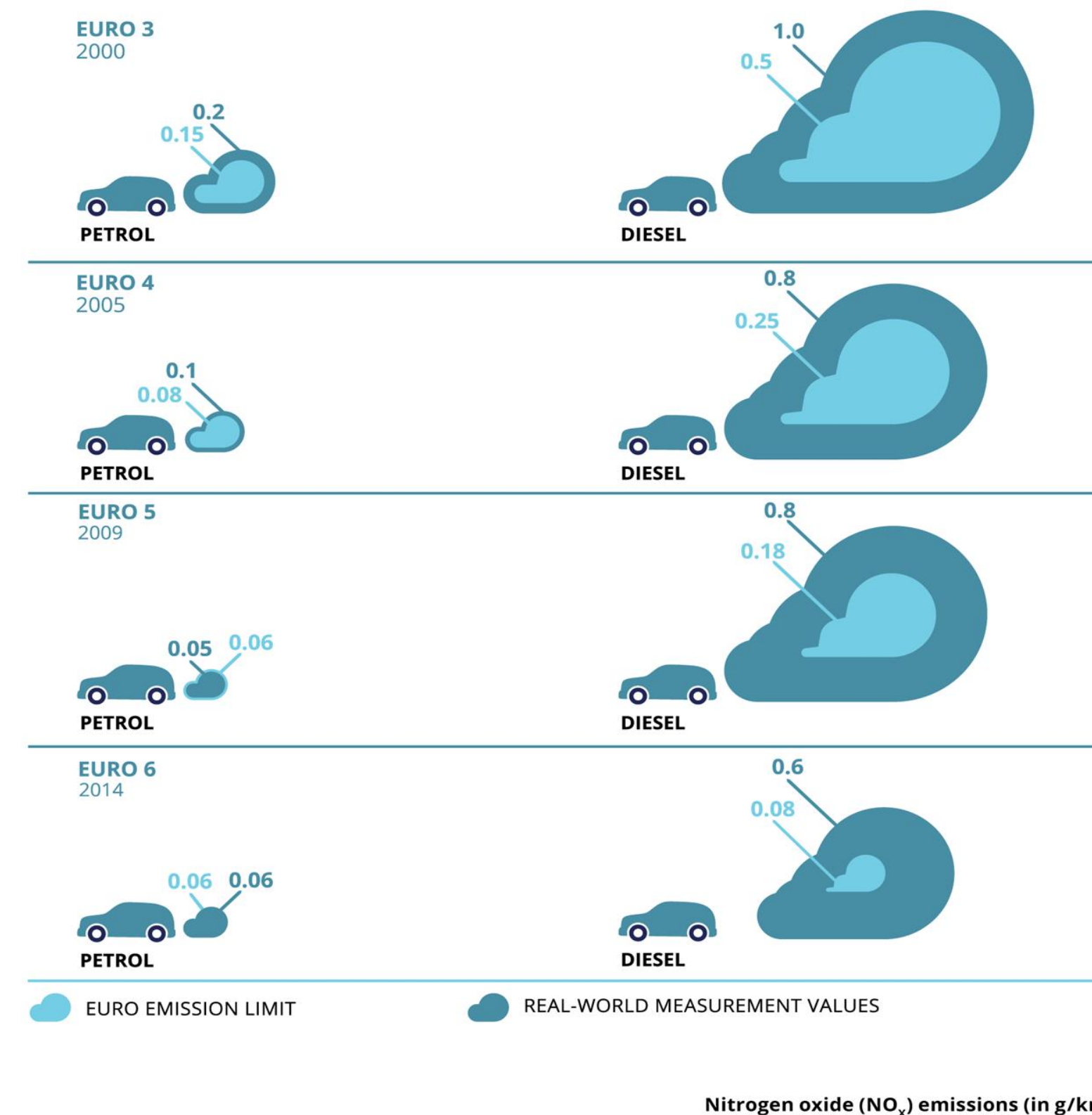
“You have power, you have energy, you have emissions: you get to choose two of them.”

- Don Hillebrand, Argonne National Laboratory and former president of the Society for Automotive Engineers

“We’ve totally screwed up.”

- Volkswagen’s U.S. CEO Michael Horn during the Dieselgate crisis

Comparison of NO_x emission standards for different Euro classes



Source: EEA (European Environment Agency), 2016

NOT JUST A THIRD WORLD PROBLEM

GOVERNMENT REGULATION IS ESCALATING

Paris, Madrid, Mexico City and Athens have announced **plans to ban diesel vehicles** from their cities by 2025

The German parliament has voted to **ban the sale of petrol and diesel vehicles** from 2030, and has urged the EU to extend the ban to the entire EU





“Car companies say they are reaching the limit of what is doable with conventional technology ... Tougher CO₂ emissions targets will accelerate the push to electrification.”

- Automotive News Europe, *European automakers call for CO₂ emissions delay*, June 2015



WELL-TO-WHEELS EV MILES PER GALLON EQUIVALENT (MPG_{ghg}) BY ELECTRICITY SOURCE

Energy Source	MPG _{ghg}
Coal	30
Oil	32
Natural Gas	54
Solar	500
Nuclear	2,000
Wind	3,900
Hydro	5,800
Geothermal	7,600

Even EV's charged **100% on coal** have lower GHG emissions intensity than the average US passenger vehicle

Table Source: State of Charge, *Electric Vehicles' Global Warming Emissions and Fuel-Cost Savings across the United States*, 2012. EV efficiency assumed to be 0.34 kWh/mile based on the 2012 Nissan LEAF (note that the current Nissan LEAF achieves ~0.28kWh/mile). Production and consumption of gasoline is assumed to produce 11,200 g CO₂e/gal.

AUTOMAKERS ARE NOW RESPONDING

EV'S ARE MOVING TO THE MAINSTREAM



VW

Forecasting sales of **2 to 3 million pure EV's by 2025**, or 25% of sales, as well as potential investment in a **multi-billion euro battery plant**



BMW

Forecasting 100,000 x-EV sales in 2017, and targeting EV's as **15-25% of its worldwide sales by 2025**



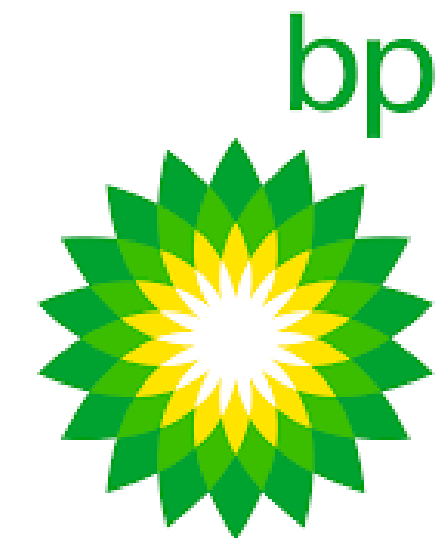
DAIMLER

Ten new EV models by 2025 supported by a **€10 billion investment program**, potentially including **battery manufacturing**



TESLA

Tesla 3 was the **most successful automotive pre-launch in history**, with 400,000 buyers reserving a car for delivery from 2017



BP

BP is forecasting **100 million EV's** on the road – circa 10% of the global car fleet - by 2035



RANGE ANXIETY WILL BE ADDRESSED

Volkswagen, Daimler, BMW and Ford have agreed to jointly invest in **thousands of fast-charging sites** across Europe

EU regulations require **all new and renovated homes to come with an EV charger** by 2019

China's State Grid announced plans to build **10,000 charging stations and 120,000 poles by 2020** for major Chinese cities

