

11 June 2024

## Calix ZESTY Investor Presentation

**Sydney, Australia | 11 June 2024** - Australian environmental technology company, Calix Limited (ASX: CXL) (“Calix” or “the Company”) is pleased to provide a copy of its investor presentation for the online briefing on Tuesday, 11 June 2024 at 10am AEST, that will provide an overview of the Zero Emissions Steel Technology (ZESTY) application and will be hosted by Chief Executive Officer and Managing Director Phil Hodgson.

Zesty is an enabling and complementary technology for multiple decarbonisation pathways for iron and steel and represents one of the largest addressable markets for the application of Calix’s unique core technology platform.

Registration for the event can be made at the following link below:

<https://events.teams.microsoft.com/event/99293a56-5f77-4134-ae9f-a0b906e783e2@41eb501a-f671-4ce0-a5bf-b64168c3705f>

Investors will be able to submit questions during the briefing using the Q&A function.

The briefing will also be made available on our website: <https://calix.global/investor-centre/> after the event.

**-ENDS-**

This announcement has been authorised for release to the ASX by:

**Phil Hodgson**  
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## About Calix

Calix Limited (ASX: CXL) is an environmental technology company solving urgent global challenges in industrial decarbonisation and sustainability.

Calix's unique patented core platform technology delivers efficient indirect heating of raw materials to enable renewably powered mineral processing and efficient capture of unavoidable industrial emissions.

With strong and increasing demand driven by global commitments to net-zero emissions, Calix is applying its core technology to the decarbonisation of cement, steel and alumina, sustainable processing of critical minerals, direct air capture of atmospheric carbon dioxide, and sustainable environmental products.

Each application of the technology is being deployed through a proven licensing, joint-venture and spin-out model. Subsidiary businesses focused on a specific application and target market accelerate commercialisation and enable a flexible equity funding model to support exponential growth.

Leveraging its core platform technology and a global network of partners, Calix is urgently developing multiple environmental businesses that deliver positive global impact. Because there's only one Earth.

Mars is for quitters.

[calix.global](https://calix.global)

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# Zero Emissions Steel Technology

Investor Briefing

11 June 2024

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This presentation has been prepared by Calix Limited (ABN 36 117 372 540) ("Company").

## SUMMARY INFORMATION

This presentation contains summary information about the Company and its subsidiaries ("Calix") and their activities current as at 11 June 2024. The information in this presentation is a general background and does not purport to be complete.

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All dollar values are in Australian dollars (\$) or A\$) and financial data is presented as at or for the full financial year ended 30 June 2021, unless stated otherwise.

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# Agenda

Calix investor webinar – Zero Emissions Steel TechnologyY

1	Key Highlights
2	Introduction to Calix
3	Technology Status
4	Industry Opportunity
5	Commercialisation Strategy
6	Q&A



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# Key Highlights



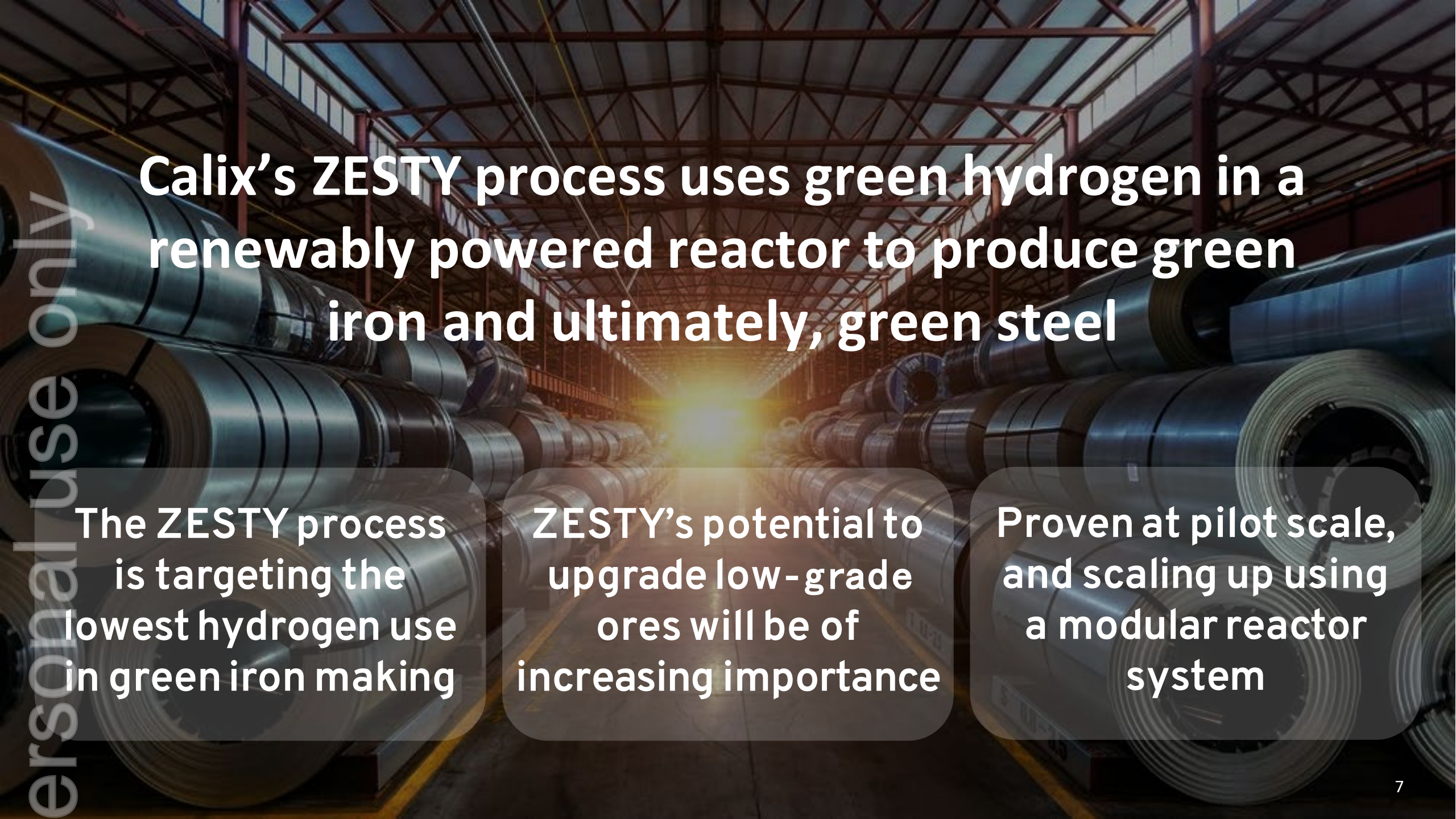
**Iron and steel are essential to our economic prosperity and continued development**

**The iron and steel industry is responsible for ~8% of global CO<sub>2</sub> emissions, with ironmaking being one of the most carbon intensive and hard-to-abate processes**

**~80% of the iron and steel industry's CO<sub>2</sub> comes from iron production**

**Countries representing 90% of global GDP now under net zero commitments**





**Calix's ZESTY process uses green hydrogen in a renewably powered reactor to produce green iron and ultimately, green steel**

