

25 February 2020

## Investor Presentations

**MELBOURNE, Australia** – Clean TeQ Holdings Limited (**Clean TeQ** or **Company**) (ASX/TSX:CLQ; OTCQX:CTEQF) is pleased to advise that Managing Director and CEO Mr Sam Riggall will be presenting at the BMO Capital Markets 29th Annual Global Metals & Mining Conference in Florida and hosting a number of investor meetings in North America during 25-26 February. Mr Riggall's presentation materials are attached.

### For more information, please contact:

Ben Stockdale, CFO and Investor Relations (Australia)

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This announcement is authorised for release to the market by the Board of Directors of Clean TeQ Holdings Limited.

**About Clean TeQ Holdings Limited (ASX/TSX: CLQ)** – Based in Melbourne, Australia, Clean TeQ is a global leader in metals recovery and industrial water treatment through the application of its proprietary Clean-iX® continuous ion exchange technology. For more information about Clean TeQ please visit the Company's website [www.cleanteq.com](http://www.cleanteq.com).

**About the Clean TeQ Sunrise Project** – Clean TeQ is the 100% owner of the Clean TeQ Sunrise Project, located in New South Wales. Clean TeQ Sunrise is one of the largest cobalt deposits outside of Africa, and one of the largest and highest-grade accumulations of scandium ever discovered.

**About Clean TeQ Water** – Through its wholly owned subsidiary Clean TeQ Water, Clean TeQ is also providing innovative wastewater treatment solutions for removing hardness, desalination, nutrient removal, zero liquid discharge. The sectors of focus include municipal wastewater, surface water, industrial waste water and mining waste water. For more information about Clean TeQ Water please visit [www.cleanteqwater.com](http://www.cleanteqwater.com).

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## Sunrise Battery Materials Complex

**Building a sustainable  
supply chain for electric  
vehicles**

**BMO Metals & Mining Conference**

February 2020



# Cautionary statement



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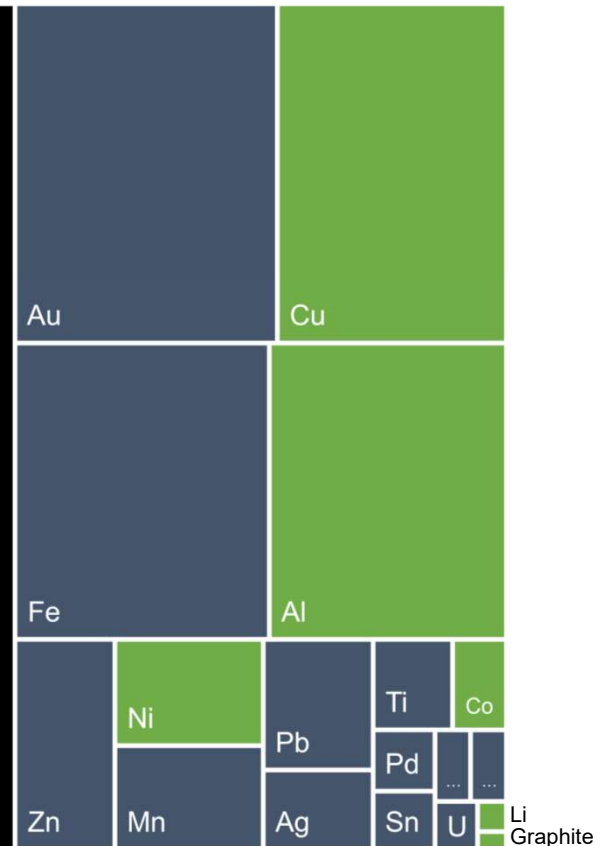
Streamlined Life Cycle Analysis by Energetics, Feb 2020. The GHG emission intensities of alternative processing routes are based on literature data that cannot be effectively harmonized. For comparison purposes the only harmonization that has occurred has been on end product (NiSO<sub>4</sub>) and using economic allocation to end products. Any comparison against Sunrise should be considered indicative only.

# Decarbonisation – the industrial challenge of this century

Metals are the new oil – for electrical generation, storage, distribution and light-weighting

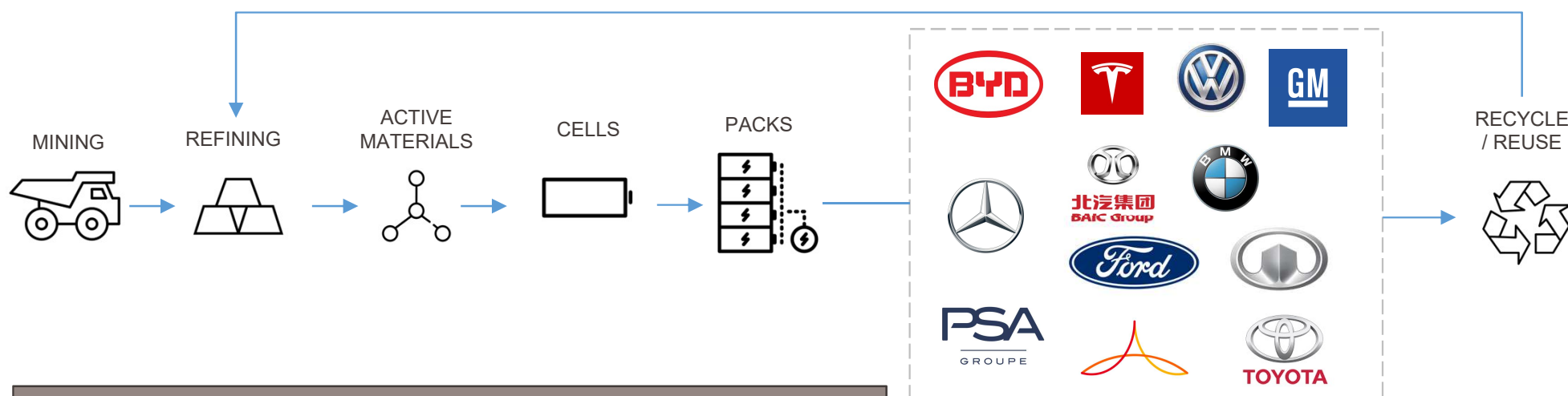
To scale - area represents global market value of the commodity

Oil



# Reinventing the supply chain

Raw materials are the most vulnerable part of the EV supply chain



## Supply Chain Foundations

### 1. Secure

- Geology
- Geography

### 2. Low cost

- Chemistry
- Metal prices

### 3. Sustainable

- Brand / reputation
- Life cycle assessment

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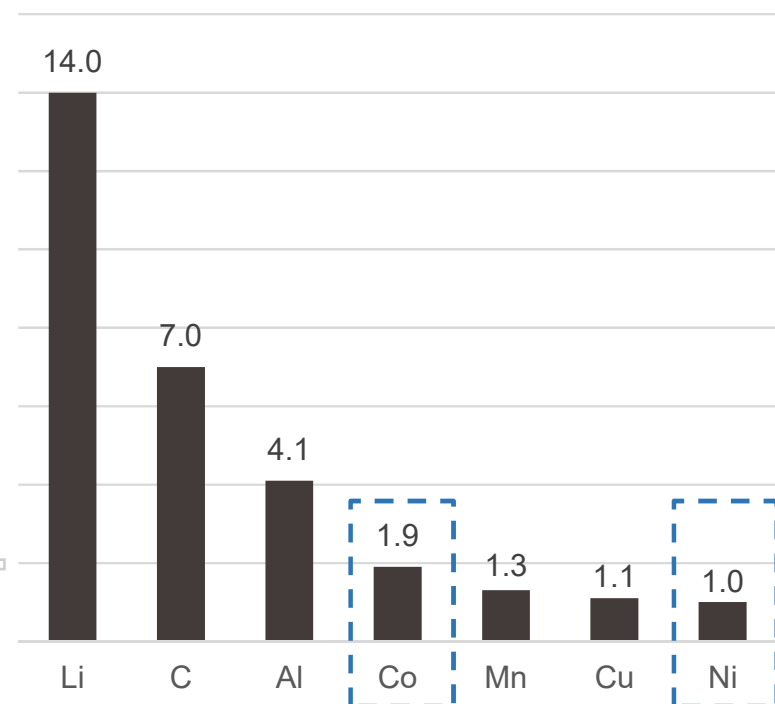
- Brand / reputation
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# Ore reserves and production rates

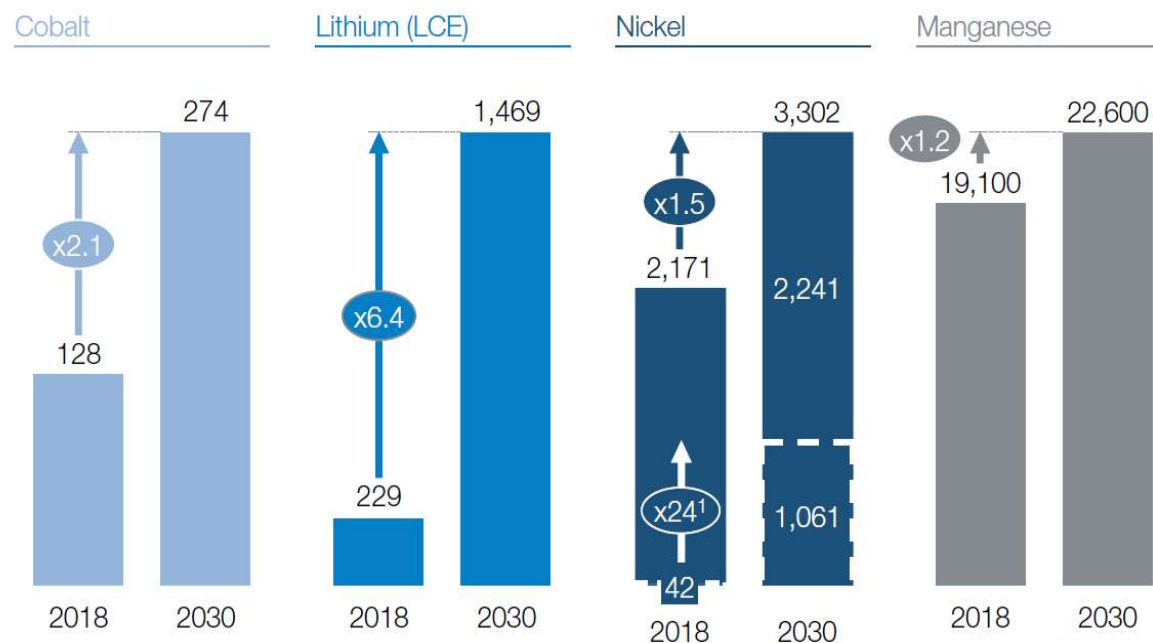
Metal markets area function of geological scarcity and demand