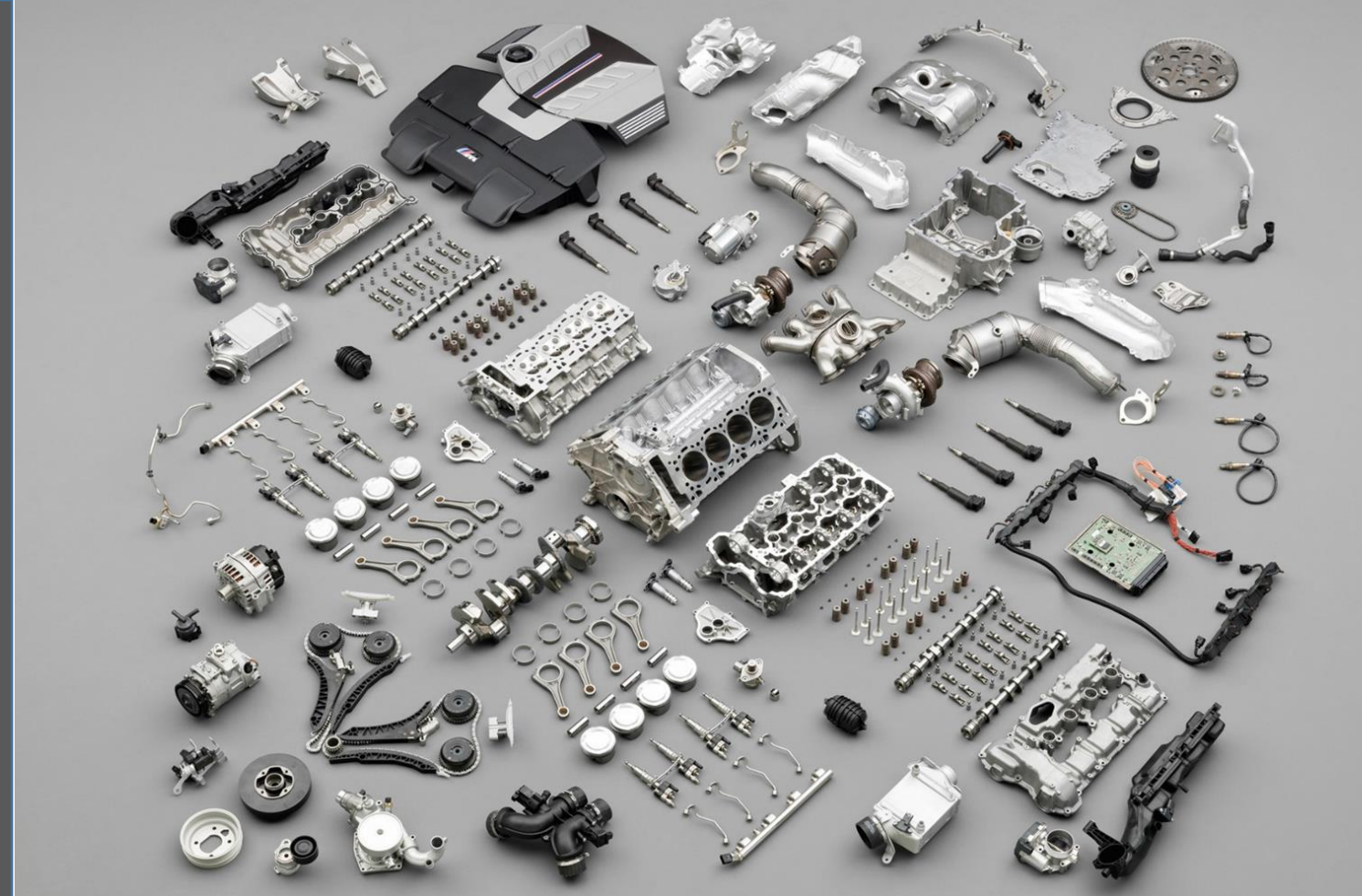
Source: Reuters, 29 Nov 2016; CRI English.com, 12 Dec 2016

Simplifying the drivetrain

Electric motors are far **simpler** than combustion engines

Lower maintenance costs and **higher reliability** – there is one moving part in an electric motor

Tank-to-wheel **efficiency** is ~16% in a combustion engine, versus ~70% in an electric motor¹



1. Wells to wheels: electric car efficiency February 22, 2013: <https://matter2energy.wordpress.com/2013/02/22/wells-to-wheels-electric-car-efficiency/>
2. Electric motor and chassis images courtesy of Tesla

BATTERY PACK COSTS ARE FALLING

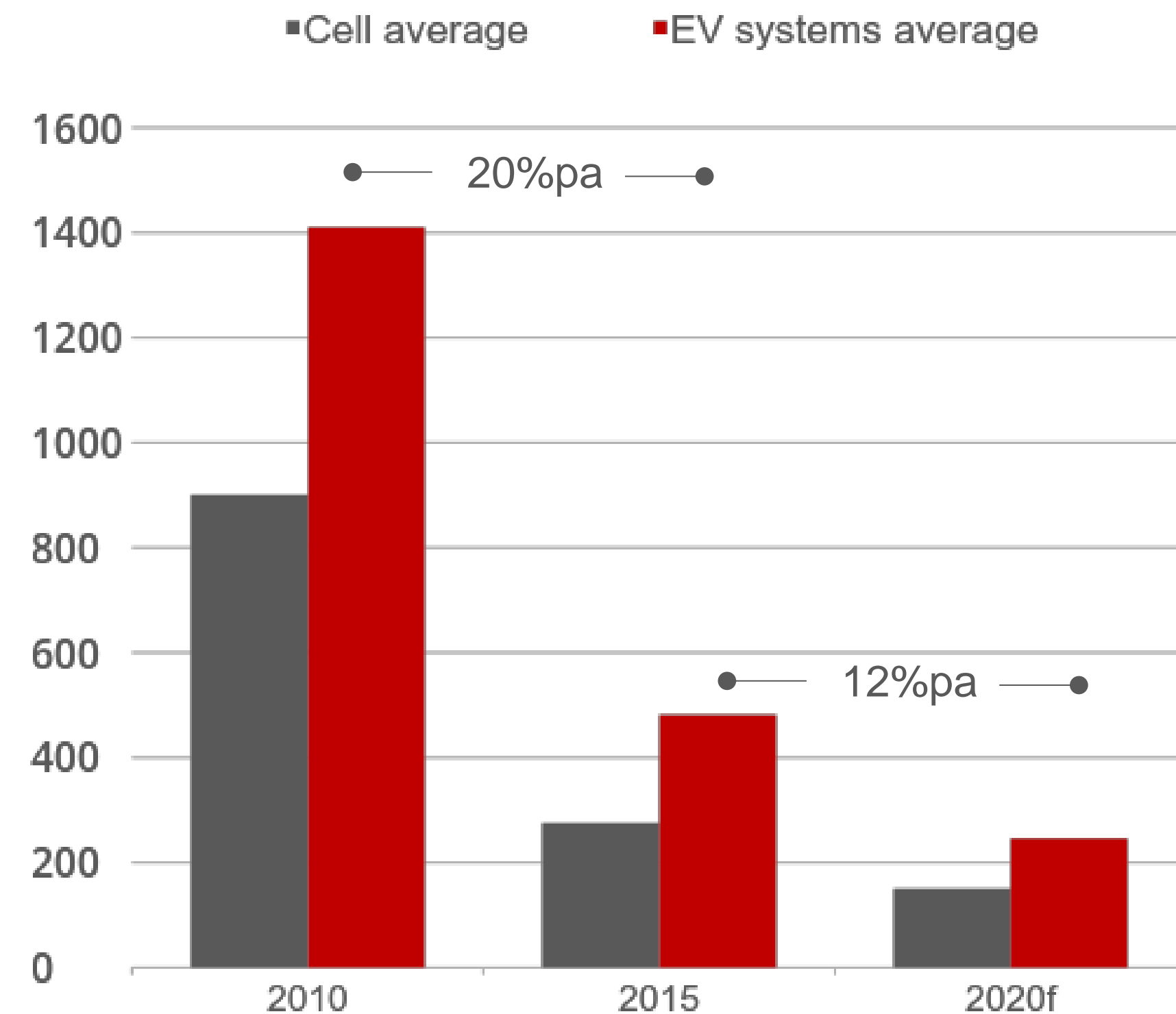
ECONOMIES OF SCALE AND THE EXPERIENCE CURVE



The last five years has seen a **20% pa cost reduction** in EV battery pack systems

At the current rate of improvement, EV drivetrains are **forecast to become competitive with combustion engines within 5 to 10 years**

Battery Costs Are Falling (\$/kWh)



Source: Deutsche Bank, Lithium 101, May 2016



SANYO, JAPAN, 2010



NISSAN, USA, 2013



TESLA, USA, 2017



SAMSUNG, CHINA, 2015



LG CHEM, CHINA, 2015



LG CHEM, USA, 2013-15

INVESTMENT IN NEW BATTERY CAPACITY IS VERY LARGE AND VERY REAL

THE SUPPLY CHAIN IS RESPONDING, FAST...