**The ZESTY process is targeting the lowest hydrogen use in green iron making**

**ZESTY's potential to upgrade low-grade ores will be of increasing importance**

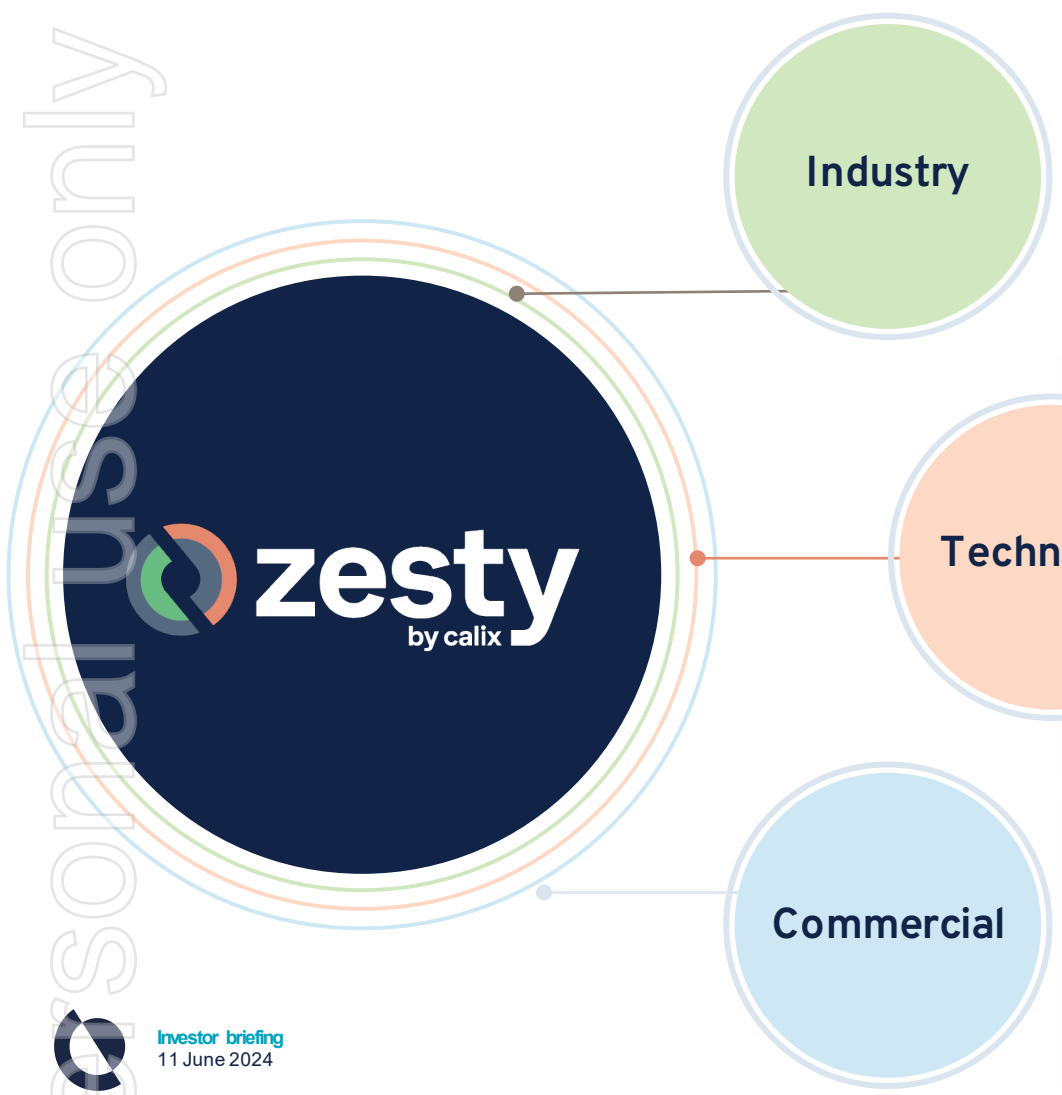
**Proven at pilot scale, and scaling up using a modular reactor system**

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# Key highlights

## Decarbonising iron & steel with ZESTY

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- One of the world's largest decarbonisation opportunities
- ZESTY's total addressable market could reach ~US\$5.9bn p.a. in 2050
- Iron and steel accounts for 2.8bn tonnes of CO<sub>2</sub> emissions annually, ~8% of global CO<sub>2</sub> emissions
- ~80% of the iron & steel industry's CO<sub>2</sub> footprint is associated with the production of iron from iron ore

- Proven pilot – green iron production from low grade Pilbara ores
- Clean & efficient electric heating
- Targeting minimum possible hydrogen use
- Compatible with fines / waste material
- Removes costly processing steps
- Green iron product can be briquetted
- Extensive testing at pilot scale & patent protected

- Capital-light business model with licensing royalties
- Potentially attractive economics even without carbon pricing
- Can enable multiple decarbonisation pathways for iron & steel
- Track record of successful focused technology spin-offs
- Collaboration with major iron ore producers & steelmakers

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# Introduction to Calix



# About Calix

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**MARS IS FOR QUITTERS**



2005  
FOUNDED



UNGC  
signatory  
= SINCE 2020 =

120+  
employees



A\$120m  
technology investment



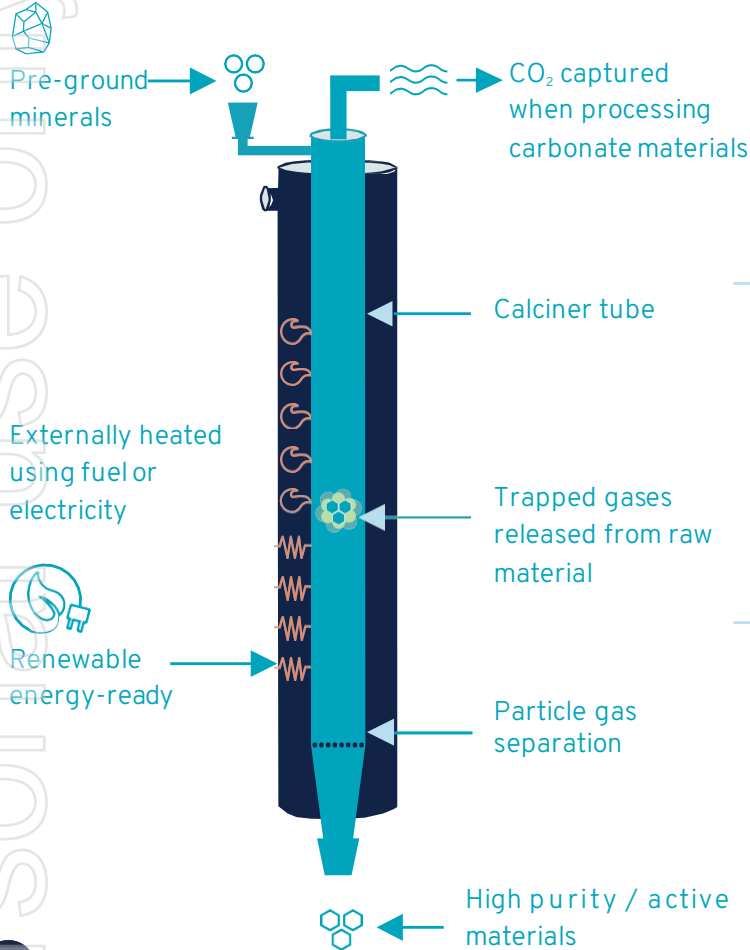
9 operational  
SITES

28  
PATENT  
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ACTIVE IN  
7 5  
countries continents

# Calix's core platform technology

A new way to “heat stuff up”



  
**CARBON CAPTURE**



Unavoidable process CO<sub>2</sub> emissions from cement and lime production and CO<sub>2</sub> from the atmosphere are captured for use or storage.



**ELECTRIFICATION & RENEWABLE ENERGY-READY**



**Sustainable Processing**

Compatible with electricity and alternative fuels to provide viable, flexible and economical pathways to sustainable processing.



**HIGHLY-ACTIVE MATERIALS**



**Magnesia**

Produces high purity / active materials with enhanced chemical and/or bioactivity.



# Calix's structure underpins a solid foundation for growth

One core technology with multiple applications for global industries.