Implied 30-Year Reserve Life as Multiple of Current Production



Source: USGS; Bernstein

Raw material demand in kilo tonnes per annum, base case



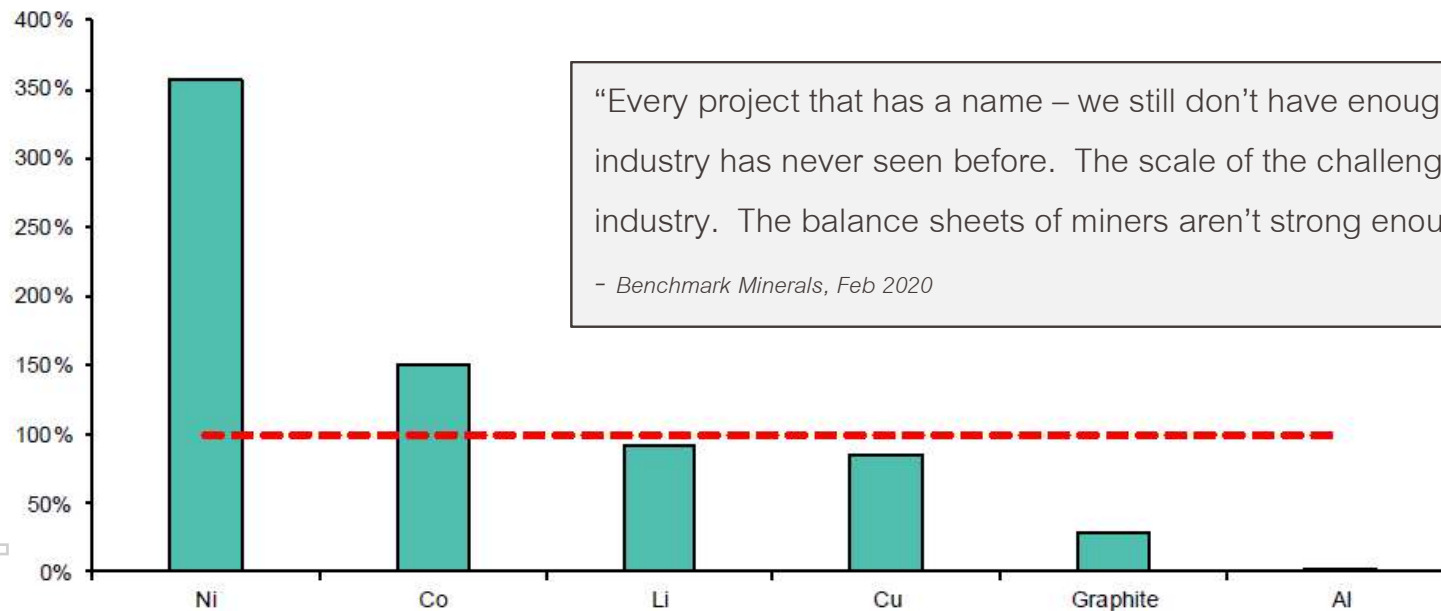
Source: Global Battery Alliance, WEF; McKinsey analysis

¹ Demand for class 1 nickel for batteries

# Reserve depletion rates

Projected EV stock by 2050 will have a huge impact on ore reserve depletion rates

EV Raw Material Bottleneck - % of Available Global Reserves Required to Deliver EV Stock by 2050



“Every project that has a name – we still don’t have enough. These are growth rates the mining industry has never seen before. The scale of the challenge hasn’t really set in for people in the industry. The balance sheets of miners aren’t strong enough to support this level of growth.”

- Benchmark Minerals, Feb 2020

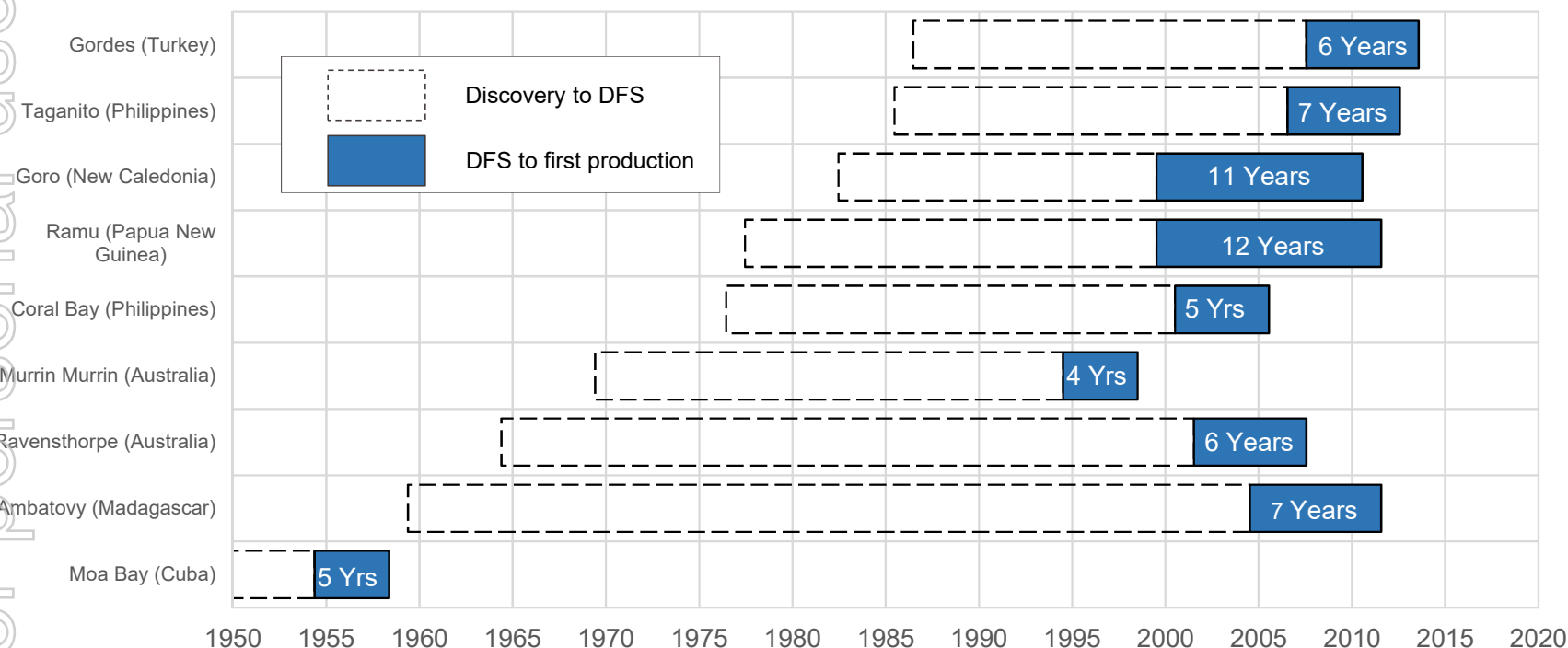
Source: USGS, SNL Financial, CRU, Wood Mackenzie, and Bernstein estimates (2050) and analysis



# Development timeframes

Building new nickel / cobalt capacity takes time

Development Time for Existing PAL Operations



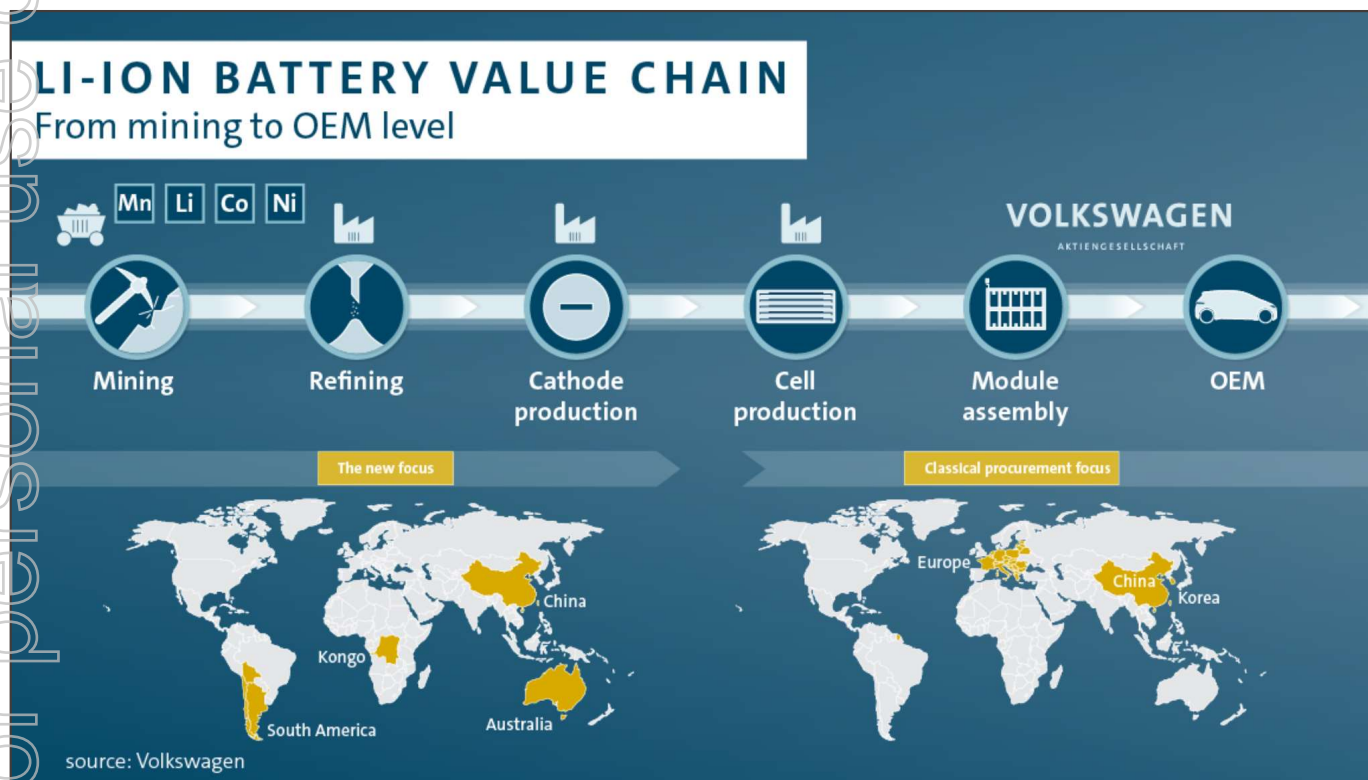
“These are markets that really need consistent investment – mines don’t build themselves. You can’t turn on that supply in 1 to 2 years. The price levels we’re seeing now aren’t enough to incentivise that.”

– Benchmark Minerals, Feb 2020

Source: SNL and public data

# Battery materials are geographically concentrated

Concentration increases supply risk



## Cobalt

Mine supply	DRC	72%
Refined Production	China	65%

## Nickel

Mine supply	Indo/Phil	39%
	Russia	12%
Refined Production	China	29%
	Russia	23%

## Lithium

Mine supply	Australia	62%
	Chile	18%
Refined Production	China	54%
	Chile	37%

Source: USGS and internal analysis. Refined production refers to cobalt chemical production, Class 1 nickel and Li<sub>2</sub>CO<sub>3</sub> and LiOH production.

## Supply Chain Foundations

### 1. Secure

- Geology
- Geography

### 2. Low cost

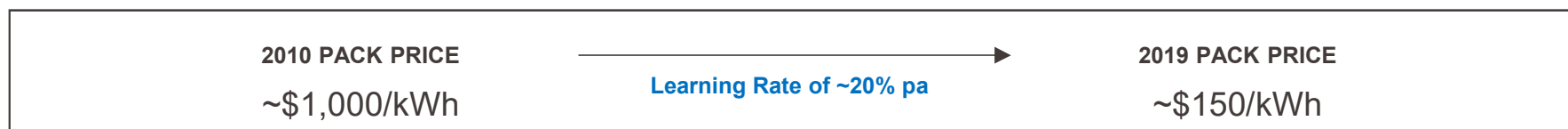
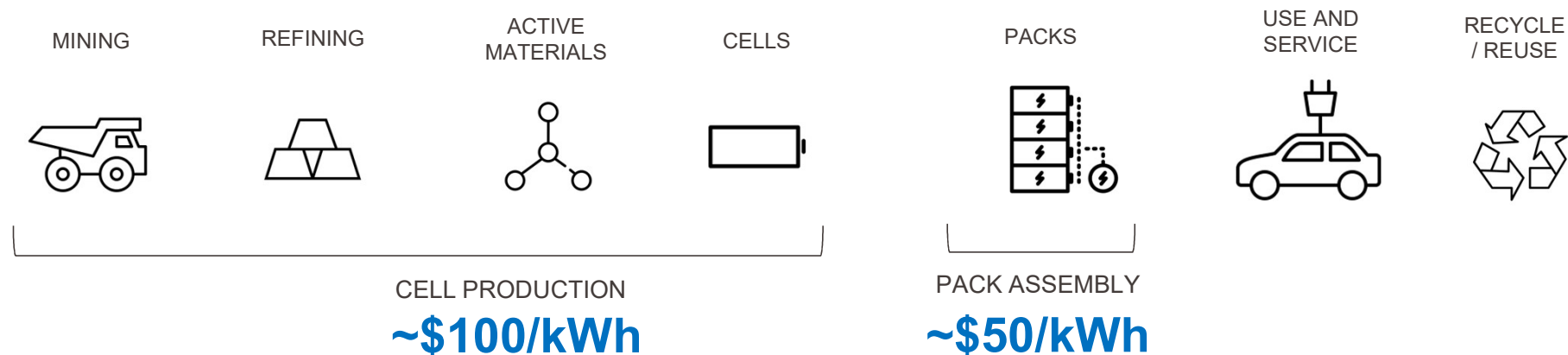
- Chemistry
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# Battery pack costs are declining rapidly...