NEW BATTERY CAPACITY IS COMING

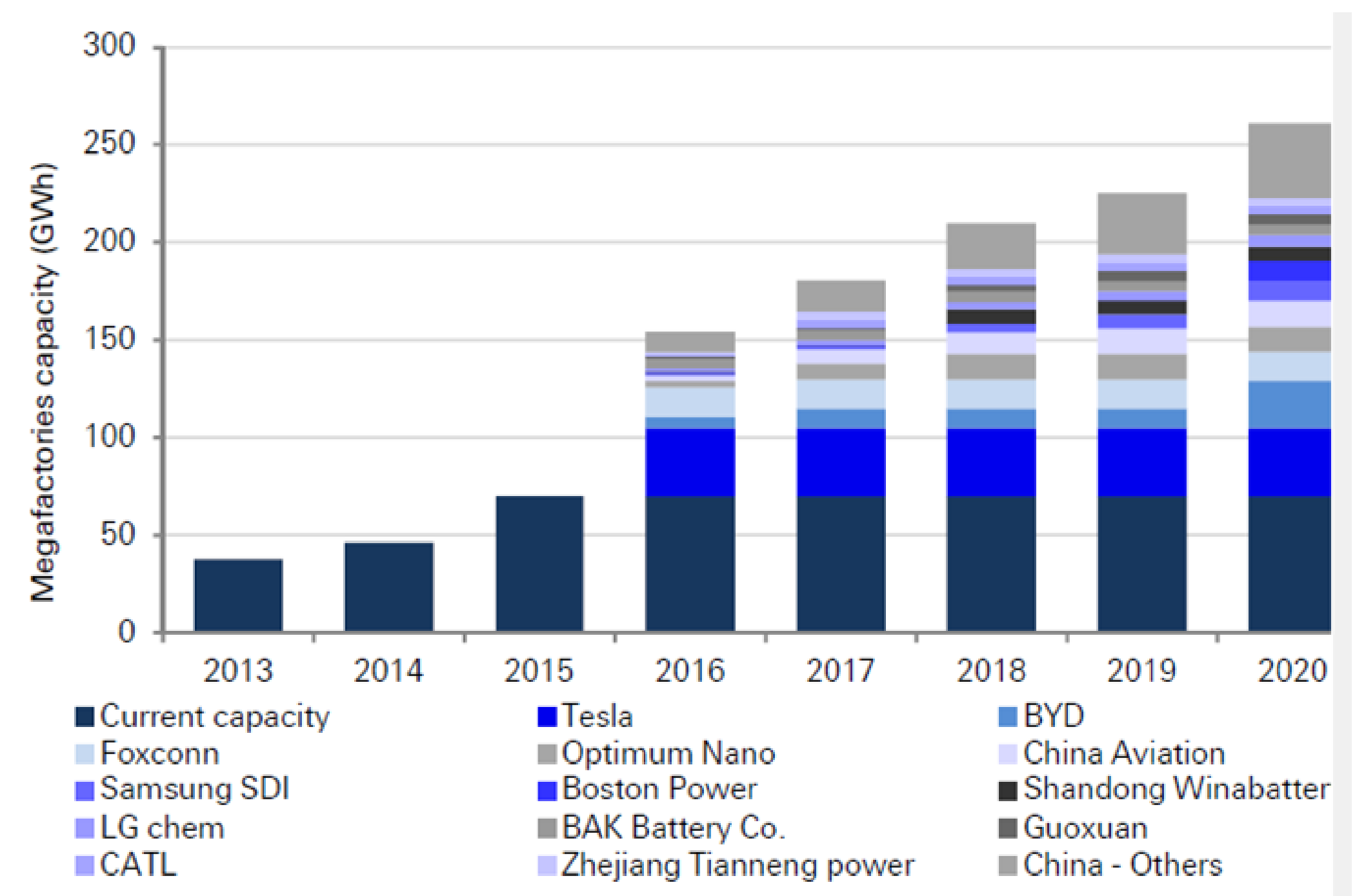
ALREADY ~US\$20B OF COMMITTED INVESTMENT

Forecasting a **~4x increase** in global battery capacity over the next five years

China is now pushing for an aggressive California-style Zero Emission Vehicle (ZEV) program: **8% of all cars sold in China by 2018 will be EV, and 12% by 2020**

Given a 1% EV adoption rate in China today, that target translates to a **12x increase** in the number of electric cars to be sold in China by end of the decade

US government policy changes on renewables and energy storage is **likely to be immaterial** to global growth projections



Source: Deutsche Bank, Lithium 101, May 2016

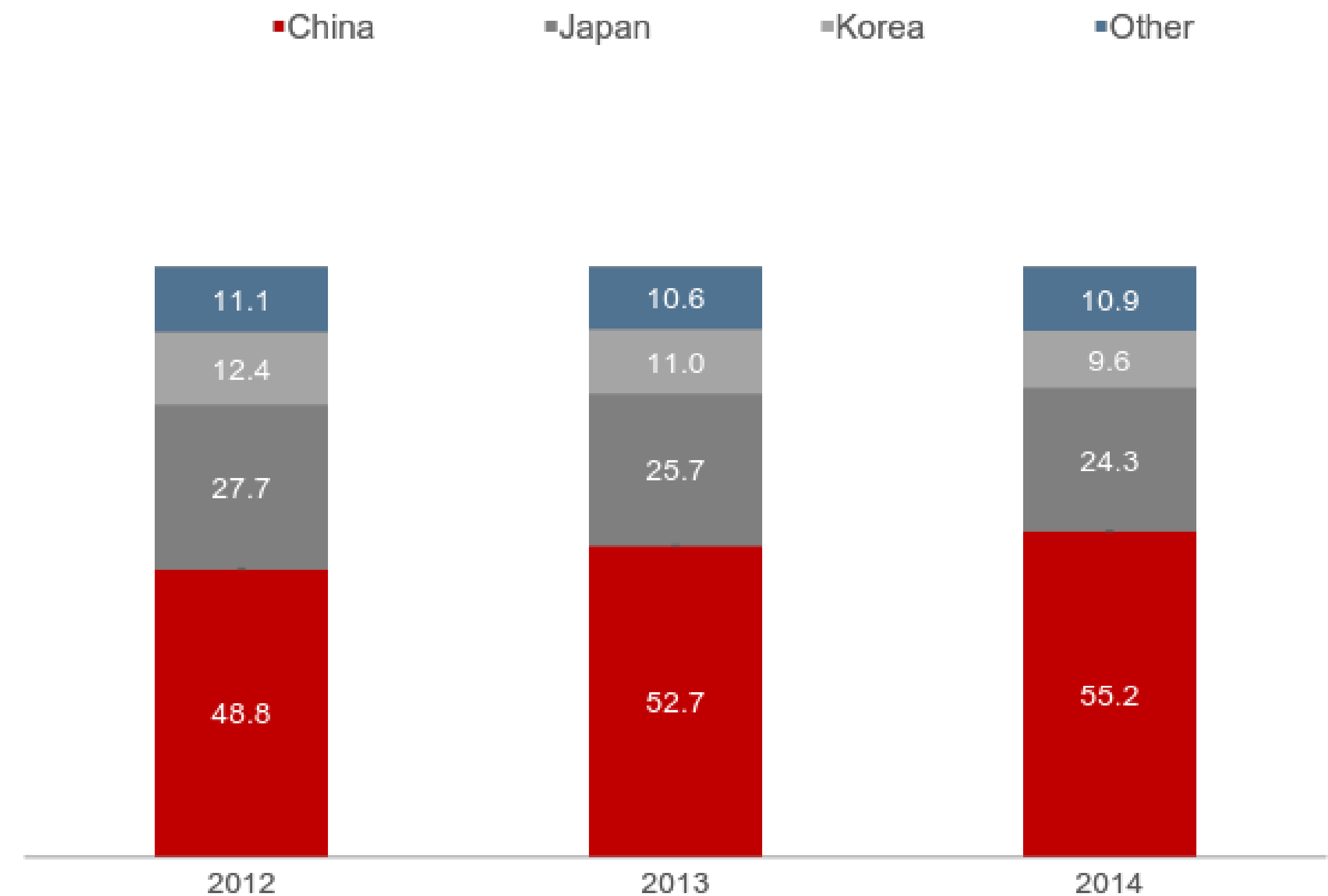
A RACE TO SECURE RAW MATERIALS

CHINA'S AMBITIONS FOR A STRATEGIC INDUSTRY

A steady stream of acquisitions

Year	Asset	Purchaser	Focus	Price
2010	Olaroz (ARG)	Toyota Tsusho / JOGMEC	Li	US\$62M + PF + Comp. Gtee
2012	Greenbushes (AUS) – 100%	Chengdu Tinaqui	Li	A\$815M
2012	Ruashi (DRC)	Jinshuan	Co / Cu	US\$1,300M
2014	Greenbushes (AUS) – 49%	Rockwood Lithium	Li	US\$474M
2015	CMSK (DRC)	Huayou Cobalt	Co / Cu	US\$52M
2015	Mt Marion (AUS)	Jiangxi Ganfeng	Li	US\$46.6M
2016	Tenke (DRC) – 56%	China Molybdenum	Co / Cu	US\$2,650M
2016	Kokkola (Finland)/ Kisanfu (DRC)	China Molybdenum	Co	US\$150M
2016	SQM – 2.1%	Tianqi Lithium	Li	US\$210M
2017	Altura Mining (AUS) – 20%	Shaanxi J&R Optimum Energy	Li	A\$42M