<b>Platform output</b>	 Carbon Capture		 Sustainable Processing			 Magnesia	
<b>Business subsidiary</b>							
<b>Applications</b>	 Cement & lime	 Direct Air Capture	 Lithium	 Alumina	 Iron & steel	 Water	 Ag / Marine / Bio
<b>Market Size</b>	1.4 BTpa CO <sub>2</sub> <sup>1</sup>	Targeting > 1 BTpa CO <sub>2</sub> <sup>7</sup>	US\$7Bpa <sup>2</sup>	US\$45.5Bpa <sup>3</sup>	US\$640Bpa <sup>4</sup>	~US\$100m <sup>5</sup>	Multi-US\$Bpa <sup>6</sup>
<b>Partners</b>							
<b>Revenue model</b>	Licence fees (\$ per tonne CO <sub>2</sub> )		Licence fees (% Total Revenues)			Growing direct / distributor sales	

- GCCA 2050 Net Zero Global Industry Roadmap
- Estimated as 50% of total lithium market as measured by lithium carbonate equivalent (LCE) derived from spodumene - <https://www.mckinsey.com/industries/metals-and-mining/our-insights/australias-potential-in-the-lithium-market>
- Alumina global market revenue estimated at <https://www.precedenceresearch.com/press-release/alumina-market#:~:text=The%20global%20alumina%20market%20size,combination%20of%20aluminum%20and%20oxygen.>
- Estimated as US\$400 per tonne of iron @ 1.6BTpa <https://www.statista.com/statistics/589979/metal-content-of-the-global-iron-ore-production/>
- US magnesium hydroxide market management estimate, caustic replacement market likely several multiples of this
- Frost and Sullivan – Independent Market Report – Calix IPO Prospectus 2018
- Heirloom statement in press release <https://fox40.com/news/local-news/san-joaquin-county/heirloom-carbon-technologies-tracy-co2/>

# Green mineral processing solutions for multiple industries

Multiple applications built & under development

**1** Magnesia



Bacchus Marsh  
Commissioned 2013  
(50,000 tonnes per annum<sup>1</sup>)

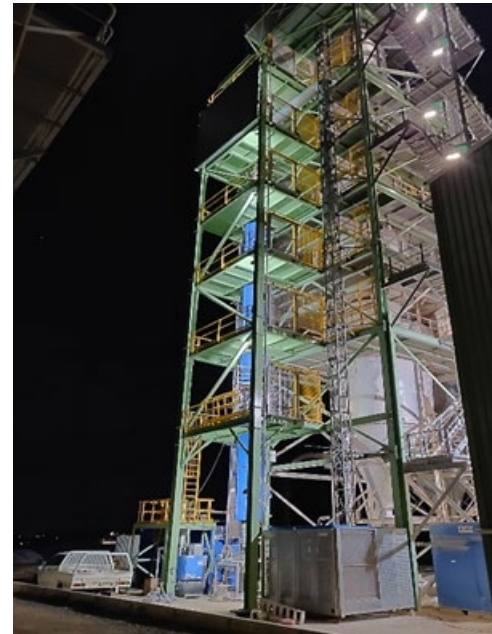
**2** Cement & Lime



Belgium – “LEILAC-1”  
Commissioned 2019  
(50,000 tonnes per annum<sup>1</sup>)



**3** Alumina, lithium & critical minerals



Victoria, Australia  
Commissioned 2019  
(2,000 tonnes per annum<sup>1</sup>,  
fully electric and renewably powered)

**4** ZESTY – Green Iron and Steel



Location TBD  
FEED Study complete  
(30,000 tonnes per annum<sup>1</sup> fully electric)

1. Annualised name plate capacity feed rate

Technology status





# Zero Emissions Steel Technology (ZESTY)



## Renewably-Powered

The whole system, including the reactor, can be powered by renewable electricity



## Lower grade ores

Proven ability to process lower grade ores, including Australian hematite / goethite



## No Fluidized Beds

Powder-based process suitable for processing of iron ore ultra-fines and fines (up to 0.5mm)<sup>1</sup>, without fluidized beds: a highly simplified process



## No Pelletisation

No requirement for iron ore fines pelletisation, avoiding significant capital and energy costs



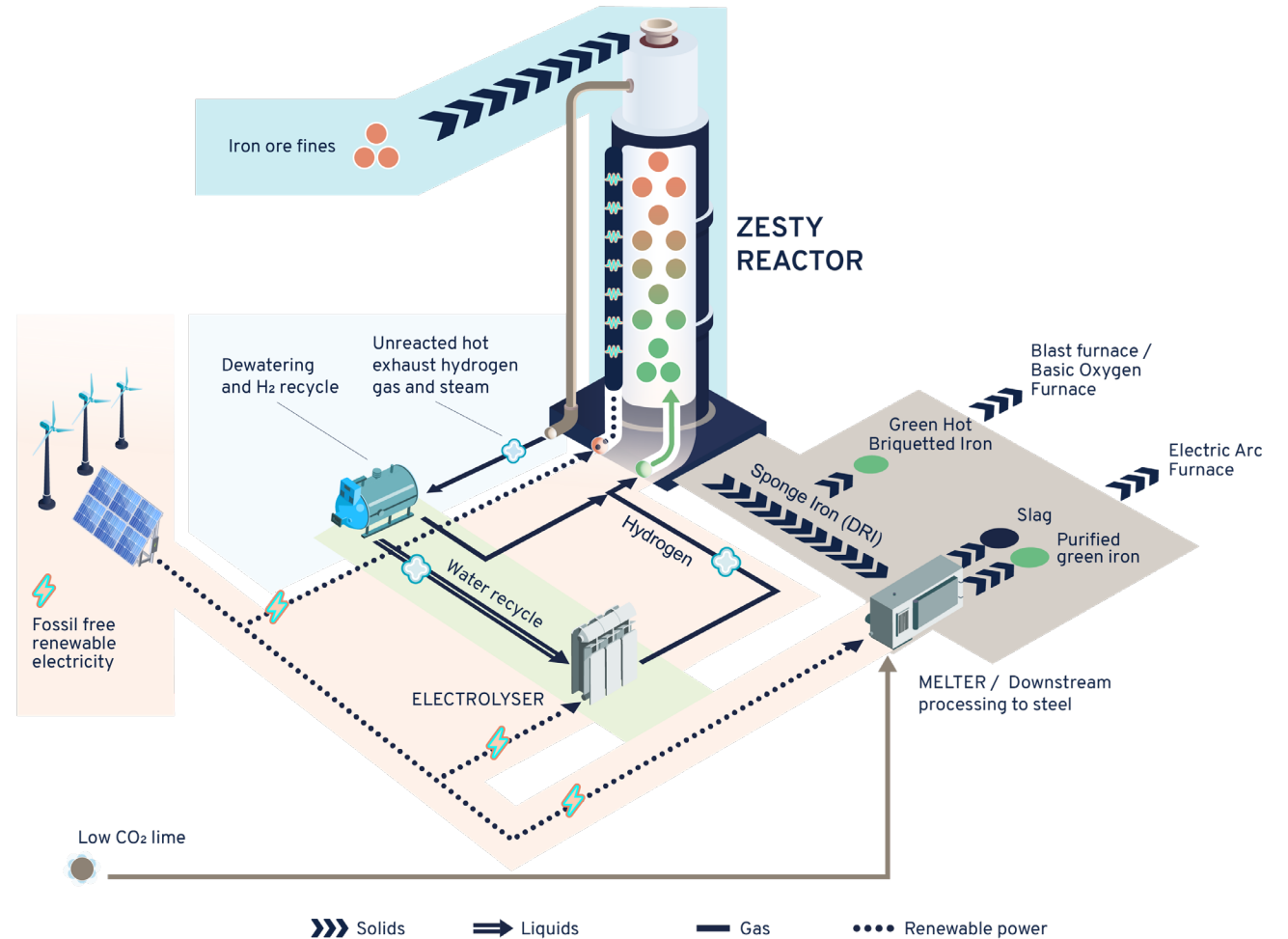
## Minimum Hydrogen Consumption

Targets theoretical minimum hydrogen use, through no use of hydrogen for combustion and through recycling of unreacted hydrogen



## Scalable & Flexible

Ability to scale production relatively easily, using electric-powered reactor modules



Process flow for 30kTpa ZESTY green steel production



# ZESTY's key points of difference

ZESTY has several inherent advantages over other hydrogen reduction and green iron / steel technologies in development

Green iron and steel technology	Simple process (low pressure / no fluidised beds)	Compatible with fines & lower-grade ores	No fossil fuel requirement	No CCS requirement	H <sub>2</sub> not combusted / easily recycled	Examples
	✓	✓	✓	✓	✓	
Carbon Capture	✓	✗	✗	✗	✗	Numerous small scale trials underway
Smelting Reduction	✓	✓	✗	✗	✗	HISARNA - Tata, 2010, 65ktpa, multiple campaigns
Fluidised Beds	✗	✓	✓	✓	✗	HYFOR (Pilot) FINMET (2m tpa - BHP - dismantled) CIRCORED (300ktpa, Trinidad - shut down)
Shaft furnace with reducing gas	✓	✗	✗	✗	✗	DRI-Midrex H <sub>2</sub> , H <sub>2</sub> Green Steel Hybrit
Flash iron making	✓	✓	✓	✓	✗	University of Utah - Lab-scale
Microwave reduction	✓	✓	✓	✗	n/a	Biolron (Rio Tinto) - Lab-scale
Electrolysis	✓	✓	✓	✓	n/a	Electra, Boston Metals - Lab-scale