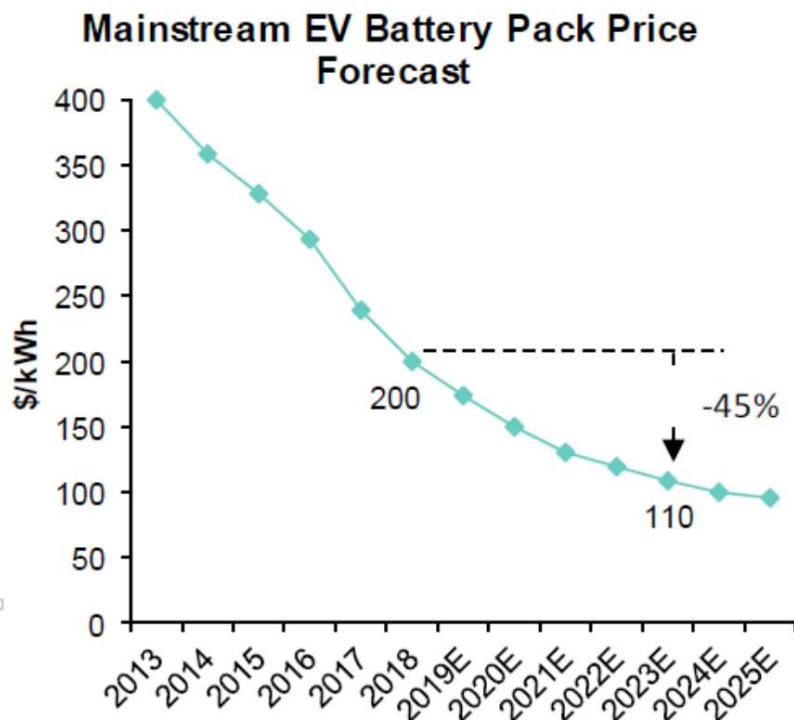
Cost parity with ICEs is approaching fast



Source: Internal company analysis validated against various studies (GREET; ANL BatPac Model; Avicenne; BNEF; Bernstein). Note: \$/kWh figures are calculated at pack level, not cell level and are not inclusive of corporate overheads, R&D expenses and margins.

... but the benefits from economies of scale will diminish

Forecasting ICE-parity by middle of this decade



Source: SNE Research, and Bernstein estimates and analysis (Global Energy Storage & Electric Vehicles team)

The largest contributing factors to battery pack unit cost reductions have been:

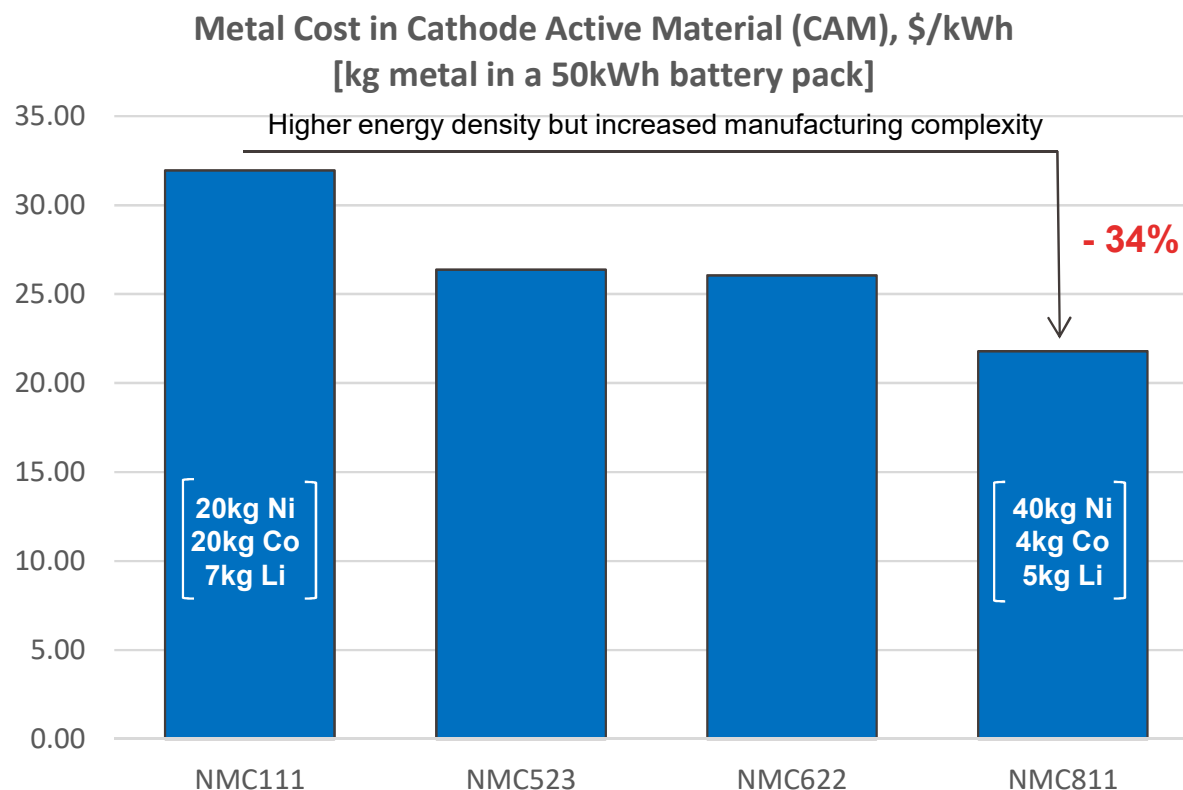
- Economies of scale in production
- Increased energy density (chemistry)

Economies of scale will taper over coming years

Chemistry and materials science remain large areas of improvement

# Cathode chemistry has trade-offs

## Cobalt thrifting – a case study in shifting risk



Benefits in chemistry, however, come with other trade-offs:

- Life cycle and safety
- Higher cost production materials and processes

By thrifting cobalt (NMC111 to NMC811) you shift pricing risk to nickel

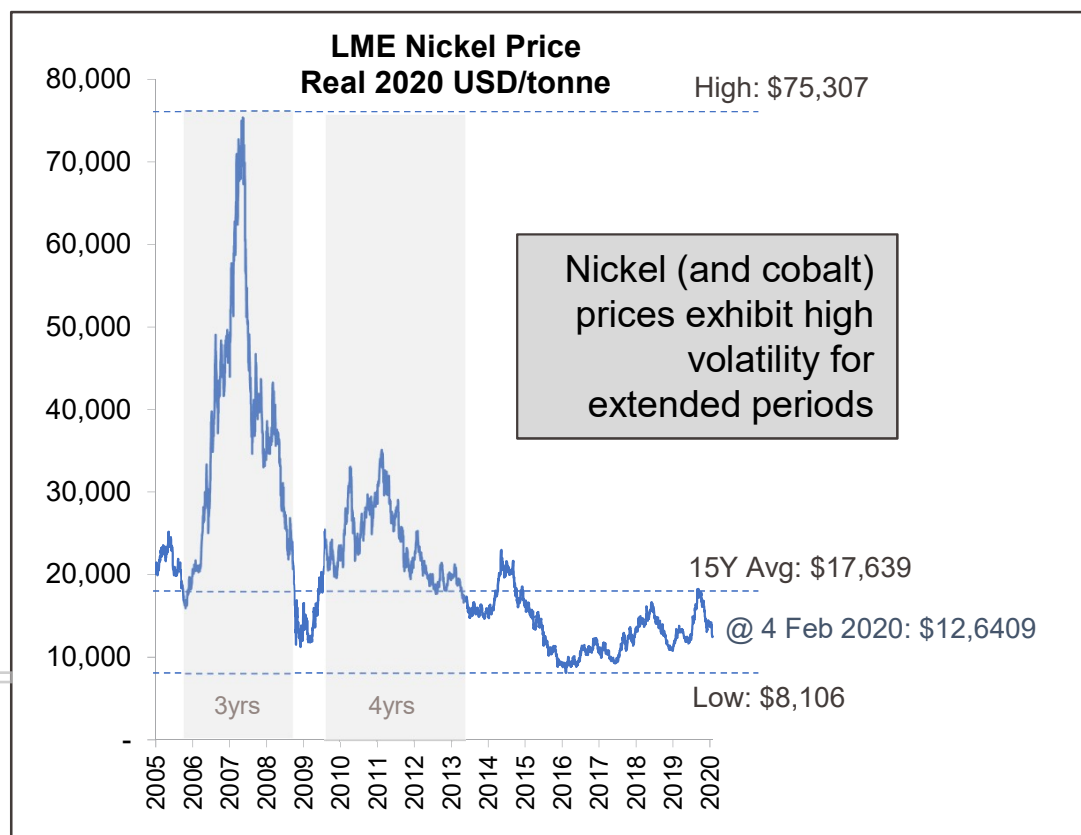
In both NMC111 and NMC811, nickel and cobalt make up **75%** of total metal cost in active material (thrifting does no more than shift risk between metals)

Note: Excludes manganese, which is immaterial for the analysis. Assumes long-term market consensus metal prices as at 6 Feb 2020.



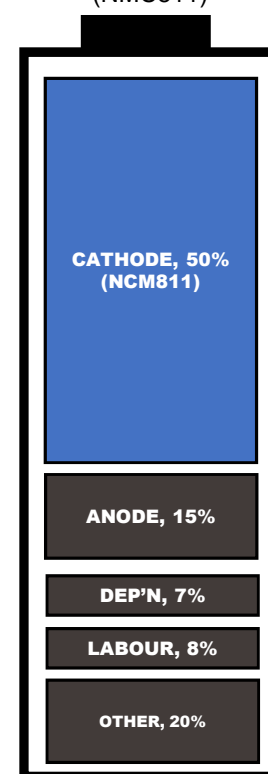
# Metal price volatility - a significant risk

Unless OEMs manage metal price volatility, cost competitiveness is rapidly eroded



Source: LME. Cell cost breakdowns based on internal company analysis.

Cell Cost Breakdown (\$/kWh)  
(NMC811)



Price Scenarios	Cost of Ni + Co
<b>1. Spot</b> (\$15k/t Ni, \$39k/t Co)	\$13.00 / kWh
<b>2. Consensus</b> (\$18.5k/t Ni, \$50k/t Co)	\$16.30 / kWh (+25%)
<b>3. High Ni</b> (\$30k/t Ni, \$50k/t Co)	\$24.00 / kWh (+85%)
<b>4. High Ni &amp; Co</b> (\$30k/t Ni, \$77k/t Co)	\$26.20 / kWh (+102%)

**For an OEM producing 1 million EVs per annum with a 50kWh battery pack, Ni / Co price volatility erodes up to \$660M pa of value between scenarios 1 and 4**

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# New supply chains create brand and reputation risk

Moral hazard: should these risks be contracted out to third party agents?