Cathode Material Market Share (percentage)

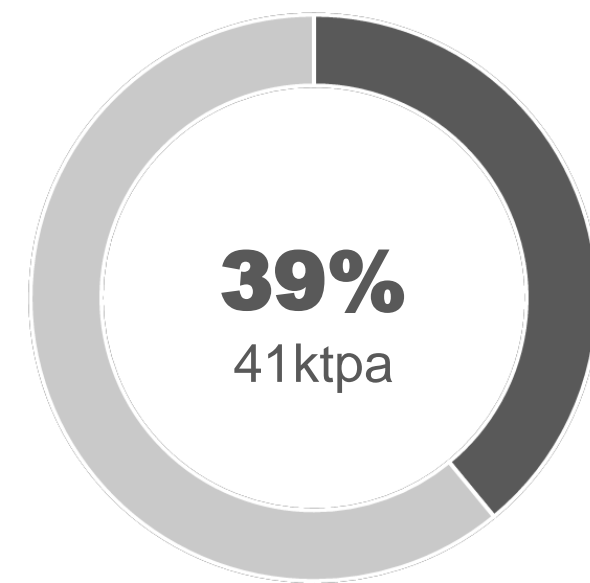


Source: KDB Daewoo Securities, 2015

CATHODE MARKET

CHEMISTRY BY MARKET

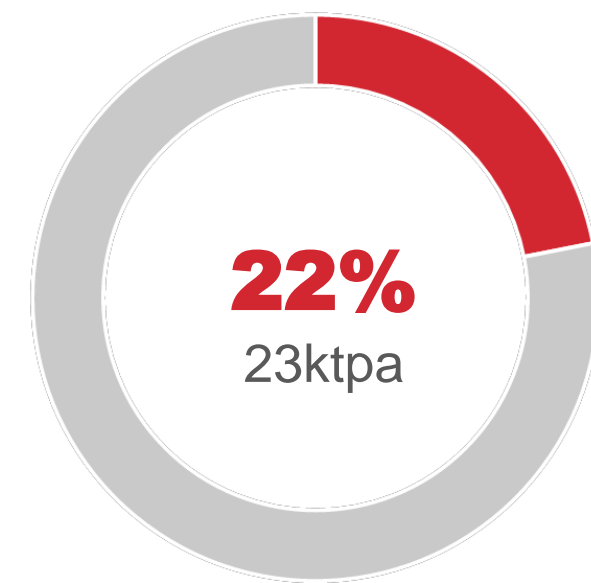
DOMINANT CHEMISTRIES FOR EV REQUIRE NICKEL AND COBALT



LCO

(Lithium-Cobalt-Oxide)

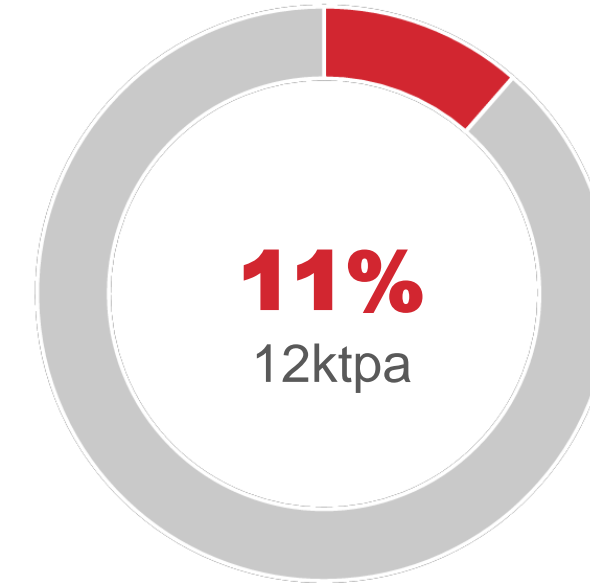
Still one of the highest energy density chemistries, but expect to see only steady growth as automotive and utility-scale applications grow



NCM

(Nickel-Cobalt-Manganese)

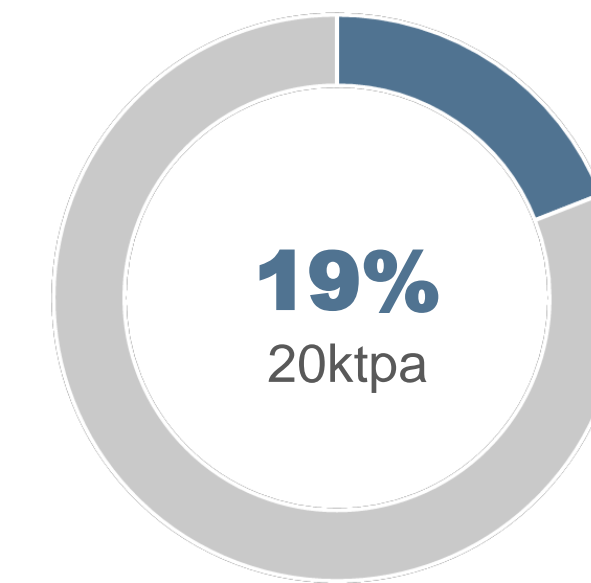
Experiencing fastest growth with a good mix of energy density, power, cost and safety for automotive applications; new chemistries constantly developing



NCA

(Nickel-Cobalt-Aluminium)

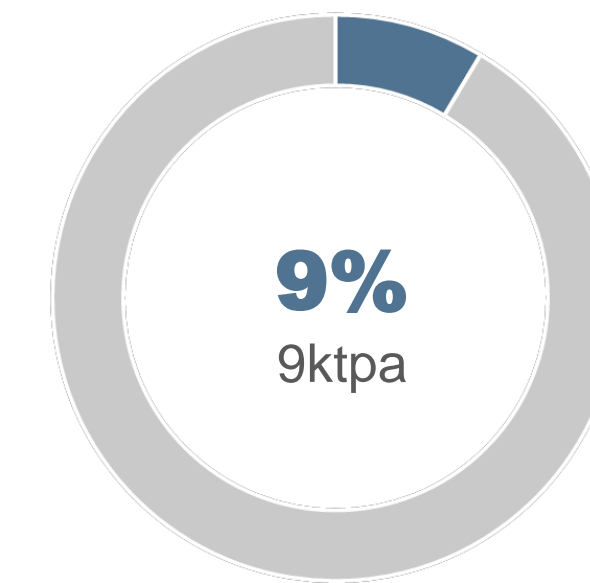
Extremely high energy density, power and manufacturing experience make it a good candidate for automotive



LMO

(Lithium-Manganese-Oxide)

Relatively low energy density (one-third of LCO), but the absence of cobalt makes this a low-cost alternative cathode material



LFP

(Lithium-Iron-Phosphate)