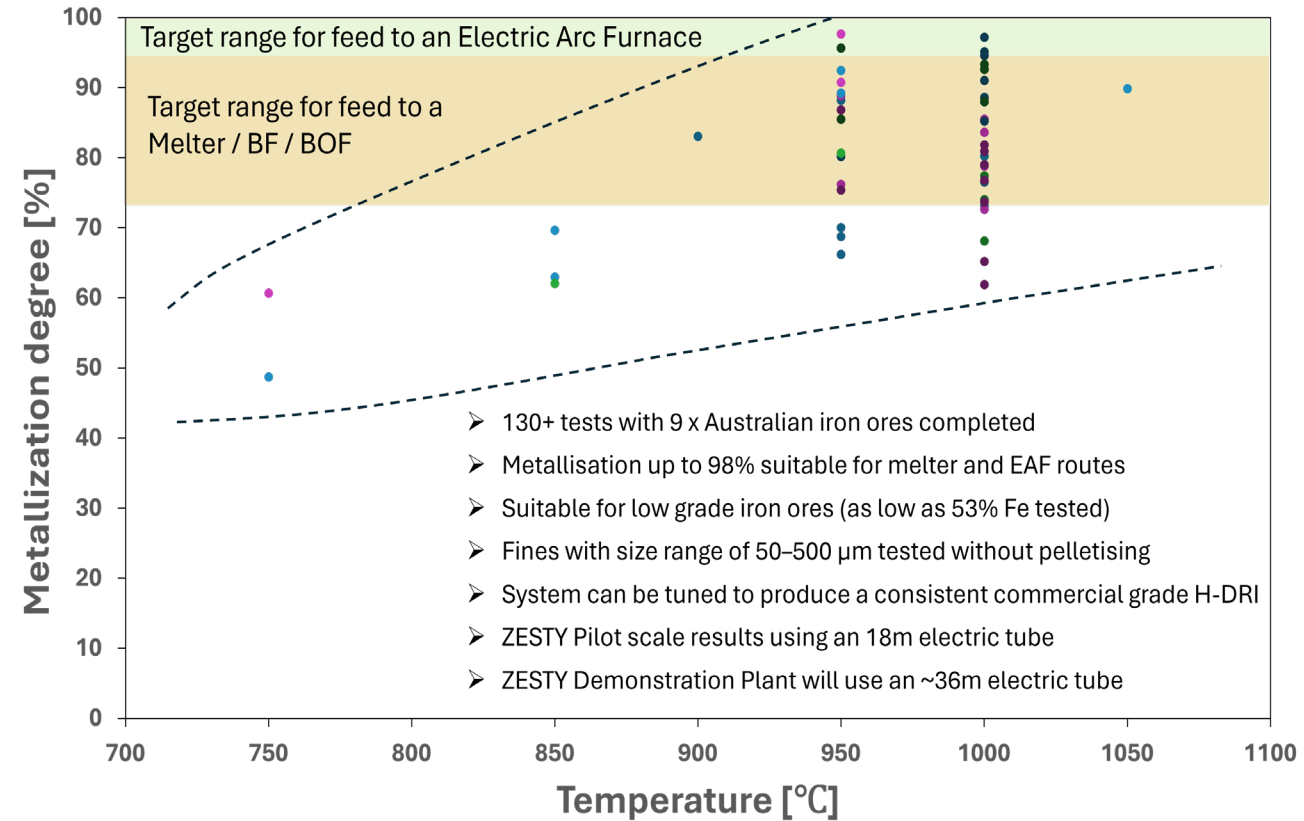
# Proven at pilot scale

## ZESTY ore testing results

- ✓ ZESTY proven at pilot scale, with metallisation rates up to 98%
- ✓ H<sub>2</sub>-DRI produced from Australian hematite/goethite ores  
~ 50% of global iron ore supply and not compatible with electric arc steel-making
- ✓ ZESTY H<sub>2</sub>-DRI fines have been successfully briquetted into a green HBI product with highly encouraging properties



Side profile of HBI produced from ZESTY H<sub>2</sub>-DRI briquetted at 200 MPa, 800 °C (scale: each square is 0.5x0.5 cm)



Metallisation Degree = Fe Wt% = the percentage of iron by weight in the ore

# ZESTY's compelling techno-economics

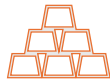
## Demonstration Plant FEED study

### Pilot testing and FEED study completed



**130+**

Tests completed



**75-98%**

Metallisation degree



**US\$410-520**

per tonne of HBI production cost



**Scalable**

Multiple tubes for modular scale-up



**9**

Australian ores variants tested



**0.9 – 1.3 MWh**

per tonne of HBI – highly efficient



**Near ZERO**

emissions



**ARENA Grant**

Broader Australian government support

### Techno-economics findings

- ✓ ZESTY could produce green HBI at costs close to the range of conventional (carbon intensive) HBI production<sup>1</sup>
- ✓ ZESTY could reduce the emissions intensity of reducing iron ore to metal iron from 1.89 tonnes of CO<sub>2</sub> / tonne of iron to near zero
- ✓ No pelletisation and sintering = considerable capital and operating expenditure savings
- ✓ Low consumption of green hydrogen = approaching theoretical minimum for reduction
- ✓ Efficient electrical indirect heating methodology
- ✓ Economics expected to improve further with scale
- ✓ Including the cost of carbon would further enhance economics

1. Assumes access to wholesale renewable electricity pricing of A\$36-48/MWh

# Towards FID for a ZESTY Demonstration Plant

ZESTY FEED study completed for a 30,000 tpa green iron demonstration plant



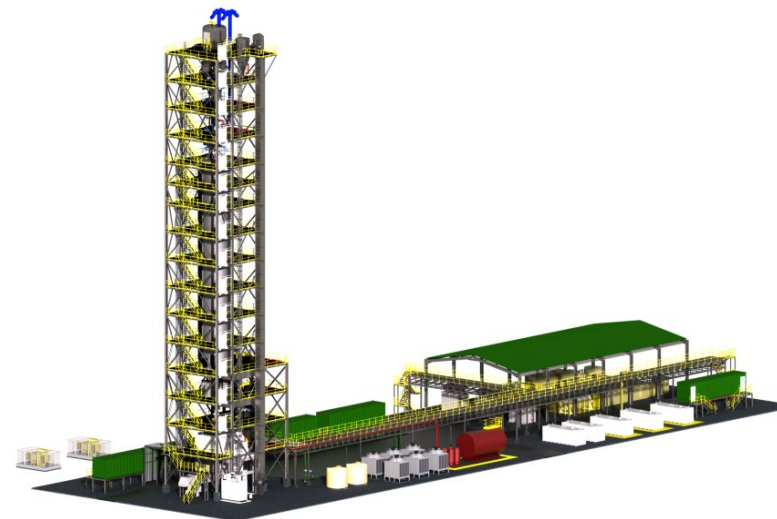
A\$947,035 ARENA grant covering  
~50% of FEED costs

The FEED study has finalised inputs to a final investment decision, subject to financing, including:

- Site layout, environmental and permitting considerations
- Process design including operating regimes, venting, emergency response
- Major equipment sizing and costings
- Construction methodologies

## Why 30,000 tpa demonstration is the right next step?

- ✓ Represents full-scale implementation of a single reactor tube – the basis for further scale-up
- ✓ Capable of processing sufficient H<sub>2</sub>- DRI / HBI for further downstream testing (steelmaking) at full scale to validate the product



The ZESTY commercial demonstrator is targeting BF-BOF suitable HBI produced from low grade iron ore

The demonstrator aims to charge a tolling fee to iron ore producers to test HBI trial products with their customers

# ZESTY commercial demonstration – next steps

A demonstration facility would target cost recovery from test campaign fees and sales of the green iron product.