## Brand, Reputation & ESG

Child labour and slavery

Water depletion or contamination

Carbon footprint

Submarine tailings disposal

Deforestation

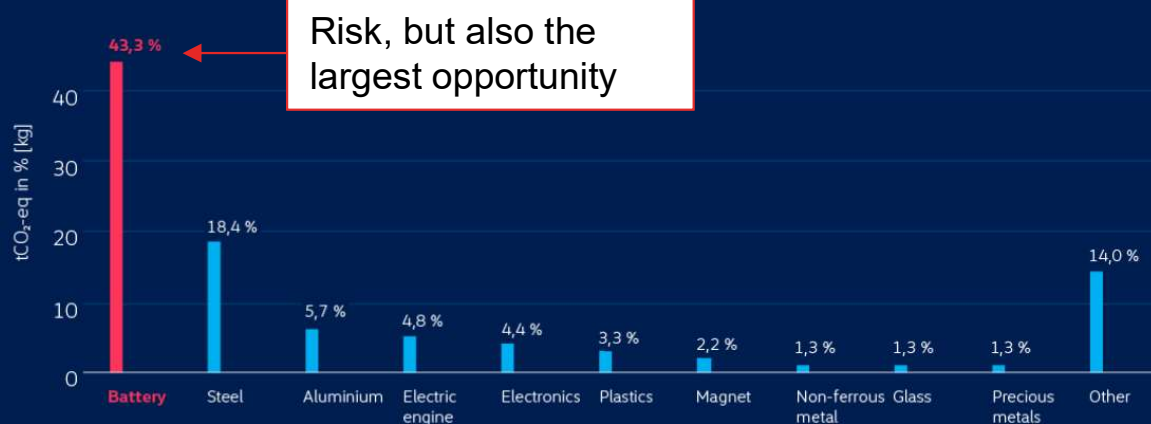
Extra-territorial law suits

# Carbon – a life cycle analysis of CO2 intensity

EVs must be designed around the battery if they are to deliver benefits to society

## Hot spots in the production process of the Volkswagen ID.3

The battery causes over 40 percent of CO<sub>2</sub> emissions



Source Volkswagen (preliminary calculation)

Source: Volkswagen

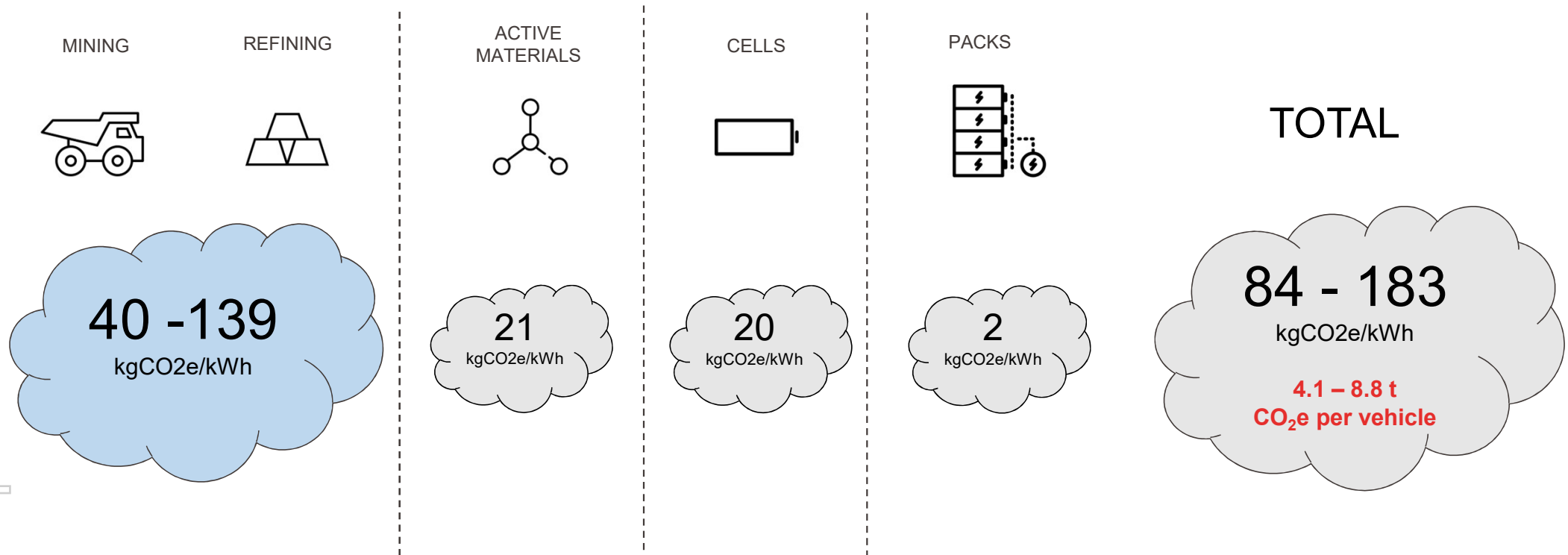
Raw materials (mining and processing) in the battery leave the biggest CO<sub>2</sub> footprint on the supply chain

OEMs need measurable carbon data to benchmark performance

**Nickel and cobalt are the major contributors to an EV's carbon footprint**, which varies widely depending on the source of metal and the processing route

# Nickel and cobalt – why they are so important

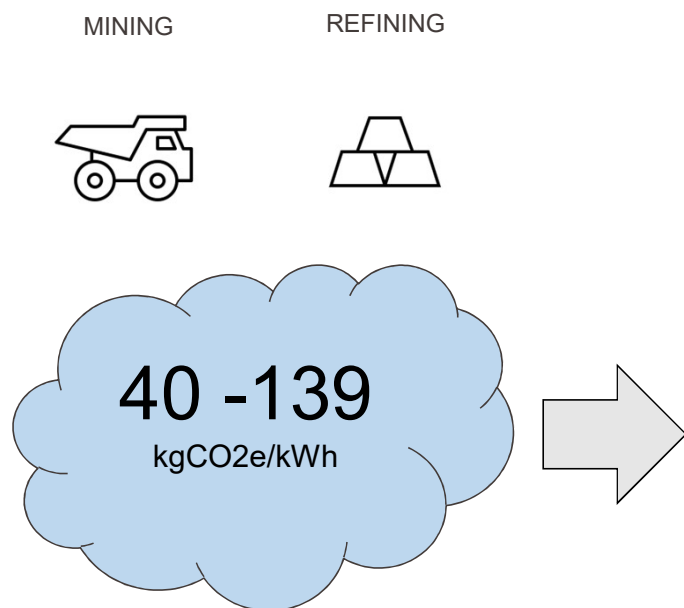
The carbon footprint of the battery pack is determined by mining/refining process routes....



Source: Energetics report and internal company analysis (GREET; ANL BatPac Model; Avicenne; Bernstein), modified to reflect the kg CO<sub>2</sub>e per kWh of pack capacity utilizing NMC 811 cathode chemistry. Mining and Refining, assumes nickel and cobalt is refined through to nickel and cobalt sulfate for conversion to precursor. Electrical energy mix assumes FeNi and NPI production is in China, HPAL in Indonesia (using black coal) and NiS is in Australia. Note that the technology for conversion of FeNi or NPI to battery-grade sulfate has not been proven at industrial scale, may not be economically viable and may add further GHG emissions which have not been accounted for in this study. Total CO<sub>2</sub>e production per vehicle assumes a 50kWh battery pack.

# Strategic procurement matters

... where nickel and cobalt make up between one-quarter and two-thirds of total pack emissions



Process and feedstock	kg CO <sub>2</sub> e / kWh for Ni+Co	Ni+Co as % of total pack emissions
Nickel Sulfide Pyromet	20	25%
High Pressure Acid Leach (HPAL)	34	35%
Ferronickel (RKEF)	89	59%
Nickel Pig Iron (BF)	50	44%
Nickel Pig Iron (EAF)	119	65%
<b>Clean TeQ Sunrise (renewables)</b>	<b>19</b>	<b>23%</b>
<b>Clean TeQ Sunrise (grid)</b>	<b>26</b>	<b>29%</b>

Source: See note on previous page. Sunrise range based on 100% renewable power supply versus Australian grid energy mix. Note that while a theoretical process was developed and evaluated to convert FeNi and NPI to battery grade sulfate, an industrial scale process has yet to be proven.





## Sunrise Integrated Battery Complex

A template for industry-leading emissions and cost performance across the cathode supply chain



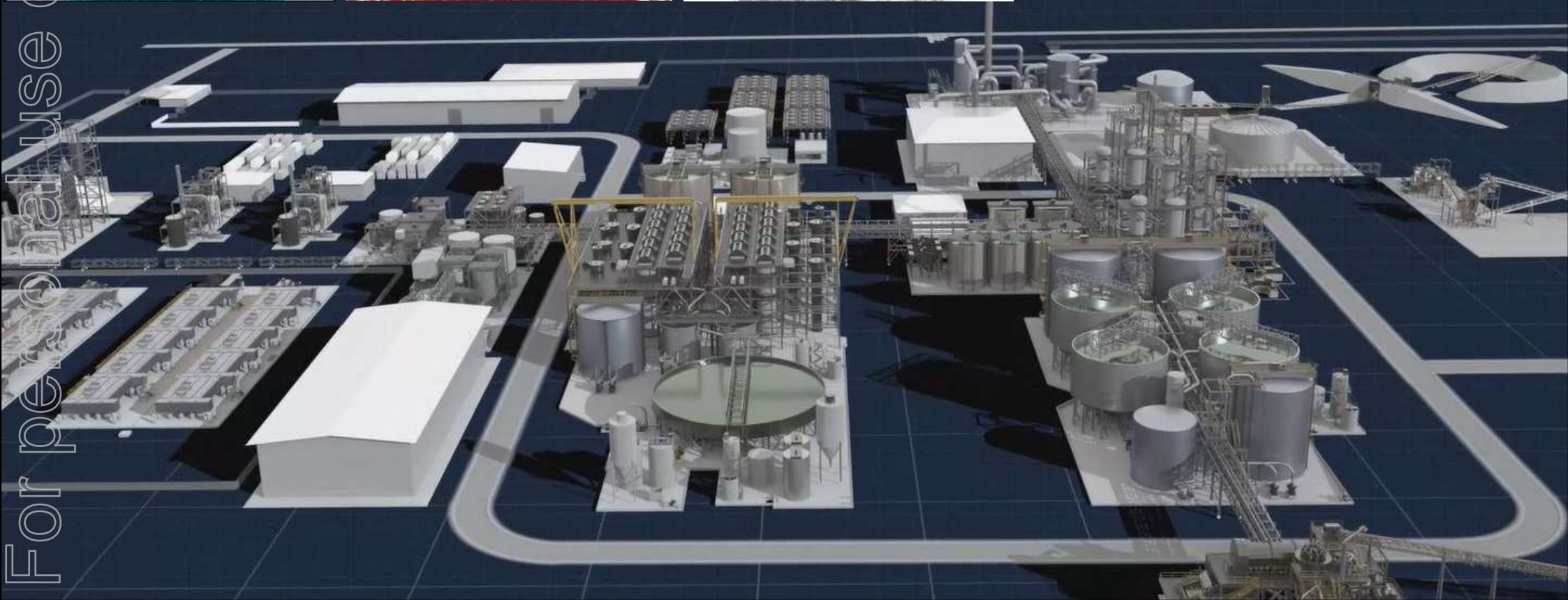
Large, low cost, long-life (and in Australia)