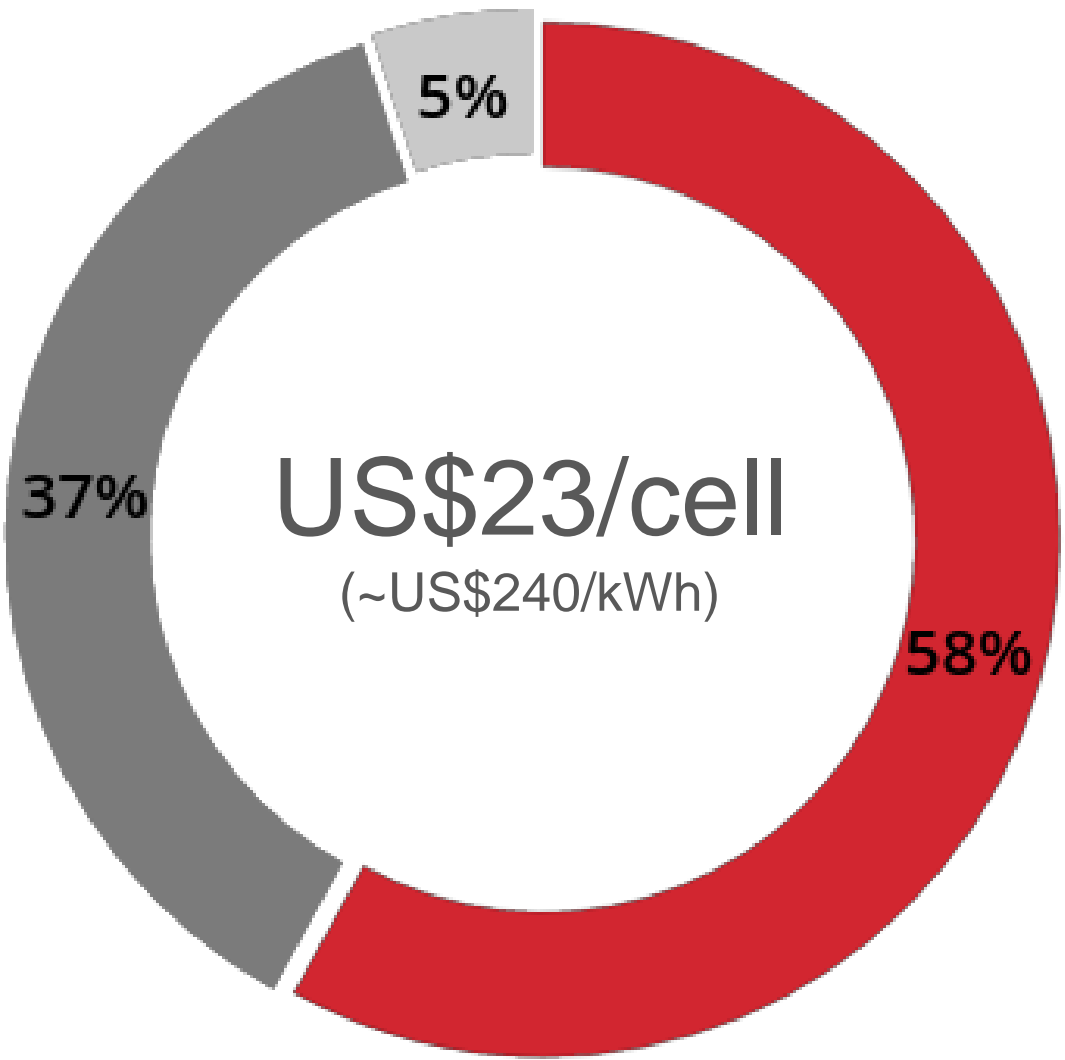
Reasonable energy density but lower power; lower cost raw materials are offset by poor conductivity and higher unit costs from assembly process