## Engineering, procurement & construction (EPC)



Detailed Engineering targeting completion FID + 18 months  
Construction targeting completion FID + 30 months

## Commissioning and demonstration



FID + 30 months onwards



Commissioning / testing phase ~ target 4 months

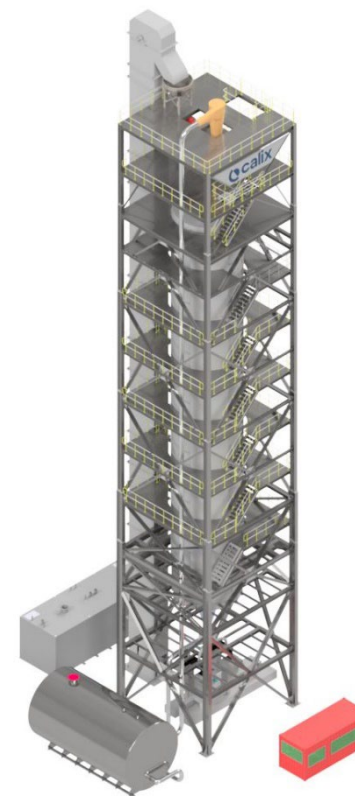


Operational proving phase target ~8+ months (leading to permanent use as a test unit / demonstrator for the ZESTY business)

## Commercial pipeline and engineering revenue



As with our experience with Leilac, our plan is to build a commercial pipeline in parallel with demonstration and commence charging engineering fees for project studies



*The ZESTY commercial demonstrator will be similar scale to the LEILAC-1 plant for cement and lime*

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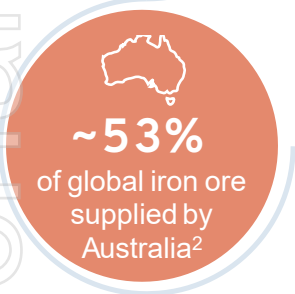
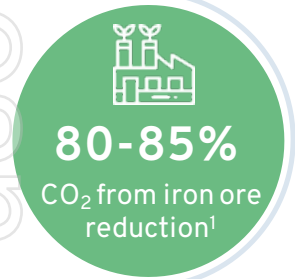
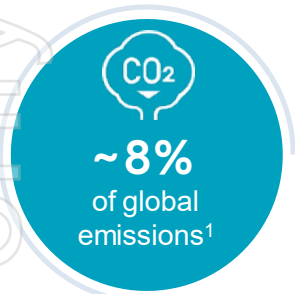
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Industry opportunity



# Decarbonising iron and steel

Indispensable, carbon-intensive & hard-to-abate

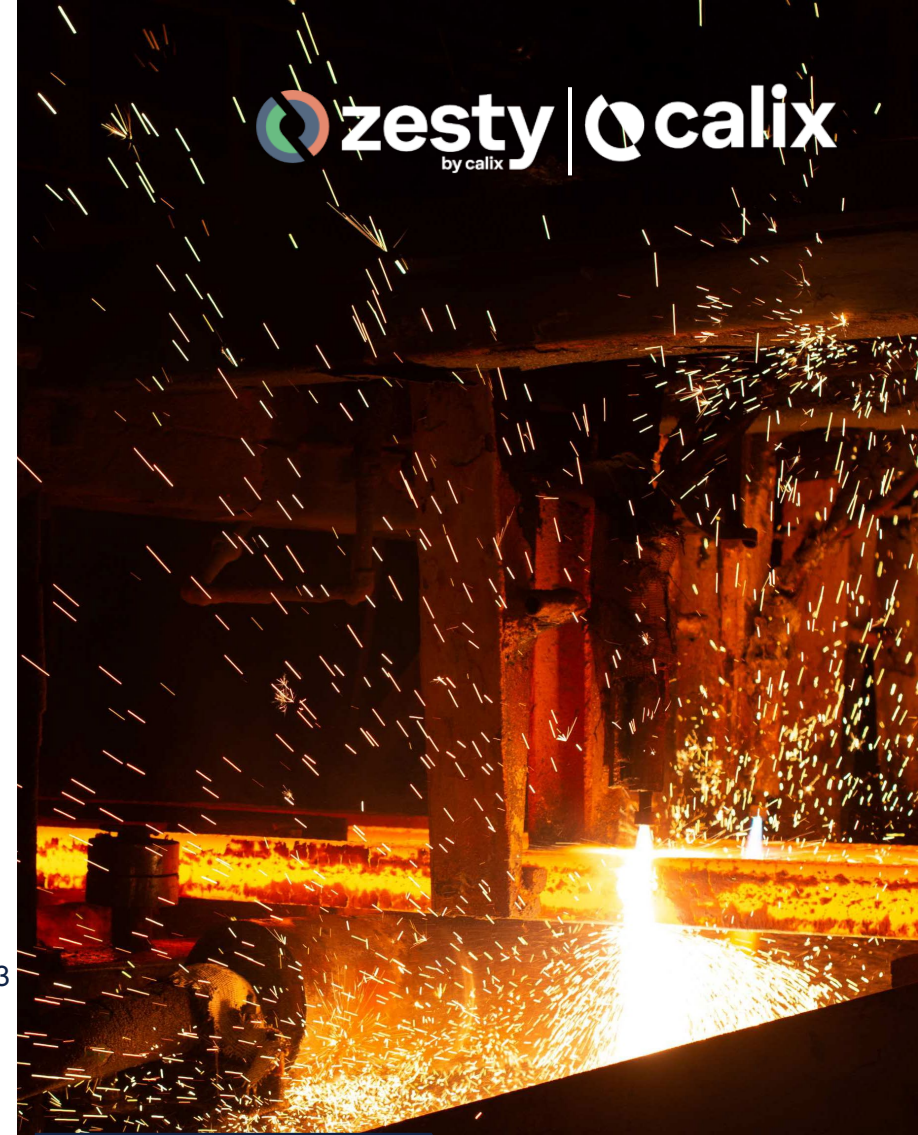


## Decarbonisation solutions should:

- Enable multiple decarbonisation pathways
- Be compatible with multiple ore types
- Minimise supply chain disruption
- Leverage existing assets
- Deliver efficient use of energy, reductant & raw material
- Be easily scalable

## Australian iron ore

- >A\$150b or ~44% of Australian resources export earnings<sup>3</sup>
- 96% of Australian iron ore is hematite / goethite<sup>4</sup>
  - not compatible electric arc steel-making
- Value-add & value creation opportunity
  - iron ore → green iron & steel



## SDG Impact



1. Climate change and the production of iron and steel. World Steel Association. 2021  
2. [www.statista.com](https://www.statista.com)

3. <https://www.minerals.org.au/news/record-high-resources-export-revenue>  
4. Iron Ore | Geoscience Australia





# Multiple drivers accelerating iron & steel decarbonisation

ZESTY's potential is being propelled by several significant tailwinds to net zero

**1** Iron and steel CO<sub>2</sub> emissions continue to increase...

**2.8 billion tonnes (direct)**

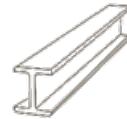
per year – an estimated 8% of the global total<sup>1</sup>



**2** Iron and steel production remains a significant contributor to CO<sub>2</sub> emissions...

**~80%**

of the iron and steel industry's CO<sub>2</sub> footprint is associated with the production of iron from iron ore<sup>2</sup>



**3** Acceleration in the demand for green iron...

**~50%**

estimated reduction in blast furnace production from 2019 to 2050 as the industry decarbonises<sup>3</sup>



**4** Strong global government support, with policy driving the need for green iron...

**90%**

of global GDP now under net zero commitments<sup>4</sup>



**5** Significant capital has been set aside to decarbonise industry...

**US\$39tn (Sep 2023)**

assets of signatories to the '2022 Global Investor Statement to Governments on the crisis'<sup>5</sup>