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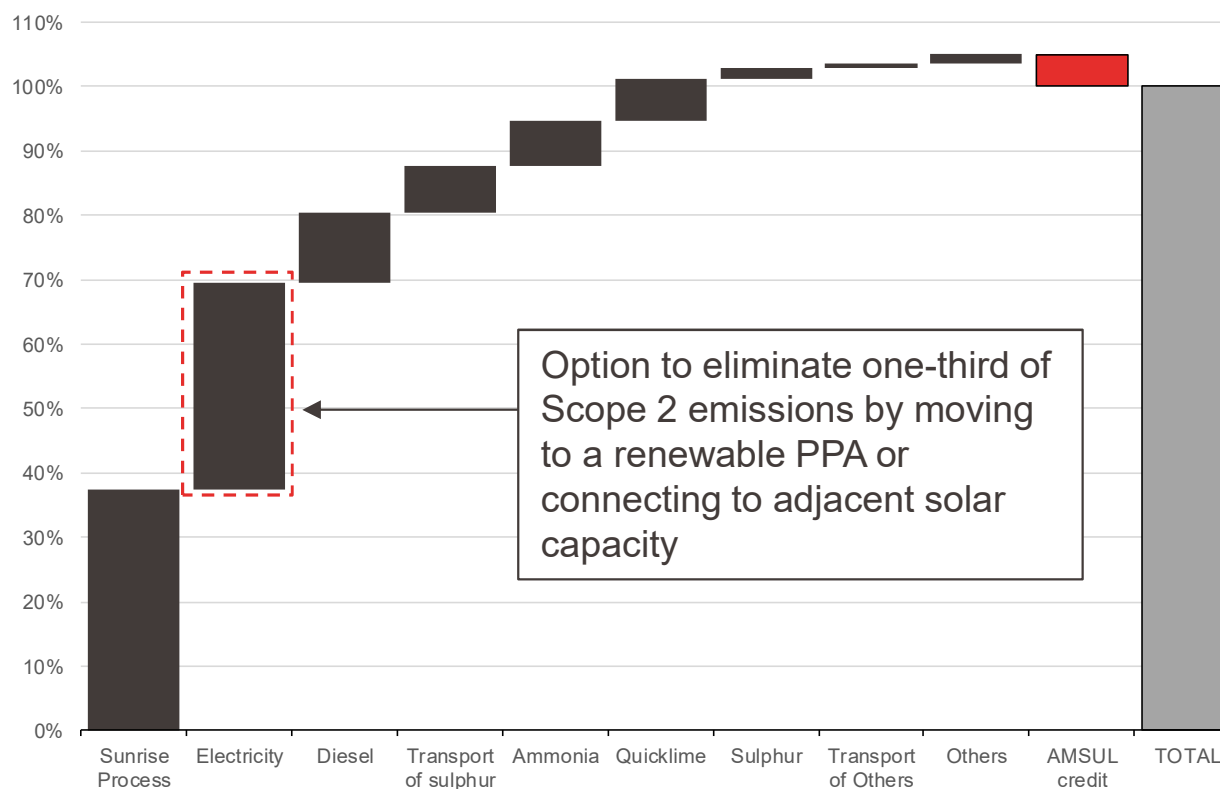


The focus is battery chemicals (metal salts and beyond)



# Sunrise – a breakdown of CO2e hotspots

Integrating renewable power at Sunrise reduces carbon by circa 30%

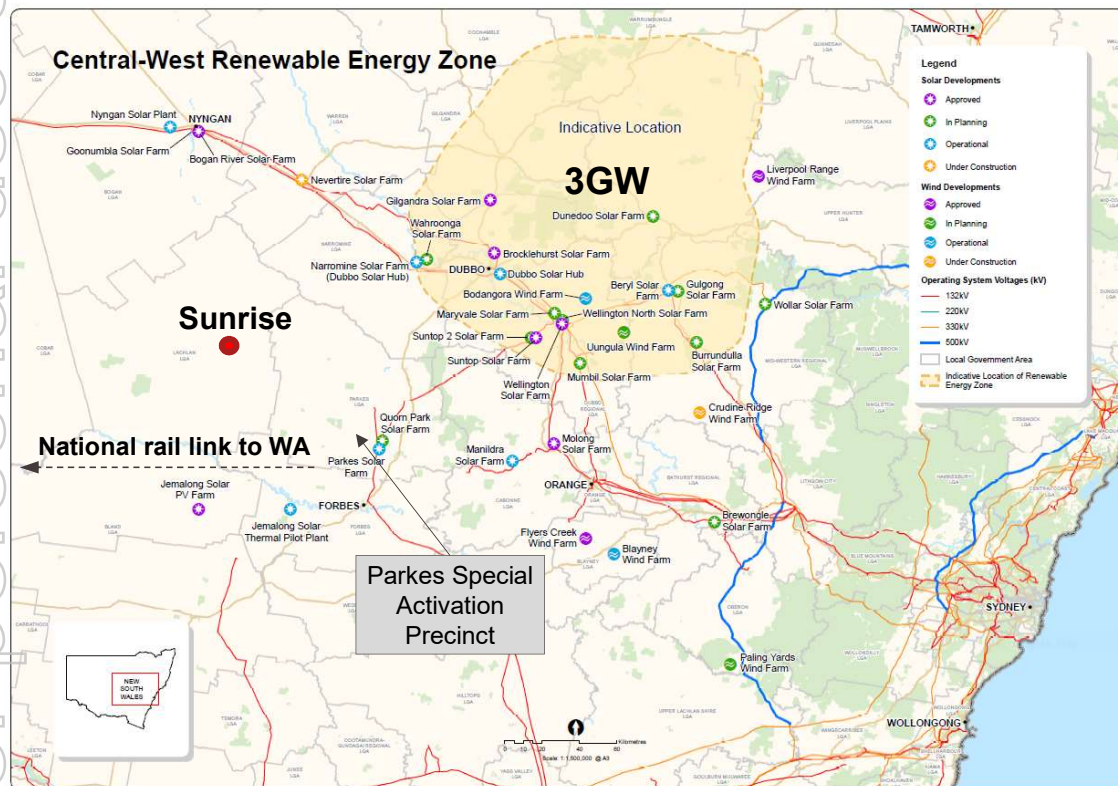


Source: Life Cycle Analysis by Energetics, February 2020.

Indicator	Unit	Value
<b>Sunrise (Imported Power)</b>		
Per kg Ni metal produced	kg CO2 e/kg	17.2
Per kg Co metal produced	kg CO2 e/kg	45.4
Per kg Sc metal produced	kg CO2 e/kg	2,107
<b>Sunrise (Renewable Power)</b>		
Per kg Ni metal produced	kg CO2 e/kg	10.8
Per kg Co metal produced	kg CO2 e/kg	28.4
Per kg Sc metal produced	kg CO2 e/kg	1,318

# The vision for Sunrise and Central NSW

Integrated precursor / cathode production, renewable generation and recycling



**Renewable Power:** The Central-West Renewable Energy Zone (REZ) will add 3GW of new solar generation capacity to Sunrise's doorstep

**Linking Li – Ni - Co:** The east-west national rail corridor connects at Parkes, linking Sunrise to the world's largest sources of lithium production

**Active material production:** significant cost savings can be generated by co-locating Ni/Co sulfate and precursor/cathode production

**Closed recycling loop:** Surplus autoclave and refining capacity allows cost-effective recycling of used cathode to recover metals (Parkes Special Activation Precinct is a dedicated industrial zone incorporating recycling/re-use facilities powered by waste-to-energy).



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**CLEAN  
TEQ**  
Powering innovation





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## **A focus on nickel in electric vehicle batteries**

**Understanding cost and the carbon footprint**

**BMO Metals & Mining, February 2020**  
**Sam Riggall, CEO**



**TSX CLQ**

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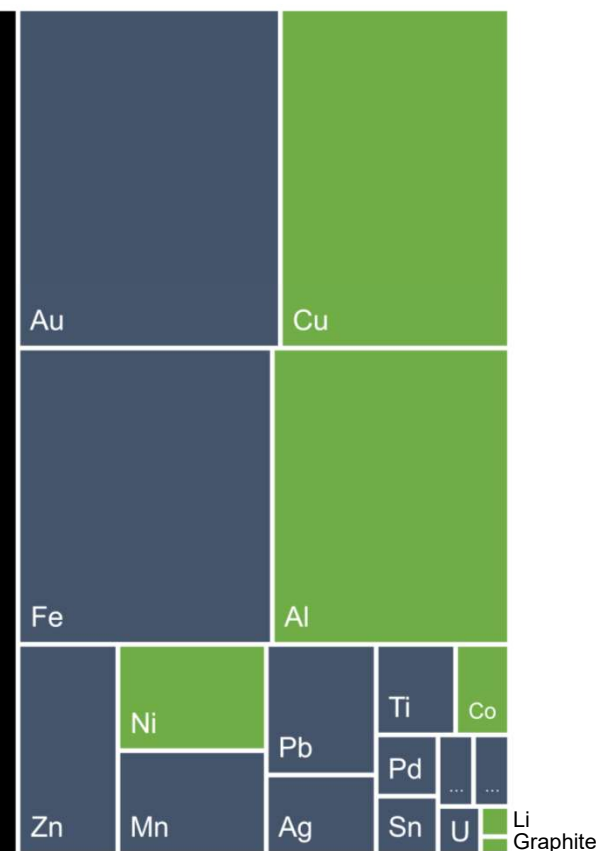
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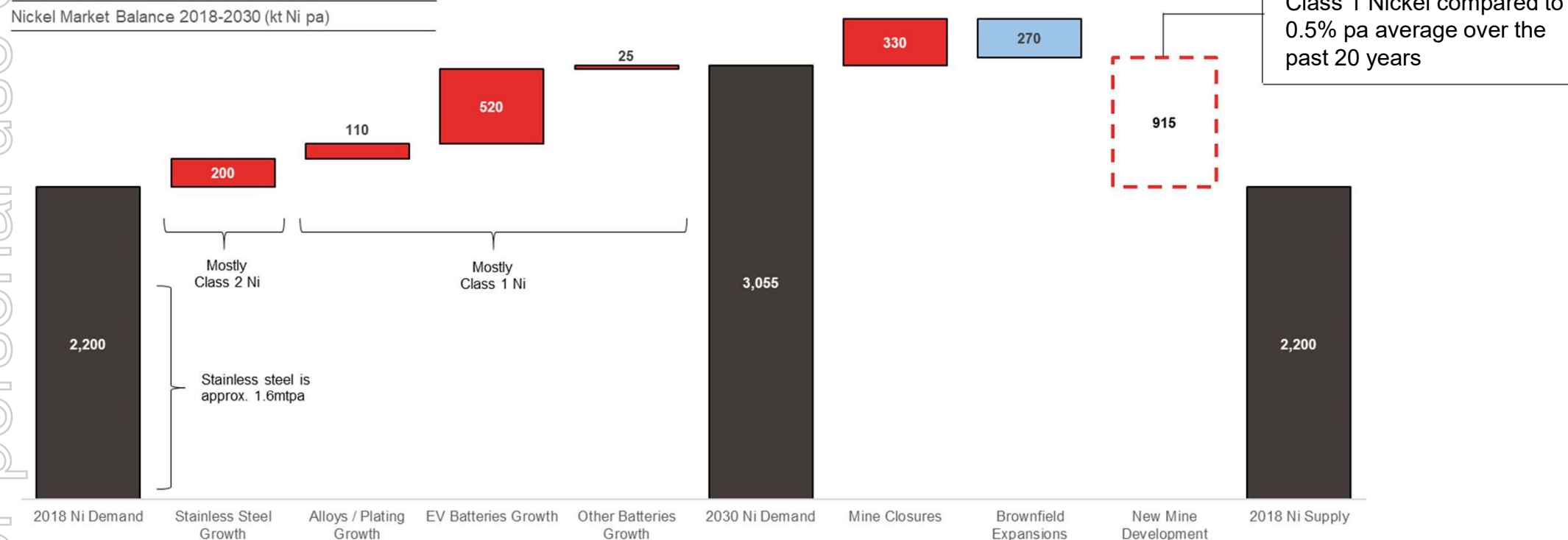
Oil



# Nickel - mind the gap

Where will battery-grade nickel come from?