Source: Avicenne Energy Analysis 2014

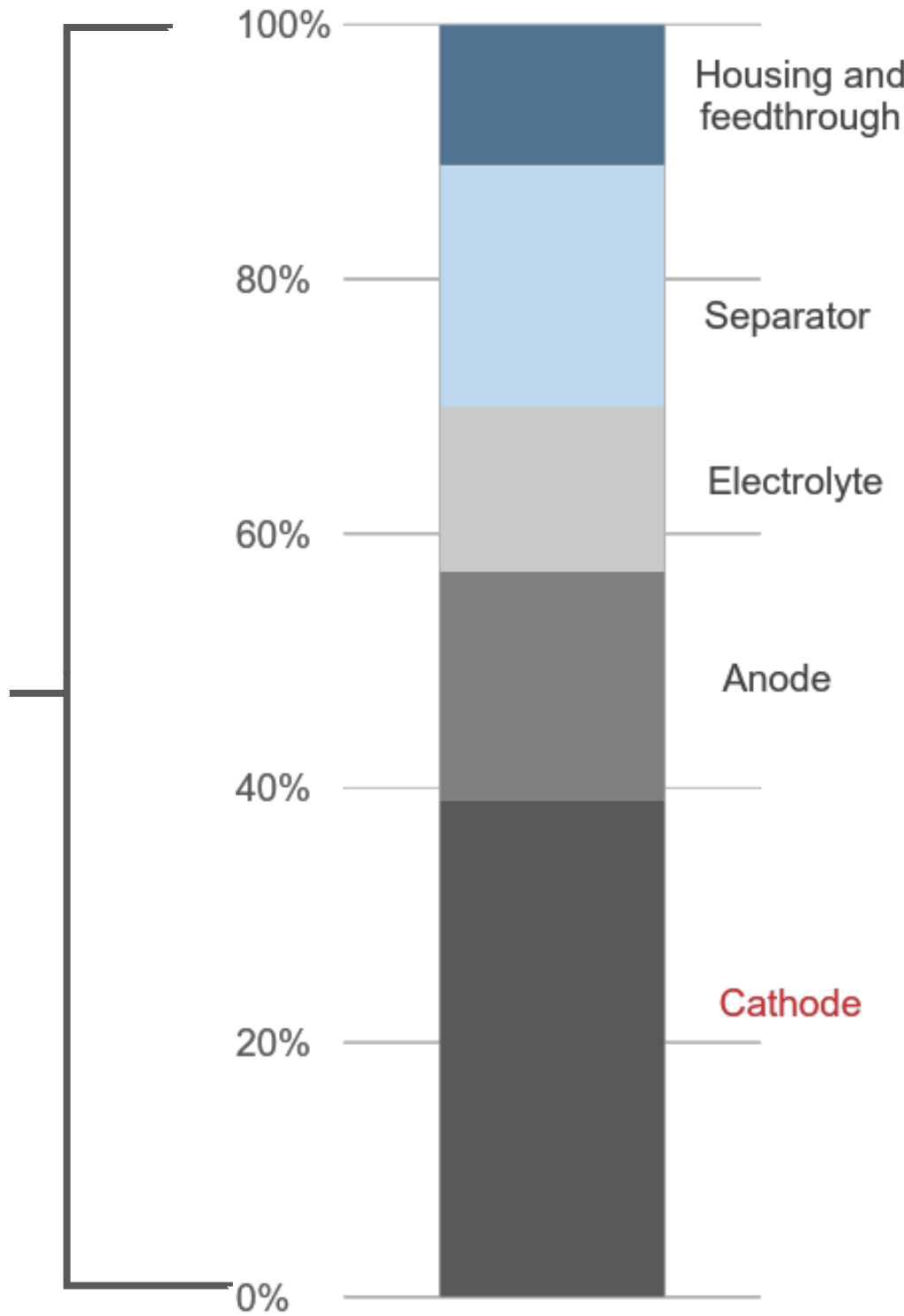
CATHODE – THE KEY TO COST

A LITHIUM ION BATTERY IS A CoNiC BATTERY IN ALL BUT NAME

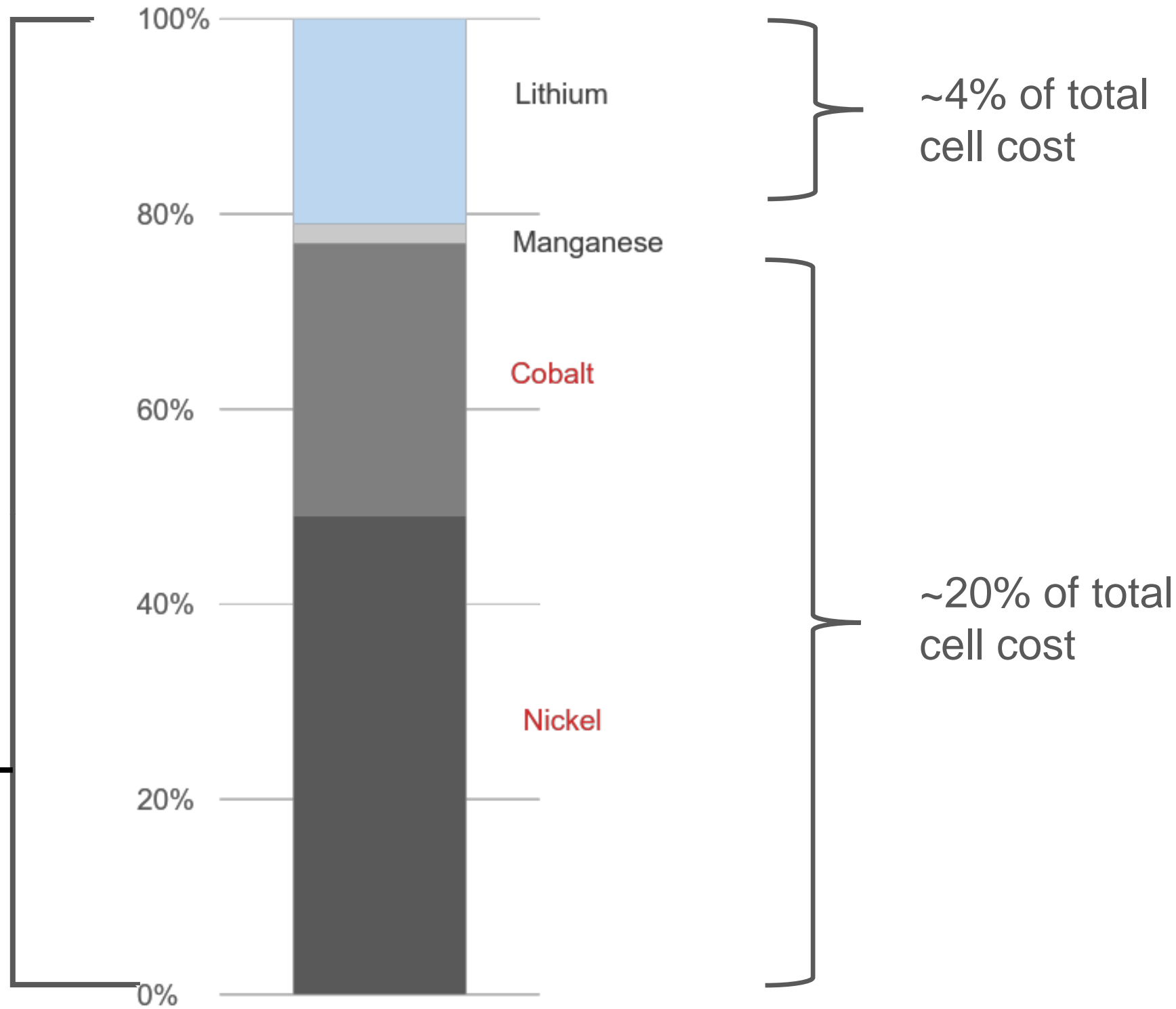
■ Raw Materials Margin
■ Manufacturing Costs
■ Producer



Raw Material Cost Breakdown



Metal Cost in Cathode Active Material



Source: Roland Berger (2012) and internal analysis. Assumes a 96Wh PHEV cell (26Ah, 3.7W) using NCM622 cathode chemistry. Cathode cost includes non-metallic materials (carbon black, binder, foil). Internal assumptions concerning split of costs assumes average long-term prices of Ni US\$7.00/lb; Co US\$12.00/lb; Mn US\$1.00/lb; Li US\$6.50/kg (as LCE).



“The main determinants on the cost of the cell are the price of the nickel **in the form that we need it** ... and the cost of the synthetic graphite with silicon oxide coating.”

- Elon Musk, Tesla CEO



NICKEL & COBALT
SULPHATE

The EV battery industry requires **metal to be supplied as salts**, usually as sulphates, to manufacture cathode precursors

The cost of converting metal units to sulphate form is often represented in the market price by a '**sulphate premium**' paid over and above the contained metal value

CATHODE DEMAND FORECAST

IMPLICATIONS FOR RAW MATERIAL DEMAND

Use of nickel and cobalt dominant chemistries is accelerating in China

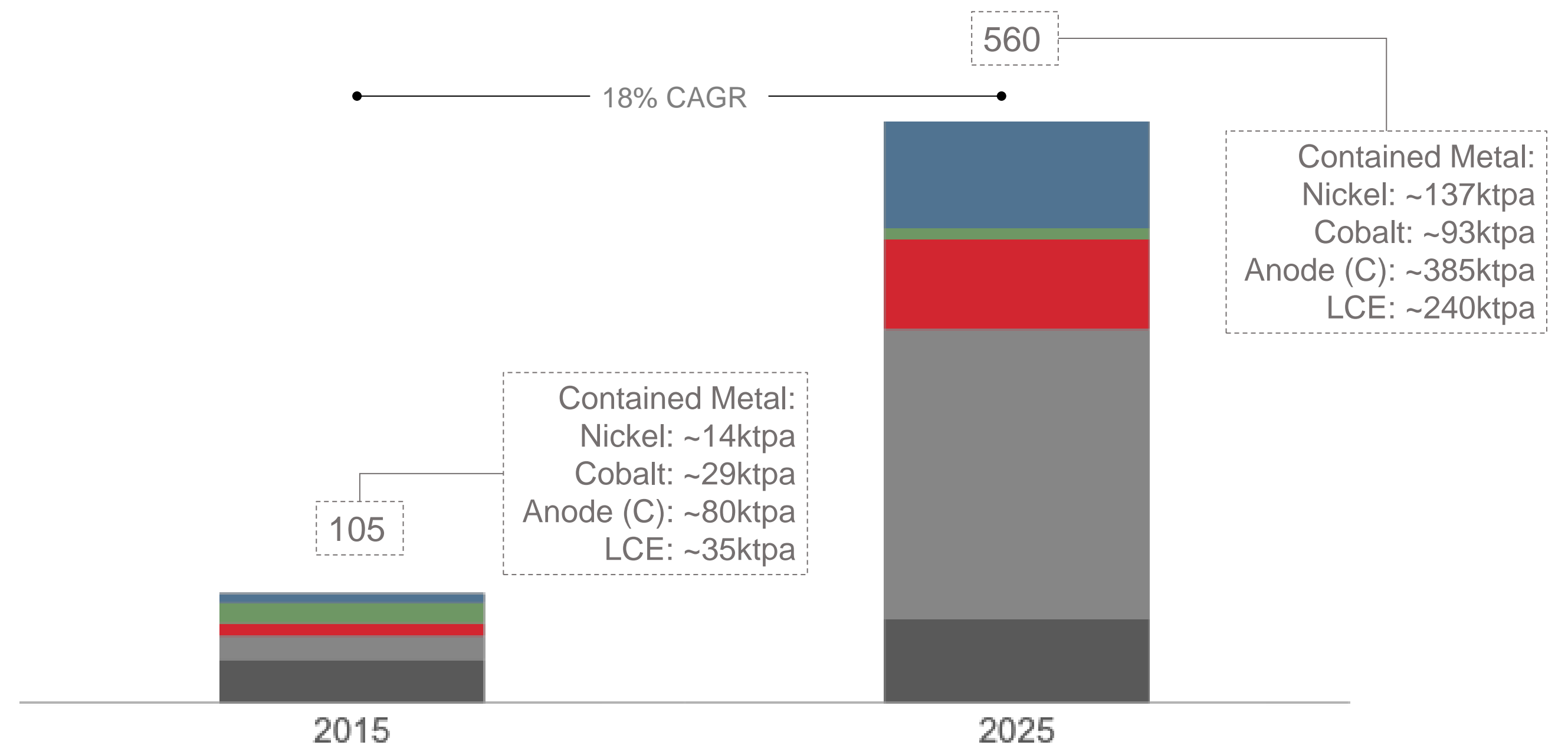
Of the 10 top selling Chinese EV's using LFP chemistry, six are already converting to NCM

“We believe this potential [Chinese] subsidy plan would further promote the development of NMC over LFP in the next few years. The **NMC penetration rate should climb significantly faster** than we previously expected.”