**6** US\$275tn of investment required to reach net zero by 2050...

**US\$275tn (Jan 2022)**

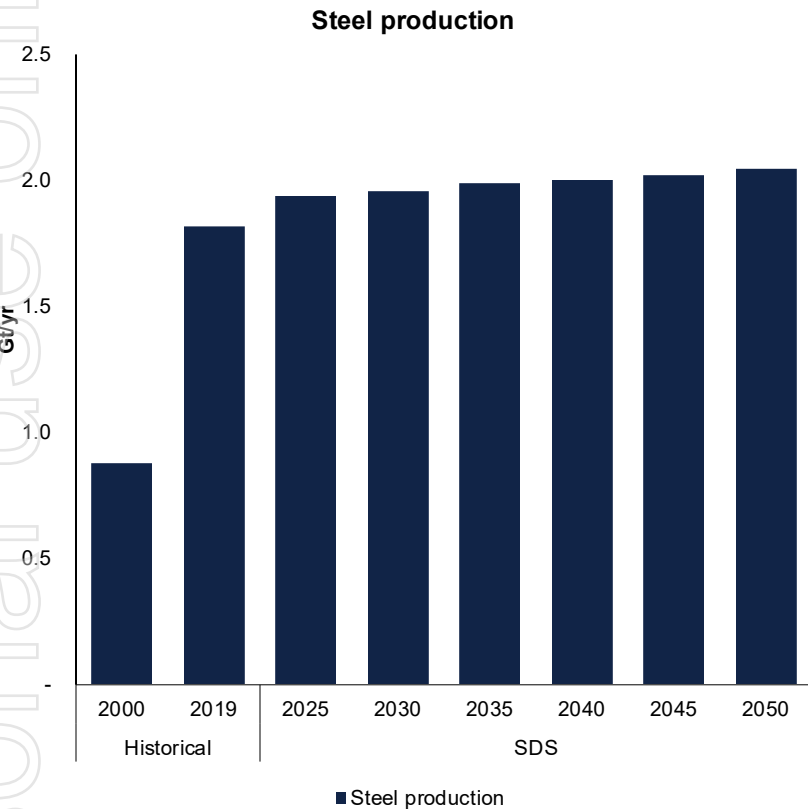
estimated spend required by 2050 to fund the global energy transition<sup>6</sup>



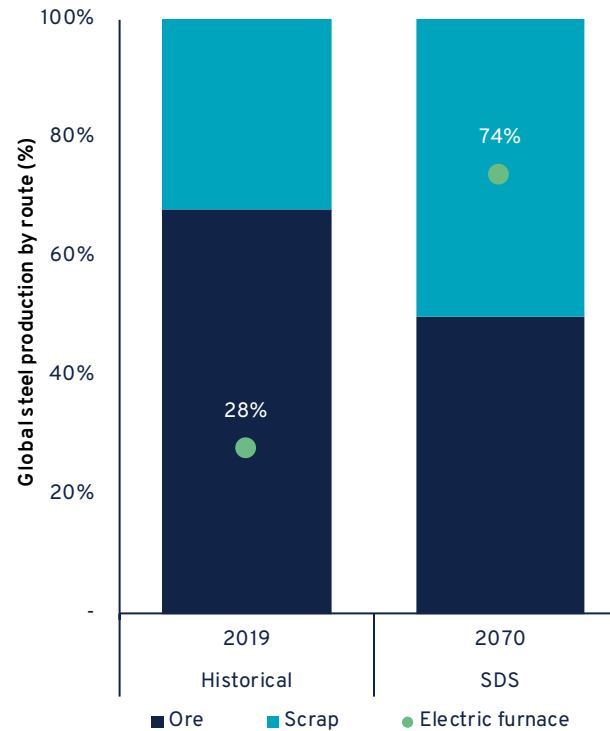
# Outlook for world iron and steel production

Whilst steel is expected to grow modestly to 2050 and iron production plateauing, under the IEA's Sustainable Development Scenario, the mix of production technology is changing with an increasing proportion becoming decarbonised

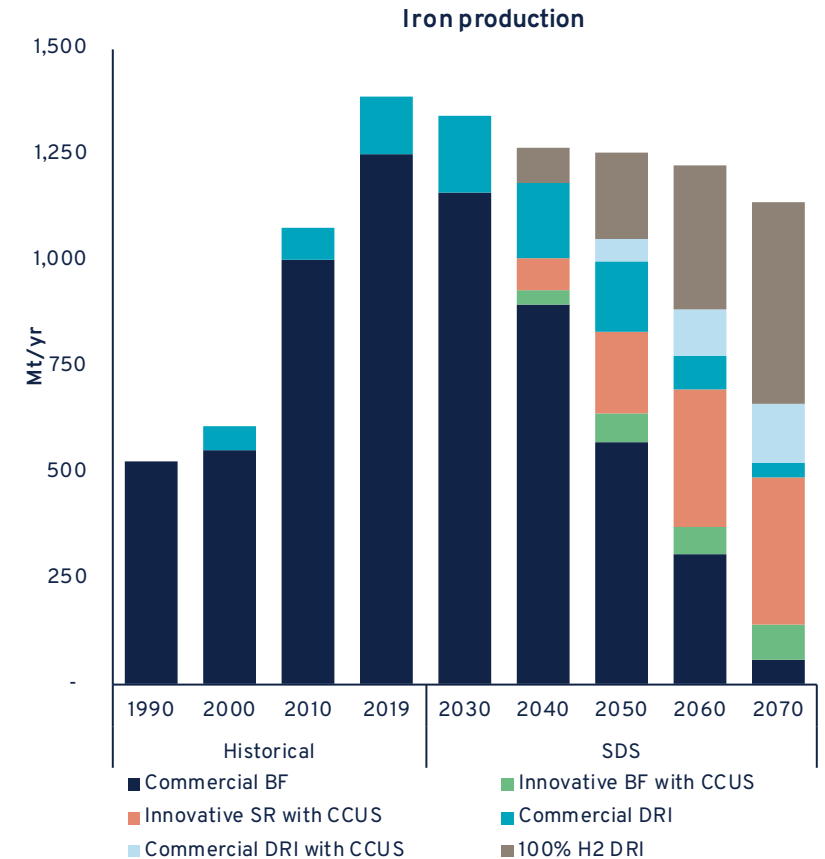
Global steel production expected to continue to rise...



Scrap expected to increase as a proportion of steel production...



Global iron production to shift towards new technologies...



Source: IEA Iron and Steel Technology Roadmap: Sustainable Development Scenario (SDS) for 2050 (2020)  
 Note: Iron production excludes scrap-based steelmaking

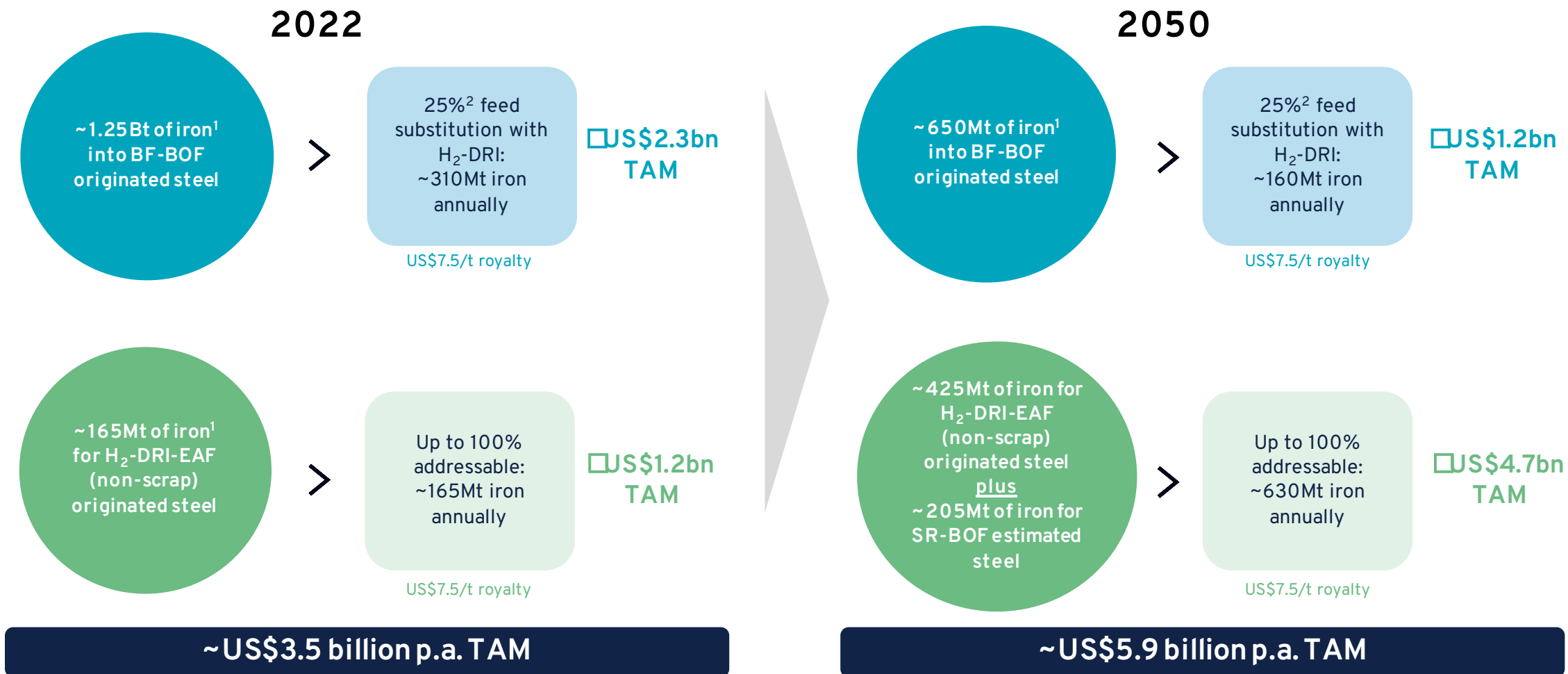
1.3bn<sup>3</sup> tonnes of expected global iron demand in 2050 → equivalent to ~4,300+ ZESTY H<sub>2</sub>-DRI modules of 300ktpa

