

BAML Smart Mine Conference 2019

Leveraging ideas to unlock value

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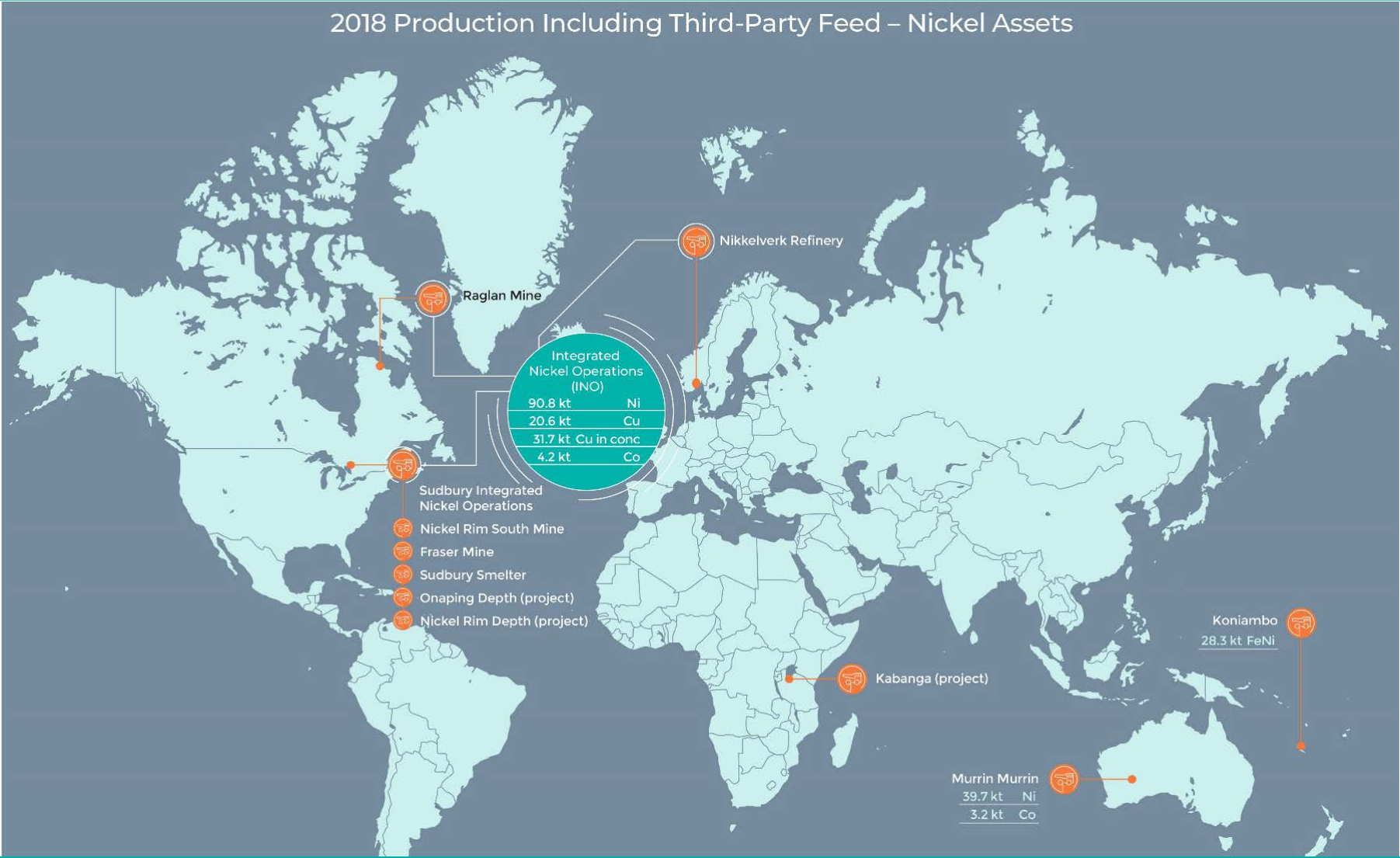
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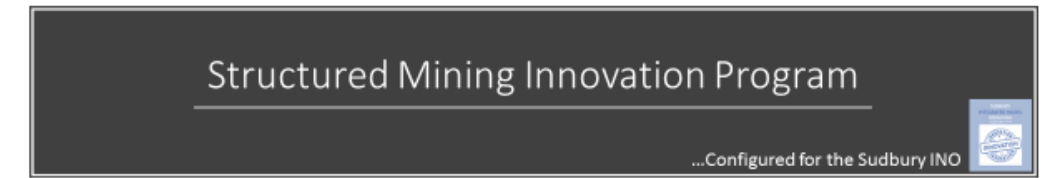
We are using a Strategic Innovation program to manage the introduction of new technology. Our “Proof of Concept” at our future Sudbury INO underground mines – Designed for Depth – is demonstrating significant potential value.