- Deutsche Bank, 2 Dec 2016

Cathode Raw Material Demand ('000 tonnes)

■ LCO ■ NCM ■ NCA ■ LMO ■ LFP



Source: 2015 data based on Avicenne Energy Analysis. 2025 case based on internal company estimates, utilising an EV adoption rate based on the average from five banks and industry consultant forecasts: HEV 5.7m, PHEV 2.7m, BEV 3.6m. EV applications forecast at 217 GWh. Non-EV applications forecast at 135GWh. Assumes an average battery size of 50kWh/BEV. No adjustments have been made for yield losses or process inefficiencies at pack or cell level, nor recycling rates.

SYERSTON PROJECT



SYERSTON ORE

SYERSTON PROJECT

OVERVIEW

The Syerston mineral deposit is rich in nickel, cobalt and scandium, located 350km west of Sydney and 100% owned by Clean TeQ

Uniquely positioned as one of the largest and highest grade sources of cobalt outside Africa

Syerston will be the first mine developed to exclusively supply the global lithium ion battery industry, with high-purity nickel sulphate and cobalt sulphate

WHY SYERSTON IS IMPORTANT

PROTECTION AGAINST SUPPLY CHAIN AND REPUTATION RISK

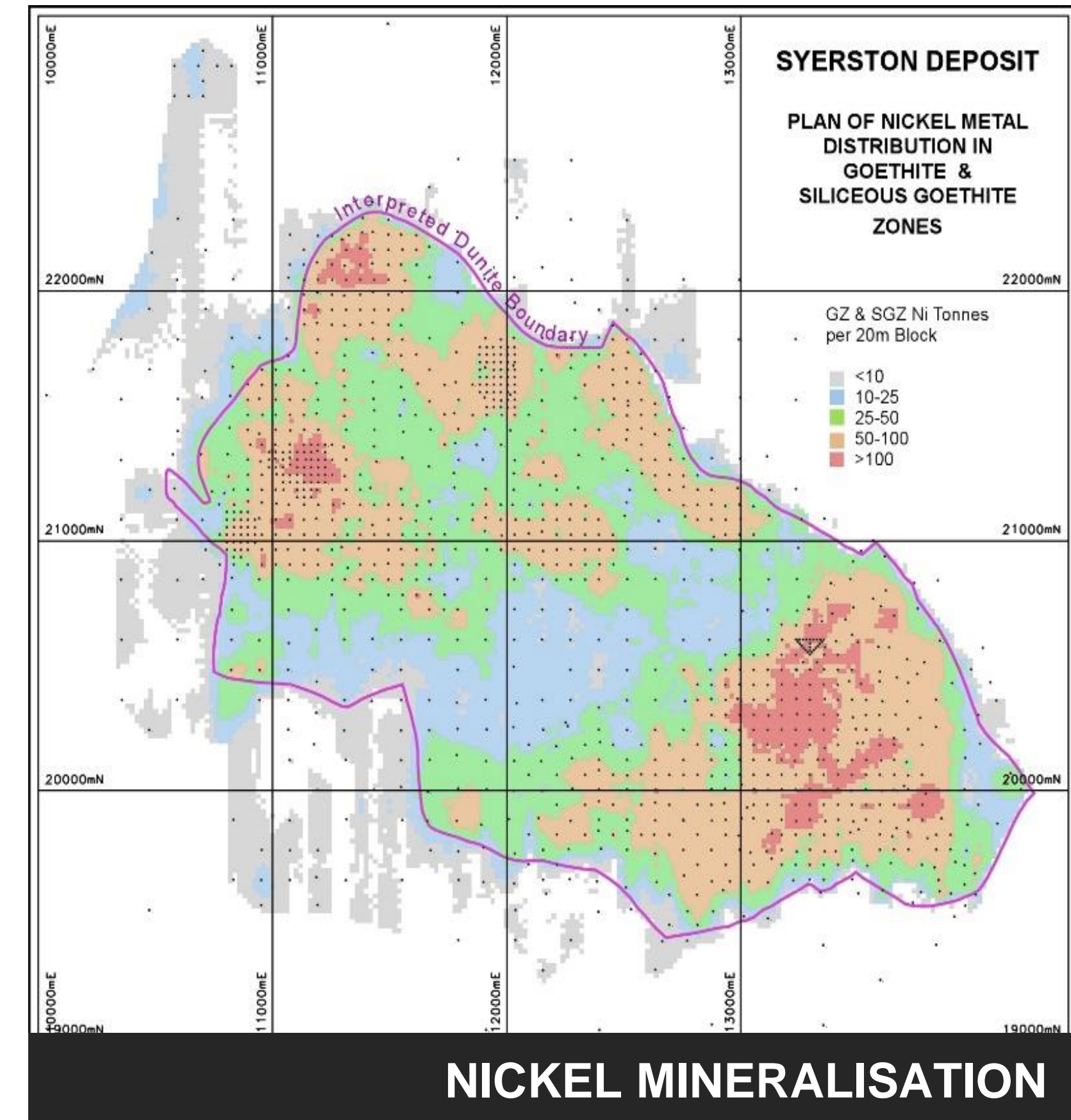
	<p>100% auditable to the mine source</p>		<p>High volume cathode quality $\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$</p>	
<p>Low risk country with minimal mining and processing risk</p>		<p>High volume cathode quality $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$</p>		<p>Sc_2O_3 for stronger and lighter aluminum alloys</p>

SYERSTON ORE RESERVE

VERY LOW MINING RISK

Over **1,300 drill holes** have defined a significant nickel / cobalt / scandium **ore reserve**

The ore reserve is **shallow** (5m to 40m) and extends over a 2km horizon; **simple, low risk strip-mining with no blasting**



2016 PREFEASIBILITY STUDY

SYERSTON CAN EASILY SUPPORT MULTIPLE GIGAFACTORIES

Parameter	Assumption / Output	
Autoclave Throughput	2.5Mtpa ¹	
Life of Mine	39 years	
Initial operating period	20 years	
Autoclave Feed Grade ² (Year 3-20 average)	Nickel	0.80%
	Cobalt	0.14%
Production (Years 3-20 average)	Nickel sulphate	85,135tpa
	Cobalt sulphate	15,343tpa
Production (Years 3-20 average)	Contained nickel	18,730tpa
	Contained cobalt	3,222tpa
Recovery (Years 3-20 average)	Nickel	94.2%
	Cobalt	93.0%
Nickel price assumption ³	US\$7.50/lb	
Cobalt price assumption ³	US\$12.00/lb	
Exchange Rate	AUD/USD 0.75	
Total Capital Cost ⁴	US\$680M (A\$906M)	
C1 Cash Cost (Year 3-20 average) ⁵	before Co credits	US\$2.96/lb Ni
	after Co credits	US\$0.89/lb Ni
Net Present Value (NPV ₈) – post tax ⁶	US\$891M	
Internal Rate of Return (IRR) – post tax	25%	

¹ Designed processing throughput rate following a 24-month commissioning and ramp up period.

² Includes pit selection, dilution and mining factors

³ Based on bank/broker long-term consensus market pricing for metal content only. Does not include premiums that are typically paid in the market for battery-grade nickel and cobalt sulphate

⁴ Includes a US\$62M (A\$83M) contingency on capital costs

⁵ C1 cash cost excludes potential by-product revenue from scandium oxide sales and royalties

⁶ Post tax, 8% discount, 100% equity, real terms

26-28

GWh p.a.#

500,000

Electric Vehicles p.a.*

Definitive Feasibility Study due for completion in Q4 2017

Scandium credits lift NPV₈ to US\$1.23 billion and IRR to 30%^

Assumes NCA chemistry with Ni and Co content by wt% within cathode active material of 48% and 9% respectively, and energy density at 1.39kg/kWh

* Assumes average energy density per battery pack of 50kWh

^ See details in Prefeasibility Study announcement in ASX Release dated 5 October 2016

COBALT

A PROBLEMATIC SUPPLY CHAIN

“The majority of the cobalt is heading straight to China. Their global hold is huge.”