# ZESTY total addressable market could be up to ~US\$5.9bn p.a.

If ZESTY can achieve a royalty of US\$7.5 / tonne green iron<sup>2</sup> (2% of HBI value), this indicates a total addressable market (TAM) of ~US\$3.5bn in 2022, growing to ~US\$5.9bn in 2050

Steel from Basic Oxygen Furnace (BOF) via BF

Steel from Electric Arc Furnace (EAF)



Commercialisation  
strategy



# Who are we working with?

Multi-year, multi-project \$200m decarbonisation development program

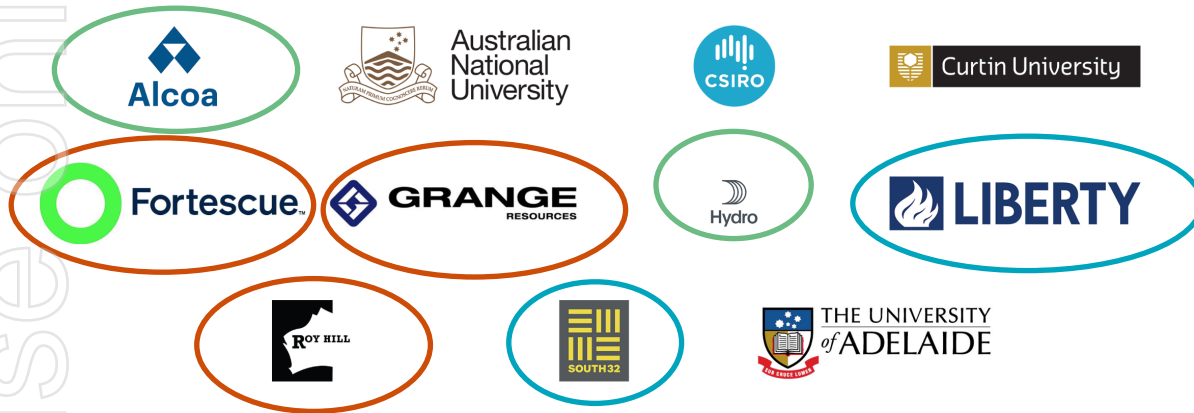
**HILTCRC**

Heavy Industry  
Low-carbon Transition

<https://hiltcrc.com.au/>

**zesty | calix**  
by calix

## CORE PARTNERS



## AFFILIATE PARTNERS



## KEY PARTNERS

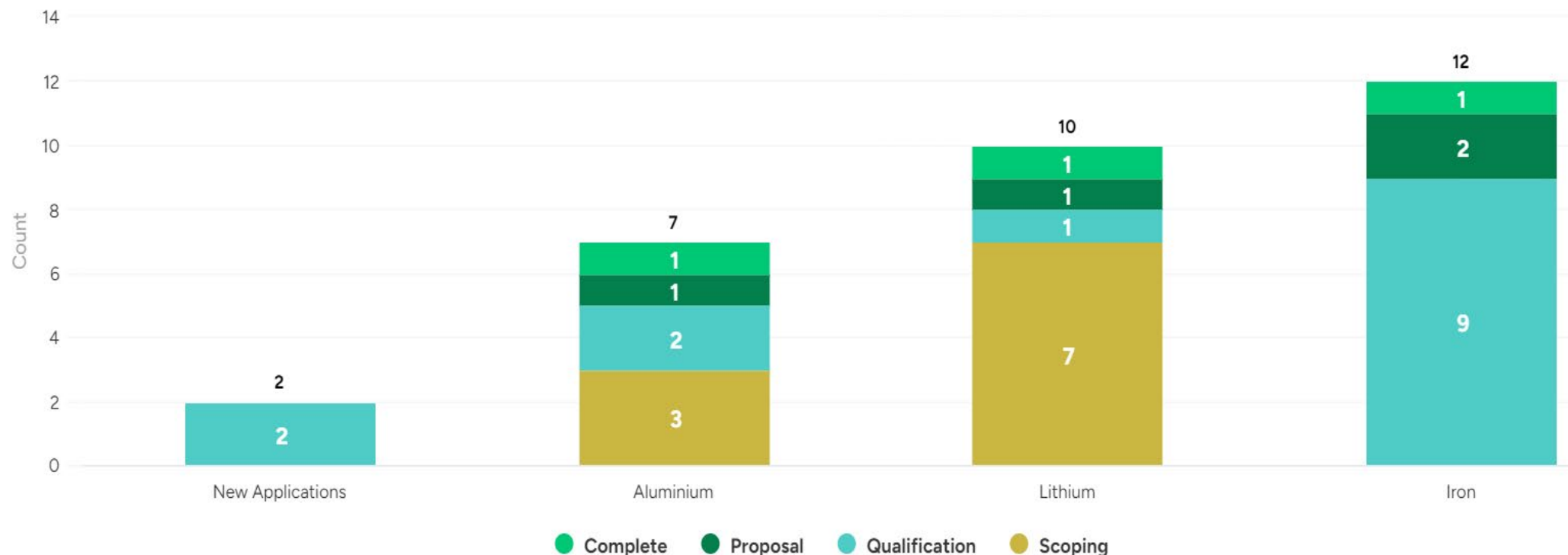


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# Commercialisation Pipeline

Our sustainable processing opportunity pipeline continues to grow across multiple applications

- 1st study packages completed across our top 3 prioritised mineral sectors
- Multiple Iron Ore work programs now qualified following the successful expanded ore testing campaign during FY24
- Proposal volume for further Iron Ore testing and study programs expected to increase during FY25



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# Capital-light business model

ZESTY intends to adopt a capital-light business model for commercialisation, with royalty fees paid under a technology licence

## Overview

Licensing technology to third party iron and steel manufacturers (“Producers”)

Following demonstration, producers to construct their own plants, reducing capital requirements for Calix & enabling technology to be easily commercialised & scaled

Licensing strategy underpins a partnership approach to collaborate with iron and steel producers for an industry-wide solution

Business model options

	← Capital intensive			Capital light →
	Own & operate	Build then transfer	Third party finance	Licence technology
Plant owner	ZESTY	Producer	Third party financier	Producer
Plant operator	ZESTY	Producer	Producer	Producer
Plant constructor	ZESTY	ZESTY	Third party EPC contractor	Producer / Third party EPC contractor
Capital required from ZESTY	Significant permanent capital	Significant temporary capital	Low / none	Low / none
Responsible for sourcing capital	ZESTY	ZESTY & Producer	ZESTY (from third parties)	Producer
Scalability	Limited	Limited	High	High

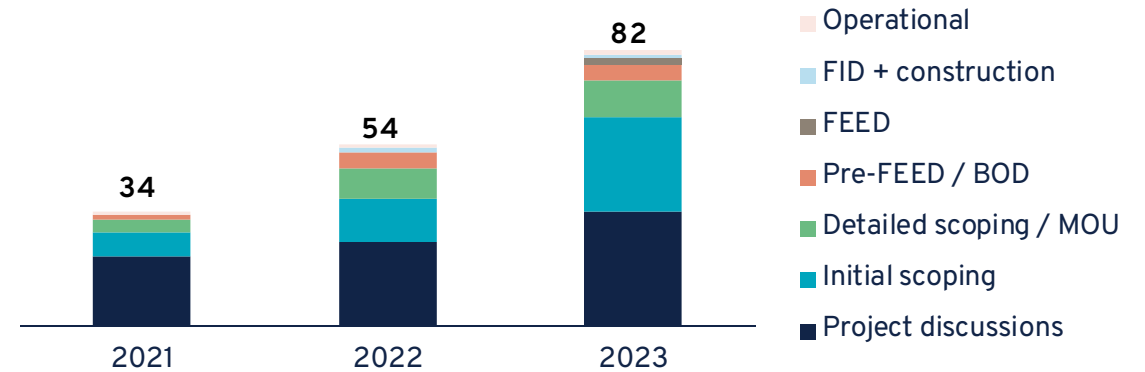
# Demonstration and growth funded via spin out