Marc Boissonneault



It's not simply technology ...
... it's solving problems to unlock value

- **Identify the key Problem to solve**
 - Not the symptom
- **Use a process**
 - Divergent-convergent
- **Use existing technology in new ways**
- **Stay connected to significant value**
- **Configure the Ecosystem to support execution**



Our Future Mines
Sustainably Designing for Depth



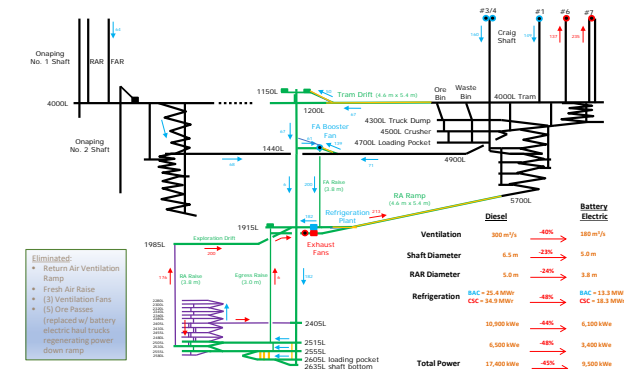
In the face of a challenging operating environment, how can we unlock hidden value?

• Sudbury INO Project constraints

- High capital cost based on reserve size
- Long project period to first production
- Margins under pressure even with high grade
- Challenging work environment: Depth – heat – logistically complex