Nickel Market Balance 2018-2030 (kt Ni pa)



Source: Internal analysis assuming 1.5% pa global passenger vehicle growth and a 15% EV penetration rate by 2030. Battery chemistry demand by 2030 is 90% split between NCM622 / NCM811 / NCA and 10% LFP. Average battery pack size is 50kWh. Stainless growth is 1% per year, Alloys / Plating growth is 1.5% per year. Mine closure and expansion data from Wood Mackenzie nickel market forecasts, September 2019. Forecast for PAL investment assumes industry standard capital intensity for 520ktpa of incremental LME Class 1 growth from laterite ore.



# Nickel - ore styles and ore genesis

The economics of laterite and sulfide development rely on very different considerations, but....

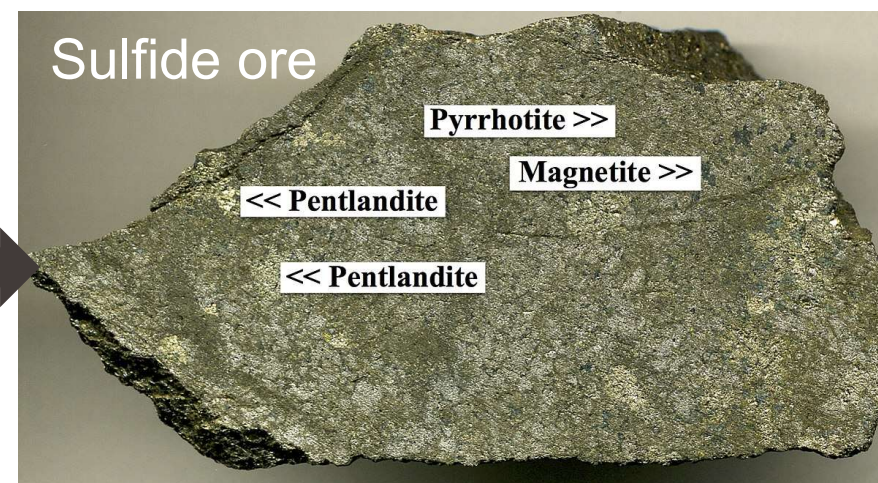


**Pyromet (RKEF):**  
FeNi, NPI



**Hydromet (PAL):**  
MSP, MHP, sulfate eluate

Grade
Acid
By-products
Energy
Cost
<u>Scarcity</u>

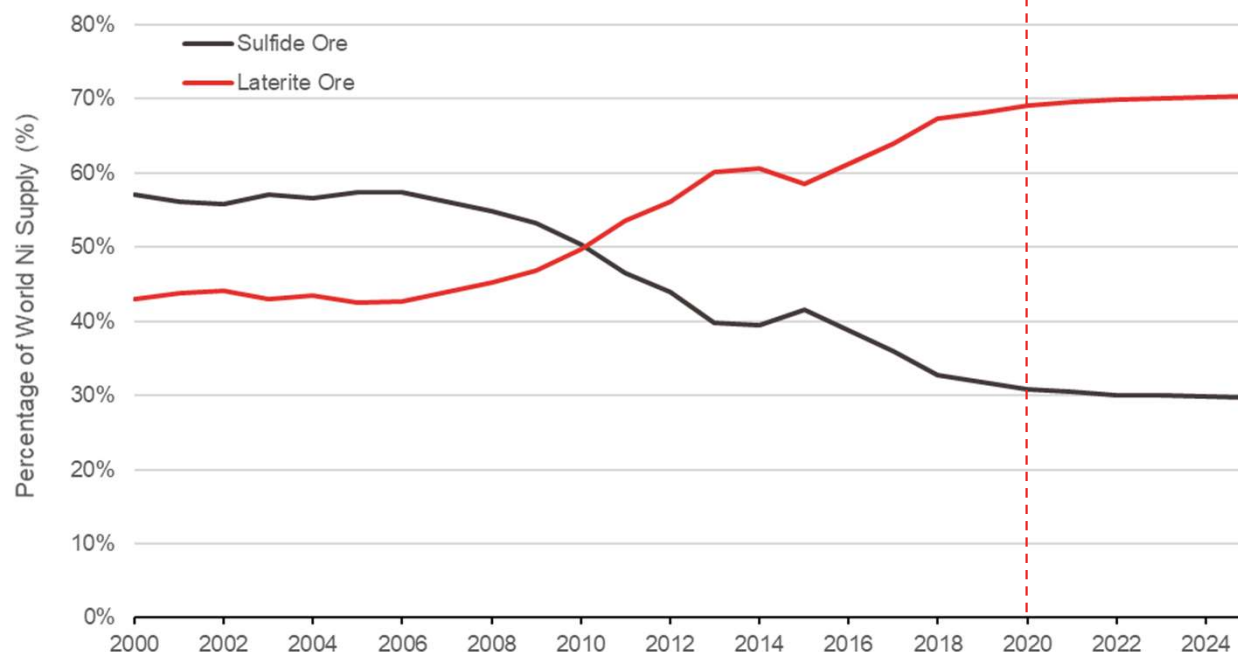


**Pyromet (smelt+refine):**  
Matte, LME metal (powder, briquette, cathode, etc)

# Good nickel sulfide resources are geologically scarce

...laterites will need to do most of the heavy lifting to meet stainless and EV demand

**Nickel Sulfide vs Laterite Production Split  
2000 to 2025**



Source: CRU Nickel & Cobalt Market Study, October 2018

- The world is increasingly dependent on nickel laterite ores
- Nickel sulfide resources are geologically scarce and insufficient to support forecast EV growth
- Pyrometallurgical processing of laterite ore will service stainless steel markets (NPI / FeNi)
- Hydrometallurgical processing of laterite ore (pressure acid leach, or PAL) will service battery markets



# Feedstocks – many routes to nickel (and cobalt) sulfate

Cost and complexity are a function of impurity loads in the feedstock



Nickel Pig Iron  
(Class 2)  
8 - 16% Ni



FerroNickel  
(Class 2)  
20 - 25% Ni



MHP  
(Intermediate)  
~40% Ni / 1.5% Co



MSP  
(Intermediate)  
~60% Ni / 4.0% Co



Matte  
(Intermediate)  
~75% Ni / 1.5% Co



Sunrise Eluate  
(Intermediate)  
70% Ni / 18% Co



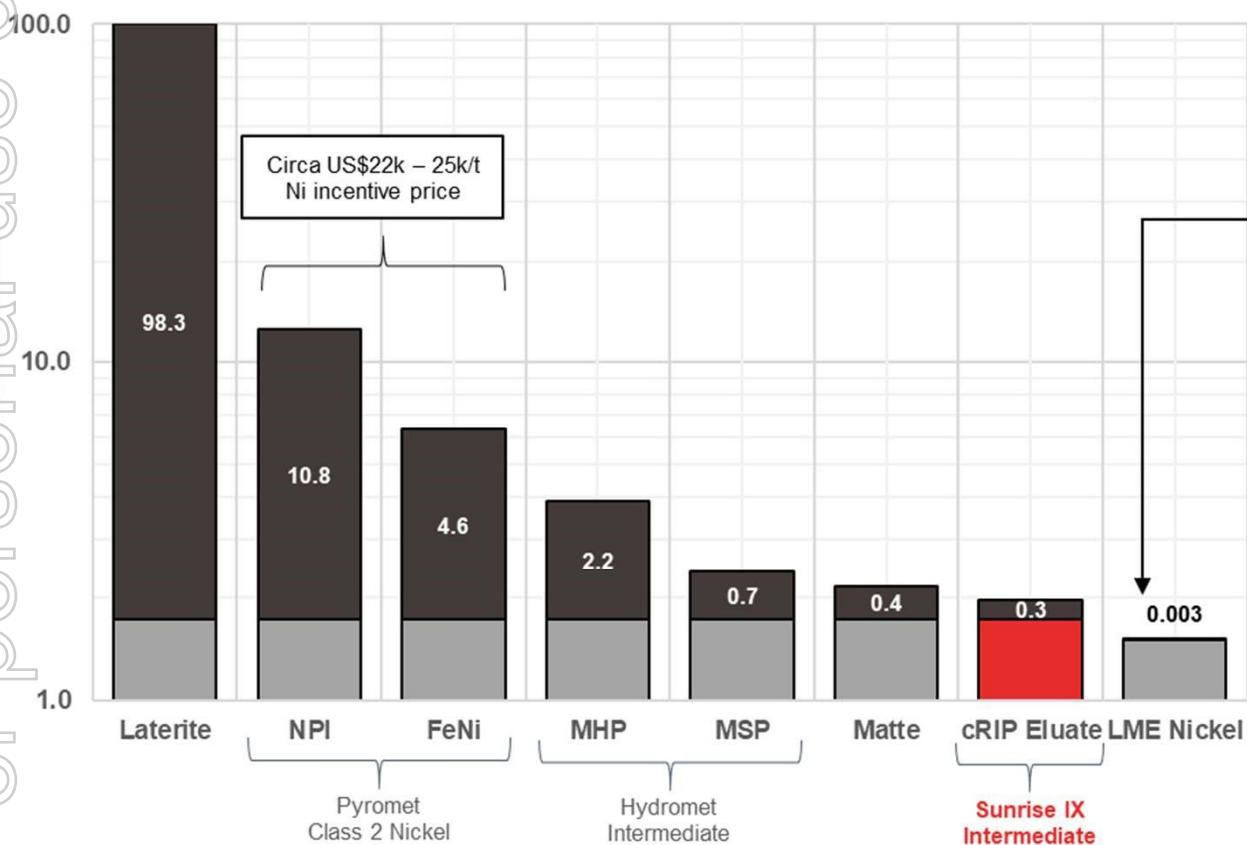
LME Ni  
(Class 1)  
99.8% Ni



Sunrise NiSO<sub>4</sub>·6H<sub>2</sub>O  
(LiB High Purity)  
99.94% Ni

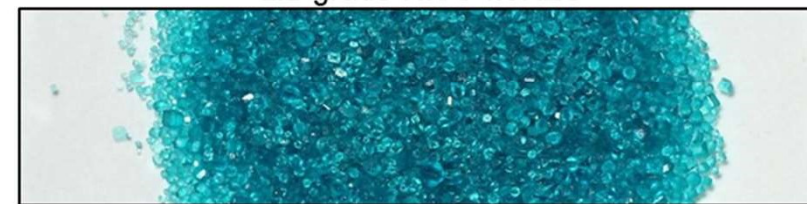
# Can FeNi and NPI plug the gap?