- CRU 2016

95%

Percentage of cobalt produced globally as by-product from copper and nickel mining

65%

Percentage of global cobalt production originating in the Democratic Republic of Congo

45%

Percentage of DRC cobalt mined artisanally

Source: Darton Cobalt Market Review 2015-2016



CHILDREN MINING COLTAN, KIVU REGION, DRC

“While the occasional [analyst] questions the availability of enough lithium or flake graphite to satisfy soaring demand from the battery industry, everybody has overlooked or ignored the most critical mineral constraint – Cobalt. It’s a truly gargantuan challenge. A Gigarisk!”
- investorintel.com, March 2016

COBALT PRICE

RISING QUICKLY FROM HISTORIC LOWS

Cobalt was one of the best performing metals in 2016, with price increasing ~50% over the year

Significant upside in the event of supply disruption – China is adding to its strategic stockpiles

At Syerston cobalt is co-product, not by-product: cobalt is ~40% of Syerston's revenues at today's spot metal prices¹



1. Prices taken as at 20 Jan 2017. Excludes scandium revenue.

SCANDIUM

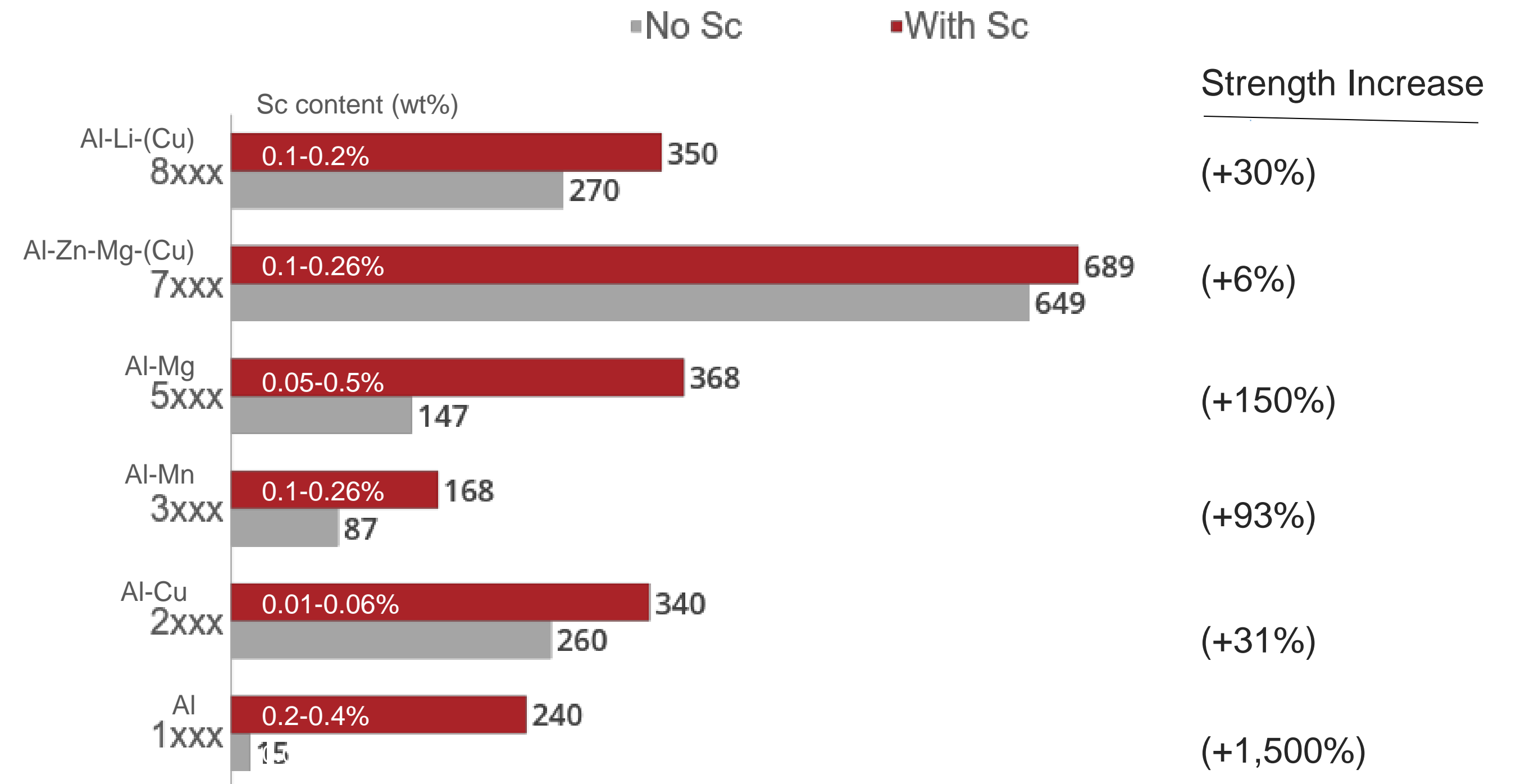
SCANDIUM WILL REVOLUTIONISE THE ALUMINUM INDUSTRY

Small additions of scandium can give aluminum a strength approaching **titanium and steel alloys**, without the weight

“Addition of scandium to aluminium gives the **highest increase in strength (per atomic percent) of all alloying elements**”

– K. Venkateswarlu, et al, High Strength Aluminum Alloys with Emphasis on Scandium Addition, 2008

Scandium Impact on Aluminum Yield Strength (Mpa)



Source: Hydro Aluminium R&D Sunndal, 2012

Scandium – a case study

Airbus Group's Lightrider: the world's first 3D printed electric bike

Aluminum-scandium frame makes it lighter and stronger

The bike weighs 35kg, contains a 6kWh battery, has a top speed of 80km/h and a range of 60km

The most effective way to increase an EV's range and performance is to make it stronger and lighter



Syerston is uniquely positioned to benefit from and support the two key imperatives facing the global transport industry: **electrification and light weighting**



NEXT STEPS

PROJECT IS DEVELOPMENT READY

KEY PERMITTING COMPLETED



STUDIES

Prefeasibility Study completed, with Bankable Feasibility Study due for completion in Q4 2017



INFRASTRUCTURE

All key infrastructure is available, including road and rail access



EIS

Environmental Impact Statement completed and approved by Government



POWER & GAS

Power and gas are within close proximity to the Project



WATER

The Project has a 3.2GLpa water allocation granted by the NSW Government



PILOT PLANT

PILOT PLANT

EXTENSIVE PILOTING COMPLETED AND SAMPLES PRODUCED

Clean TeQ has a large scale pilot plant located in Perth, Western Australia to simulate the entire leaching and extraction process at scale

A pilot campaign in October 2016 to process 20 tonnes of Syerston ore will produce nickel and cobalt sulphate samples for customer sampling and testing

Scandium samples were produced and shipped in 2016

INVESTMENT TAKEAWAYS

Forty year
mine life

Exceptional
cobalt deposit
in OECD,
100%
auditable

Highly geared
to emerging
EV and ESS
growth

World's
largest and
highest grade
scandium
resource

Key
permitting in
place

RESERVES AND RESOURCES

COMPETENT PERSON CONSENTS

The information in this document that relates to nickel-cobalt Mineral Resources is based on information compiled by Diederik Speijers and John McDonald, who are Fellows of The Australasian Institute of Mining & Metallurgy and employees of McDonald Speijers. There was no clear division of responsibility within the McDonald Speijers team in terms of the information that was prepared – Diederik Speijers and John McDonald are jointly responsible for the preparation of the Mineral Resource Estimate. Diederik Speijers and John McDonald have sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity which they are undertaking to qualify as Competent Persons as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Diederik Speijers and John McDonald, who are consultants to the Company, consent to the inclusion in the report of the matters based on their information in the form and context in which it appears.

The information in this document that relates to scandium Mineral Resources is based on information compiled by Sharron Sylvester, who is a Member and Registered Professional of the Australian Institute of Geoscientists and is an employee of OreWin Pty Ltd. Sharron Sylvester has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity which she 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'. Sharron Sylvester, who is a consultant to the Company, consents to the inclusion in the report of the matters based on their information in the form and context in which it appears.

The information in this document that relates to Ore Reserves is based on information compiled by Michael Ryan, MAusIMM (109558), who is a full time employee of Preston Valley Grove Pty Ltd, trading as Inmett Projects. Michael Ryan has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration 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'. Michael Ryan, who is a consultant to the Company, consents to the inclusion in the report of the matters based on his information in the form and context in which it appears. Michael Ryan holds options in Clean TeQ Holdings Limited, the ultimate parent entity of Scandium21 Pty Ltd, the owner of the Project.

For further details on the content of this presentation, please refer to the ASX releases on the Company's website.

CONTACT



Robert Friedland
Co-Chairman



Clean TeQ Holdings Limited
12/21 Howleys Road
Notting Hill VIC 3168
AUSTRALIA

www.cleanteq.com