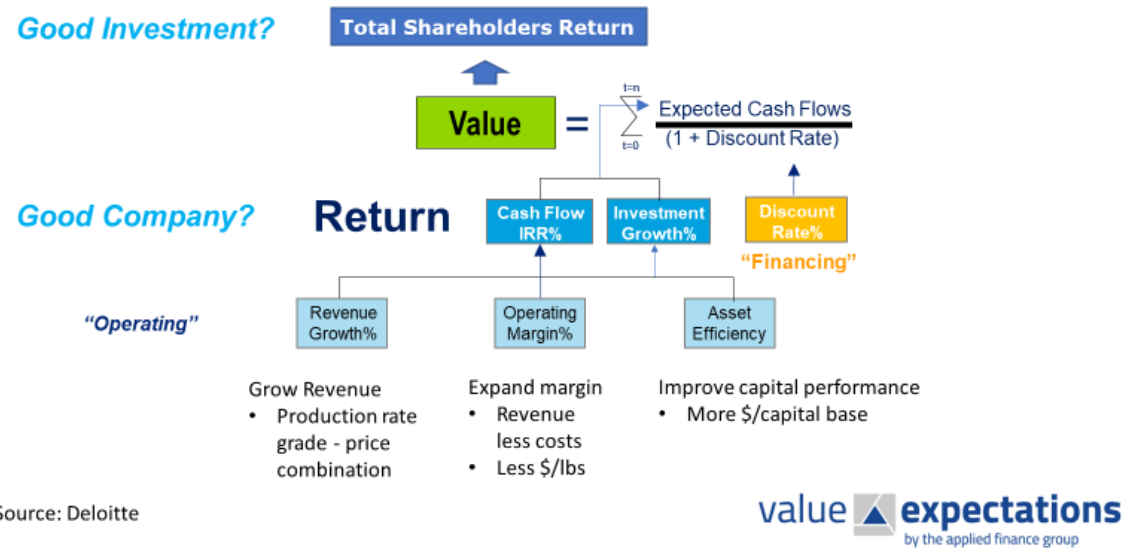


Battery Electric Vehicles – Onaping Depth



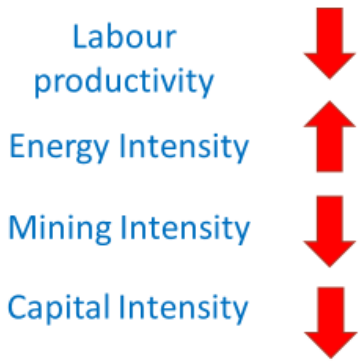
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What does it mean to focus on VALUE?



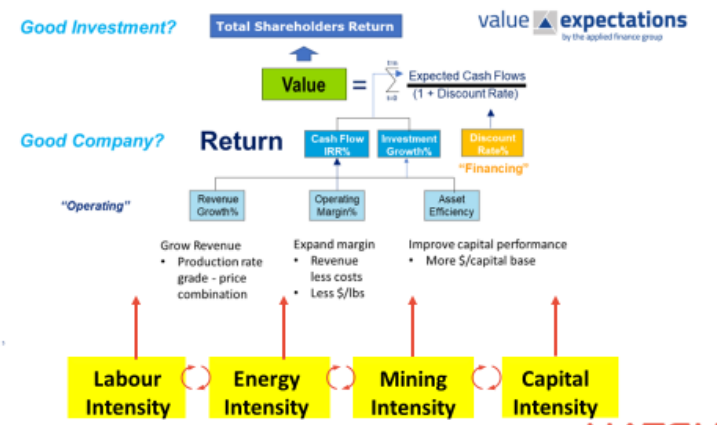
How to translate value measure into a mine operation?