Impurities increase conversion costs to nickel / cobalt sulfate



1.5 tonne of LME-grade nickel contains ~3.0kg of impurities, of which ~2.1kg needs to be removed to produce battery-grade nickel sulfate

LiB grade  $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$



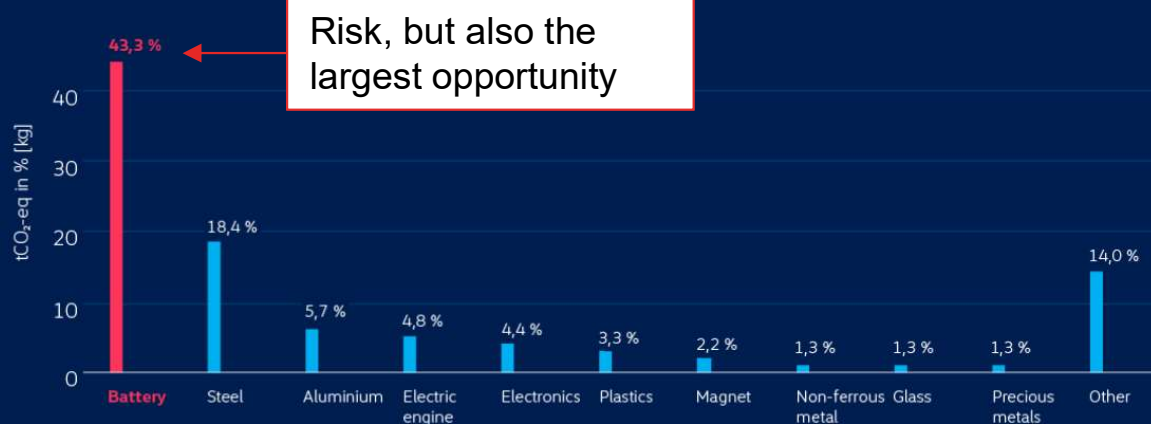
Assumes laterite grading 1.5% Ni and 0.075% Co. Nickel equivalent grade calculated using a US\$7.5/lb Ni price and a US\$22.5/lb Co price. cRIP eluate impurities include all compounds other than payable nickel, cobalt and sulphate mass. LME Nickel and LiB grade  $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$  use nickel grade only, not nickel equivalent (hence a reduction in payable metal).

# Carbon – a life cycle analysis of CO2 intensity

EVs must be designed around the battery if they are to deliver benefits to society

## Hot spots in the production process of the Volkswagen ID.3

The battery causes over 40 percent of CO<sub>2</sub> emissions



Source Volkswagen (preliminary calculation)

Source: Volkswagen

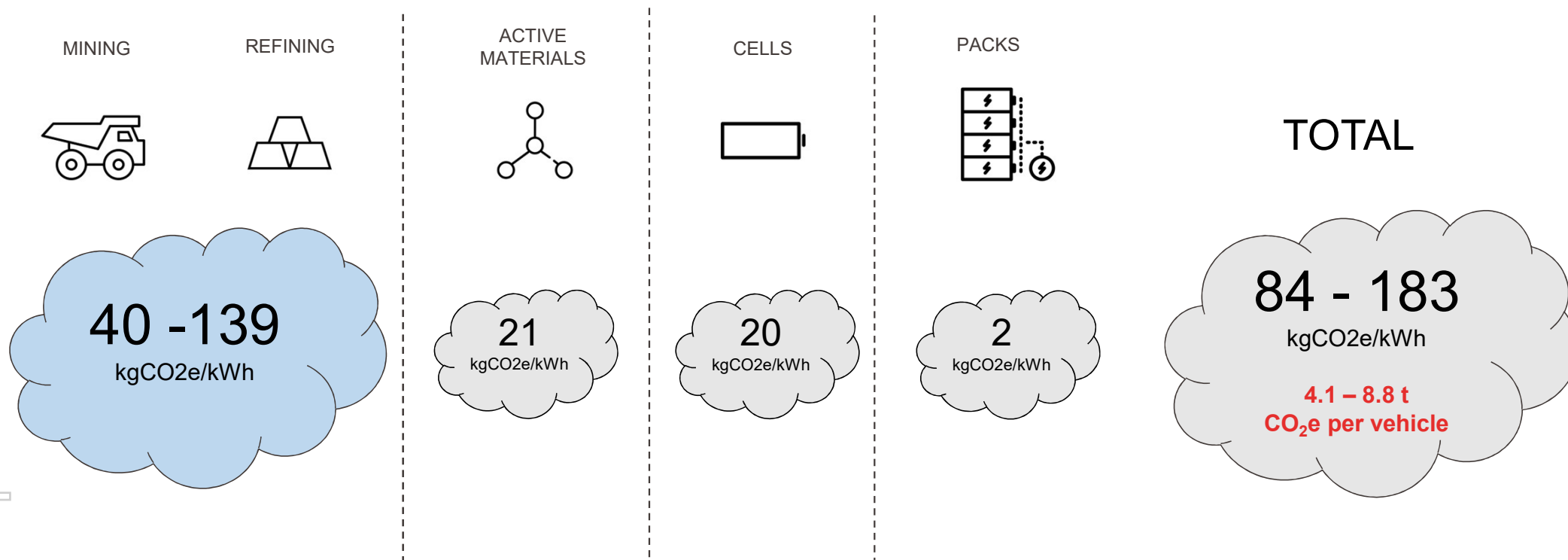
Raw materials (mining and processing) in the battery leave the biggest CO<sub>2</sub> footprint on the supply chain

OEMs need measurable carbon data to benchmark performance

**Nickel and cobalt are the major contributors to an EV's carbon footprint**, which varies widely depending on the source of metal and the processing route

# Carbon accounting for the battery supply chain

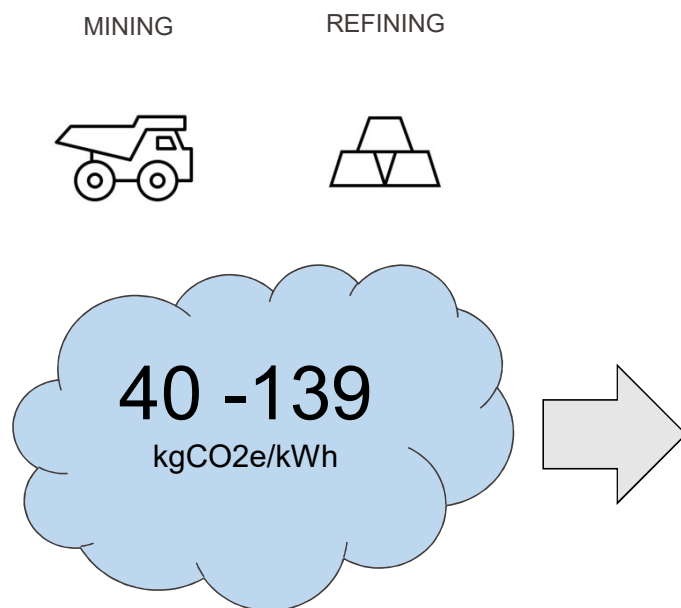
The carbon footprint of the battery pack is determined largely by mining/refining process routes....



Source: Energetics report and internal company analysis (GREET; ANL BatPac Model; Avicenne; Bernstein), modified to reflect the kg CO2e per kWh of pack capacity utilizing NMC 811 cathode chemistry. Mining and Refining, assumes nickel and cobalt is refined through to nickel and cobalt sulfate for conversion to precursor. Electrical energy mix assumes FeNi and NPI production is in China, HPAL in Indonesia (using black coal) and NiS is in Australia. Note that the technology for conversion of FeNi or NPI to battery-grade sulfate has not been proven at industrial scale, may not be economically viable and may add further GHG emissions which have not been accounted for in this study.

# Importance of nickel and cobalt

... where nickel and cobalt make up between one-quarter and two-thirds of total pack emissions

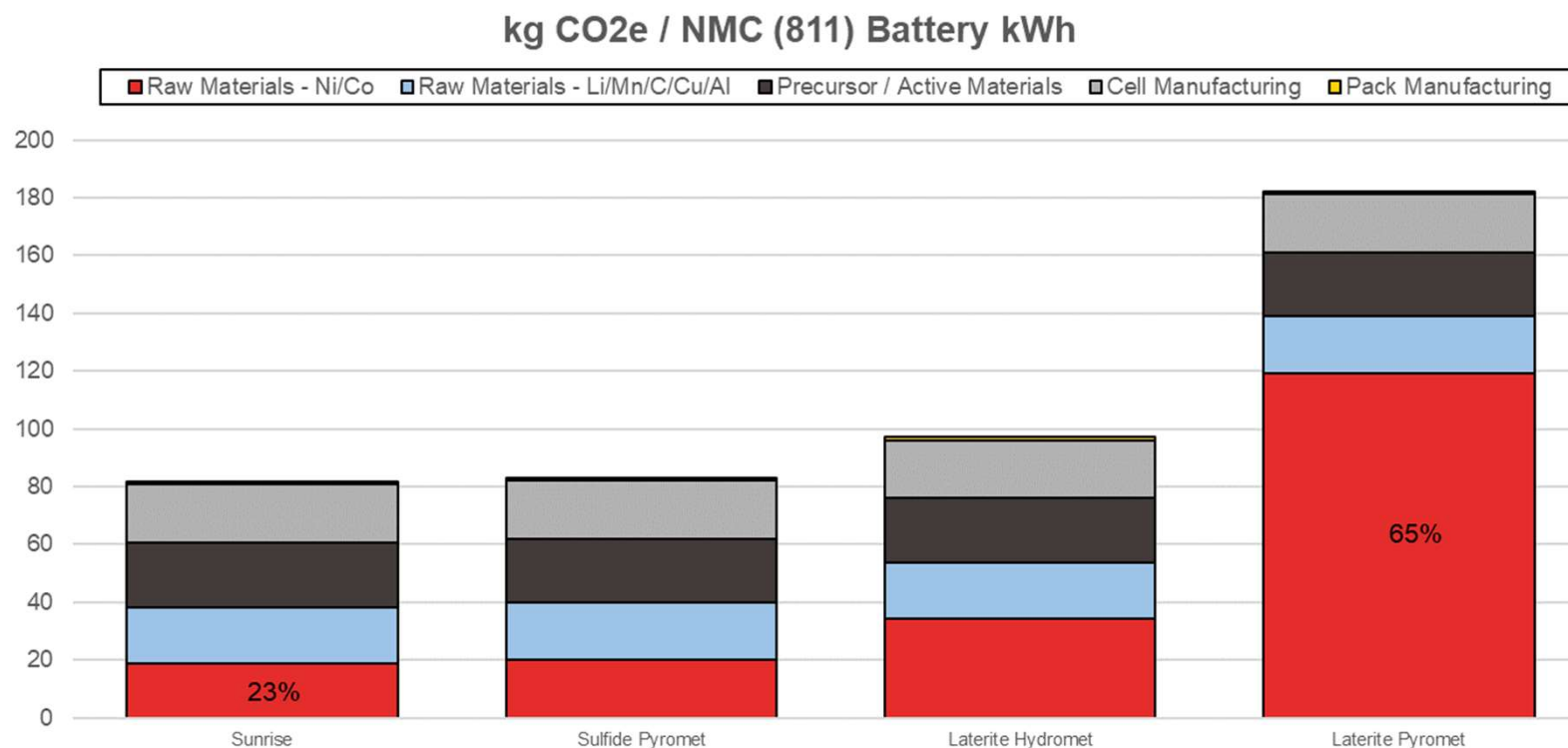


Process and feedstock	kg CO <sub>2</sub> e / kWh for Ni+Co	Ni+Co as % of total pack emissions
Nickel Sulfide Pyromet	20	25%
High Pressure Acid Leach (HPAL)	34	35%
Ferronickel (RKEF)	89	59%
Nickel Pig Iron (BF)	50	44%
Nickel Pig Iron (EAF)	119	65%
<b>Clean TeQ Sunrise (renewables)</b>	<b>19</b>	<b>23%</b>
<b>Clean TeQ Sunrise (grid)</b>	<b>26</b>	<b>29%</b>

Source: See note on previous page. Sunrise range based on 100% renewable power supply versus Australian grid energy mix. Note that while a theoretical process was developed and evaluated to convert FeNi and NPI to battery grade sulfate, an industrial scale process has yet to be proven.