- Calix has experience in successfully spinning out technologies like ZESTY – attractive to private capital
- Calix successfully “soft” spun out (7%) Leilac in 2021, valuing Leilac at €215m post money, plus 30% of all Leilac royalties to be paid to Calix
- Since then, Leilac has progressed substantially, both technically and commercially

## Overview

- Leilac represents significant potential to decarbonise the cement and lime industries
- Cement and lime contribute ~8% of global emissions and are one of the largest and hardest-to-abate sources of global CO<sub>2</sub> emissions
- Rising global carbon prices create strong tailwinds that support an industry-wide transition to the Leilac process

Leilac Project Pipeline (# projects)



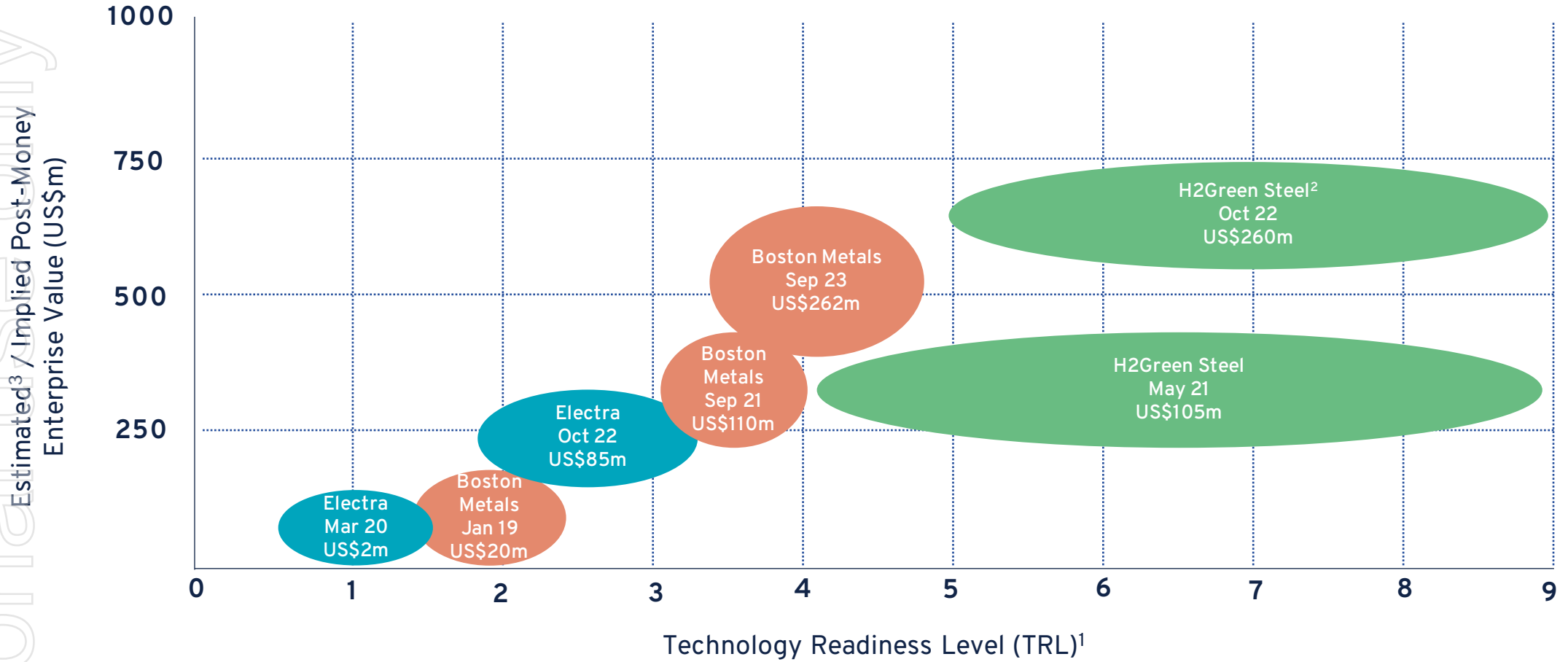
## Multiple blue-chip and global partners





# Significant valuations have been achieved for green iron / steel technologies

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1. TRL is based upon management estimates given reported data on testing equipment / status and <https://www.estep.eu/assets/Uploads/210308-D1-2-Assessment-and-roadmapping-of-technologies-Publishable-version.pdf>
2. Utilising Midrex technology = TRL9 for nat gas, lower TRL estimate for high hydrogen input is management estimate based upon (lack of) public data both from Midrex and Hybrit (modified Midrex process)
3. Where public data is not available, estimate is 25 to 40% dilution which is conservative-case based upon averages <https://www.saastr.com/carta-the-actual-real-dilution-from-series-a-b-c-and-d-rounds/#:~:text=20%25%20dilution%20in%20an%20A,much%20you%20need%20the%20money>

# Key takeaways

ZESTY presents a significant growth opportunity for Calix leveraging its unique patented platform technology to develop scalable decarbonisation solutions for the iron and steel industry

- Estimated total addressable market of up to US\$5.9bn p.a. (2050) – one of the world’s largest industrial decarbonisation opportunities
- Growing demand, driven by government policies and the need for scalable & cost-effective decarbonisation solutions
- Capital-light royalty-based revenue model from iron and steel producers licensing the ZESTY process
- Calix has experience in successfully raising capital and achieving look-through valuation via spin-out of subsidiaries
- ZESTY has several competitive advantages over existing hydrogen reduction and green iron/steel technologies and has been extensively tested at pilot scale



**Efficient & clean electric heating**



**Targets minimum hydrogen consumption**



**Green iron from Australian Pilbara ores**



**Simplified & scalable process**



**Protected by 8 patent families**



Q&A





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# Glossary

Term	Meaning
BF-BOF	Blast Furnace / Basic Oxygen Furnace – the most prevalent steelmaking technique in the world today, using coal as both a heat source and reductant
Calciner	A term describing a kiln or furnace - typically used in the mineral processing industries
CCS	Carbon Capture and Storage
CFC	Calix Flash Calciner – technical term for Calix’s core technology
DRI	Direct Reduced Iron – a product derived from the removal of oxygen from iron ore to form metallic iron in the solid state (without melting, as is the case in the blast furnace)
EAF	Electric Arc Furnace – a process to make and recycle steel at very high temperatures using electricity as the heating source
FEED	Front End Engineering and Design
H <sub>2</sub> -DRI	The process of directly reducing iron ore to metallic iron (DRI) with hydrogen as the reductant
HBI	Hot Briquetted Iron, referring to briquetted DRI or H <sub>2</sub> -DRI, “bricks” of relatively high purity iron ready for steelmaking
IP	Intellectual Property
Process CO <sub>2</sub> Emissions	CO <sub>2</sub> emissions that evolve from heating limestone or calcium carbonate (CaCO <sub>3</sub> ) to make lime or calcium oxide (CaO)
Reductant	A substance that carries out reduction (i.e. oxygen removal), in converting iron ore to iron
Reduction	The chemical process of removing oxygen – in this instance removing oxygen from iron ore (largely iron oxide) to make metallic iron
SR	Smelting Reduction – a combination of the iron reduction process with iron melting (and possibly purification) process
TAM	Total addressable market
Tpa	Tonnes per annum
TRL	Technology Readiness Level (NASA Scale)
Ultrafines	Tiny particles, typically smaller than 0.15 to 0.2 mm (150 to 200 microns) in diameter
ZESTY <small>investor briefing</small>	Zero Emissions Steel TechnologY – brand name for Calix’s green iron / steel application of its core technology

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**Mars is for  
quitters**