Macro Technical Drivers of Value

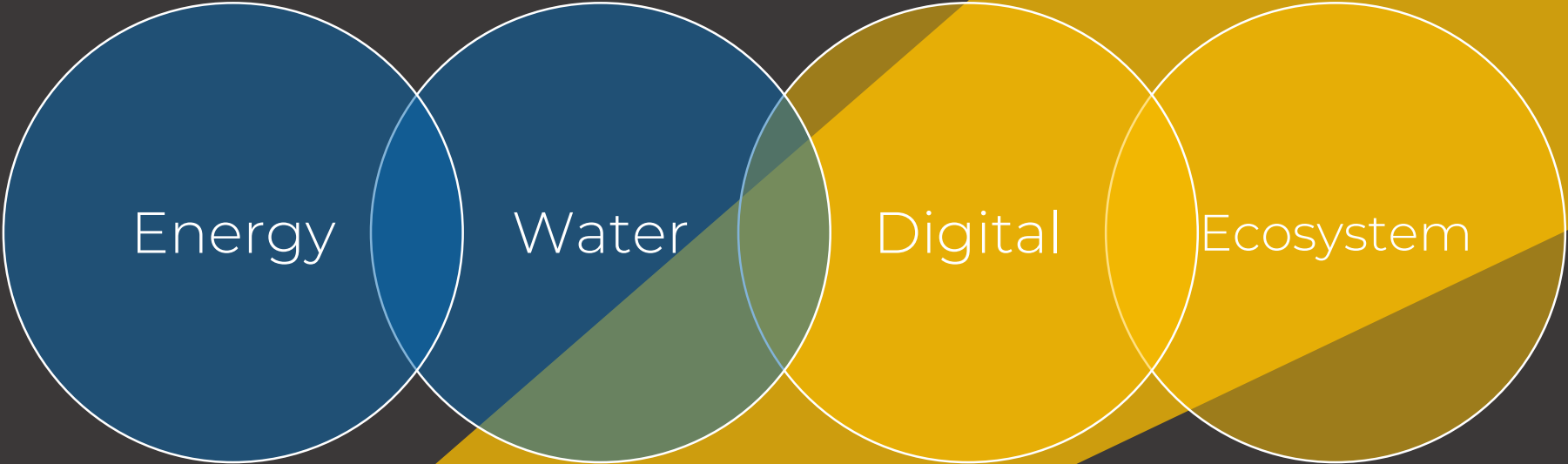


- Margins being squeezed
- Capital performance reducing

What does it mean to focus on VALUE?