# Nickel sulfate process routes

The environmental promise of EVs depends greatly on procurement strategy



Source: See note on previous page. Sunrise emissions based on renewable electricity supply.





## Sunrise Integrated Battery Complex

A template for industry-leading emissions and cost performance across the cathode supply chain



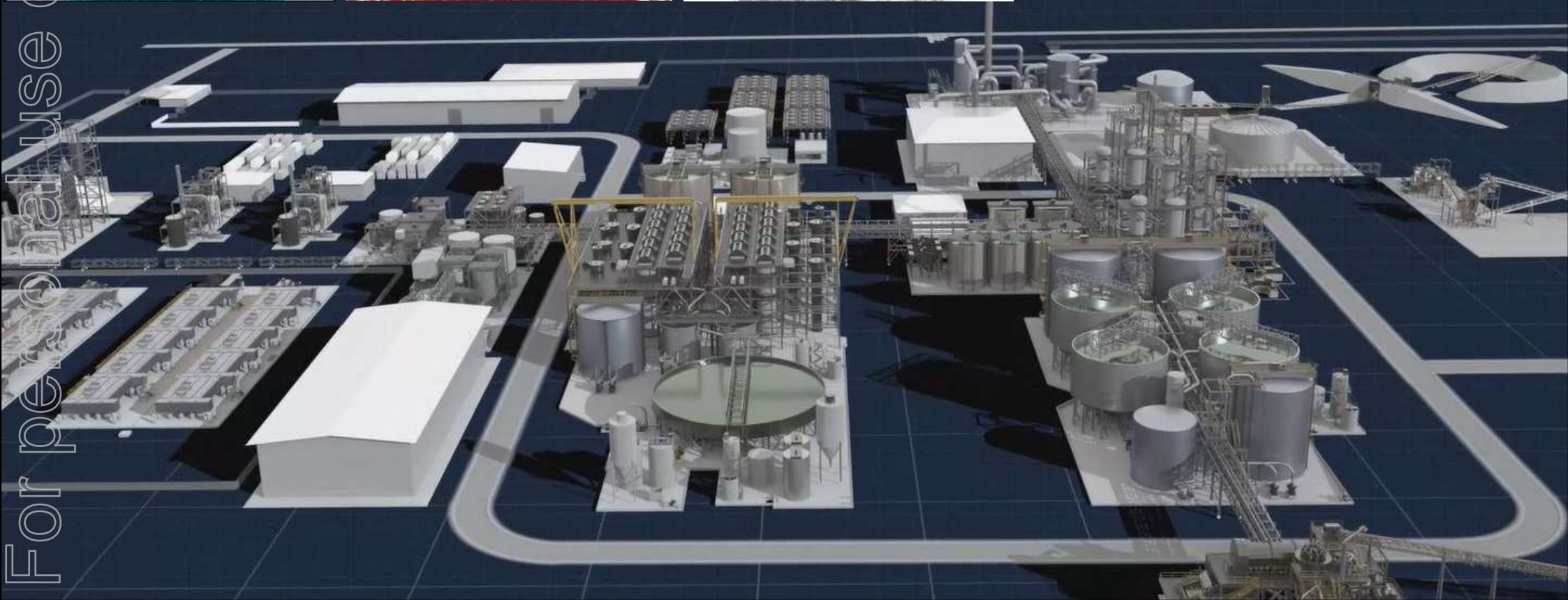
# Sunrise Battery Materials Complex

personal use only





# Sunrise Battery Materials Complex



# GHG intensity of Clean TeQ Sunrise

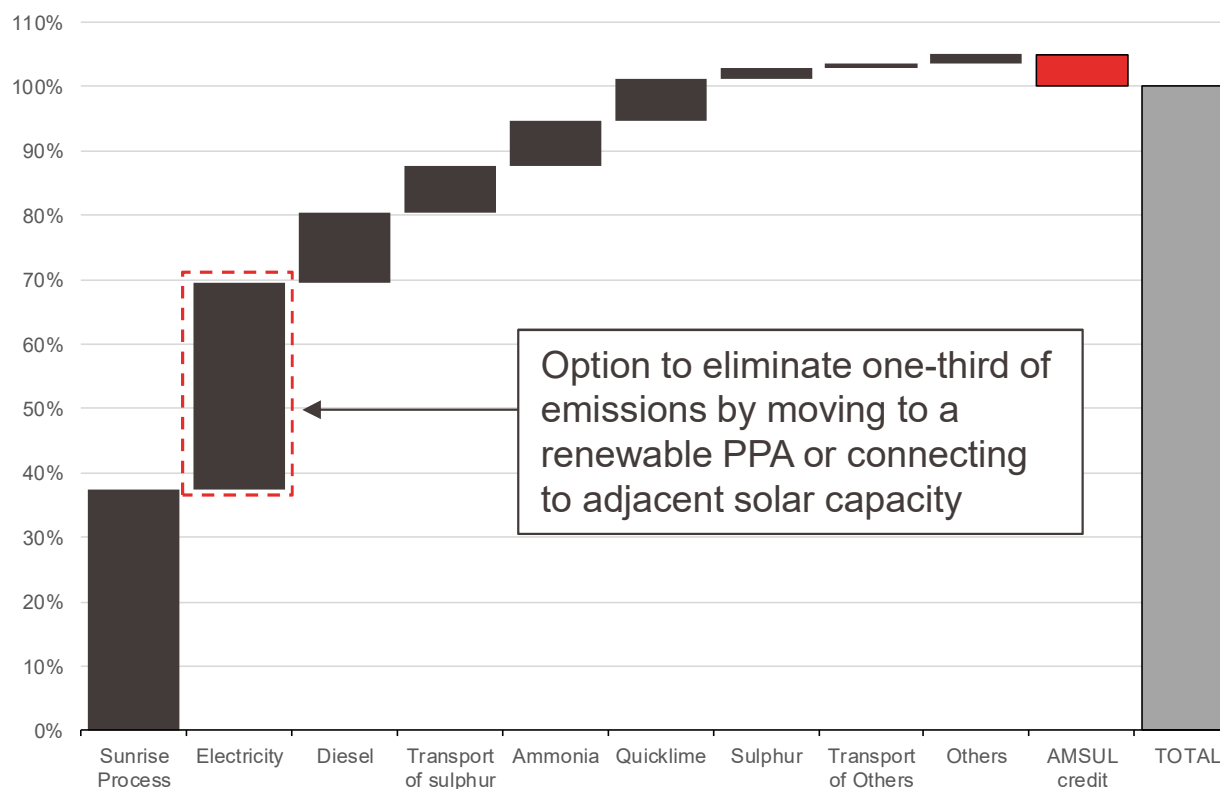
## Understanding the Sunrise emission hot spots

Indicator	Unit	Value	
Total Sunrise Project, cradle to gate	t CO2e/year	571,457	
- scope 1 emissions	t CO2e/year	265,577	
- scope 2 emissions	t CO2e/year	165,844	
- scope 3 emissions	t CO2e/year	140,036	
Nickel carbon intensity	kg CO2e/kg Ni	17.2	→ 354kt CO2e pa
Cobalt carbon intensity	kg CO2e/kg Co	45.4	→ 204kt CO2e pa
Scandium carbon intensity	kg CO2e/kg Sc	2,107	→ 14kt CO2e pa

Source: Energetics Report and internal company analysis. Assumes Australian grid energy mix in carbon calculation (scope 2).

# Breakdown of CO2e releases for Sunrise

Integrating renewable power at Sunrise reduces carbon by circa 30%

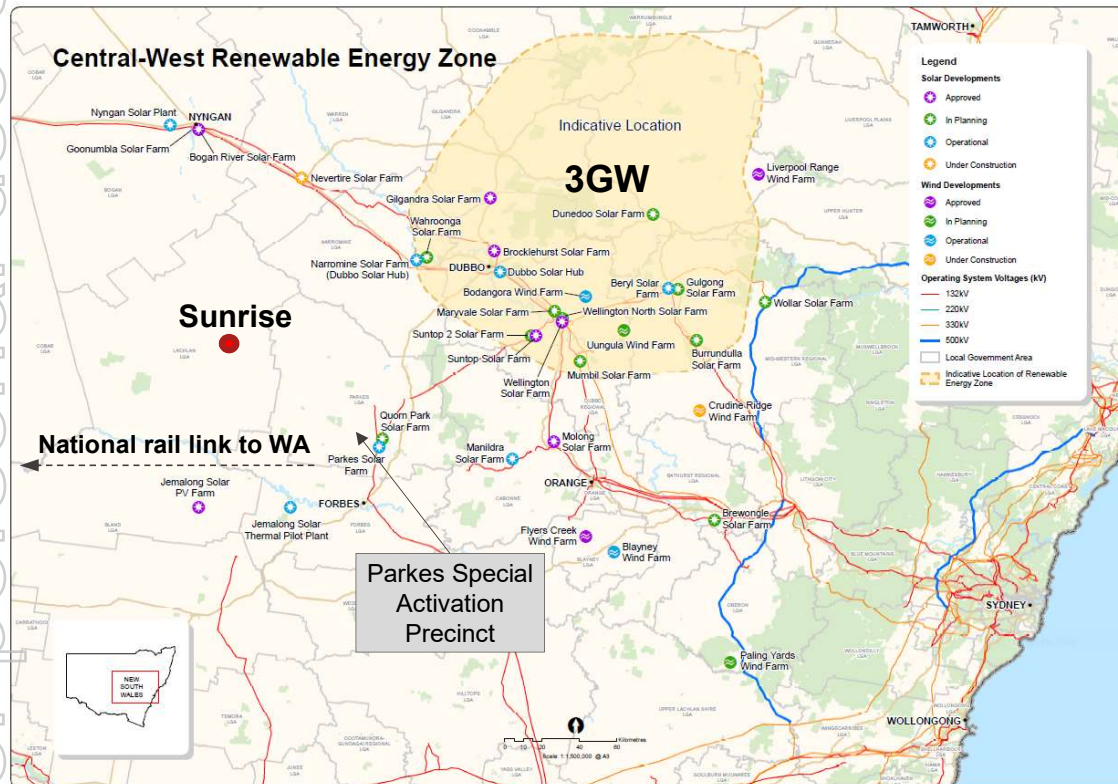


Source: Life Cycle Analysis by Energetics, February 2020.

Indicator	Unit	Value
<b>Sunrise (Imported Power)</b>		
Per kg Ni metal produced	kg CO2 e/kg	17.2
Per kg Co metal produced	kg CO2 e/kg	45.4
Per kg Sc metal produced	kg CO2 e/kg	2,107
<b>Sunrise (Renewable Power)</b>		
Per kg Ni metal produced	kg CO2 e/kg	10.8
Per kg Co metal produced	kg CO2 e/kg	28.4
Per kg Sc metal produced	kg CO2 e/kg	1,318

# The vision for Sunrise and Central NSW

Integrated precursor / cathode production, renewable generation and recycling



**Renewable Power:** The Central-West Renewable Energy Zone (REZ) will add 3GW of new solar generation capacity to Sunrise's doorstep

**Linking Li – Ni - Co:** The east-west national rail corridor connects at Parkes, linking Sunrise to the world's largest sources of lithium production

**Active material production:** significant cost savings can be generated by co-locating Ni/Co sulfate and precursor/cathode production

**Closed recycling loop:** Surplus autoclave and refining capacity allows cost-effective recycling of used cathode to recover metals (Parkes Special Activation Precinct is a dedicated industrial zone incorporating recycling/re-use facilities powered by waste-to-energy).



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