Unifiers
across
Translators



Value
Translators



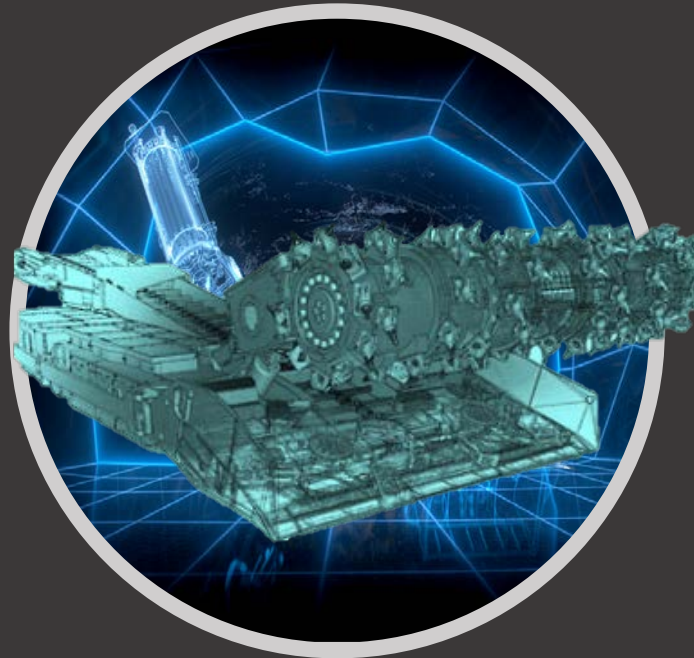
Our Footprint

Powering the design for depth

Safer – Greener – Efficient – Sustainable – Faster to 1st Ore



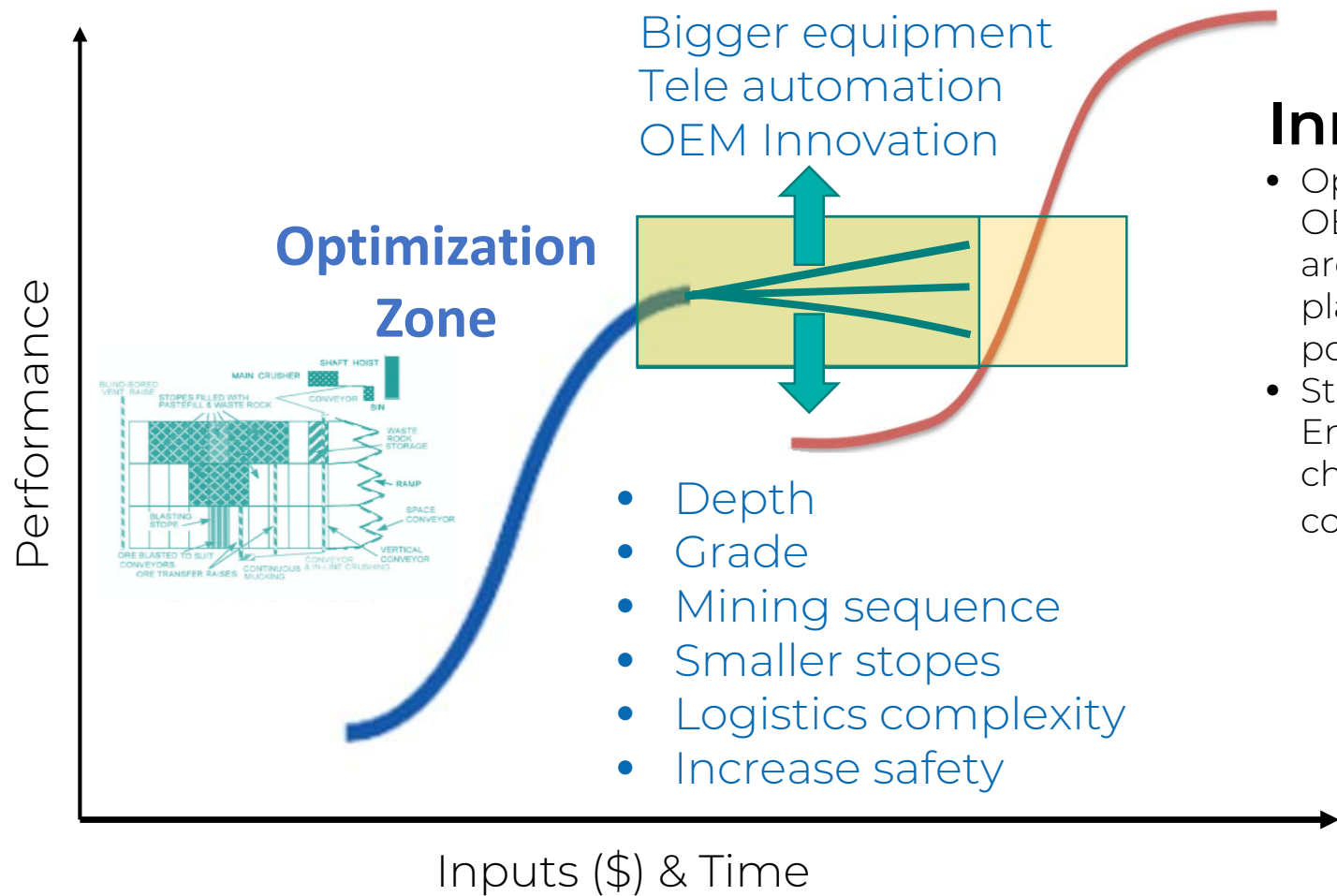
Digital
Transformation



Towards
Continuous
Mining

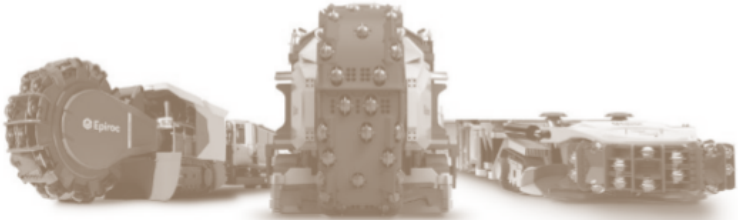
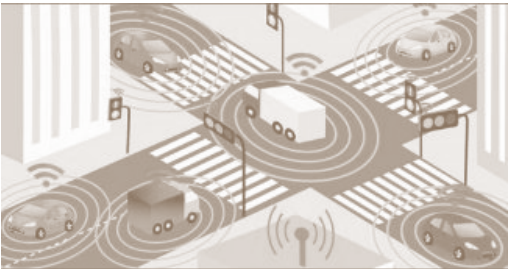


Agile
Ecosystem



Innovation Zone

- Optimisation driven by OEMs and service providers around existing mining platform. Often a series of point solutions.
- Step change needs a new End-to-End mining system change. From batch to continuous.



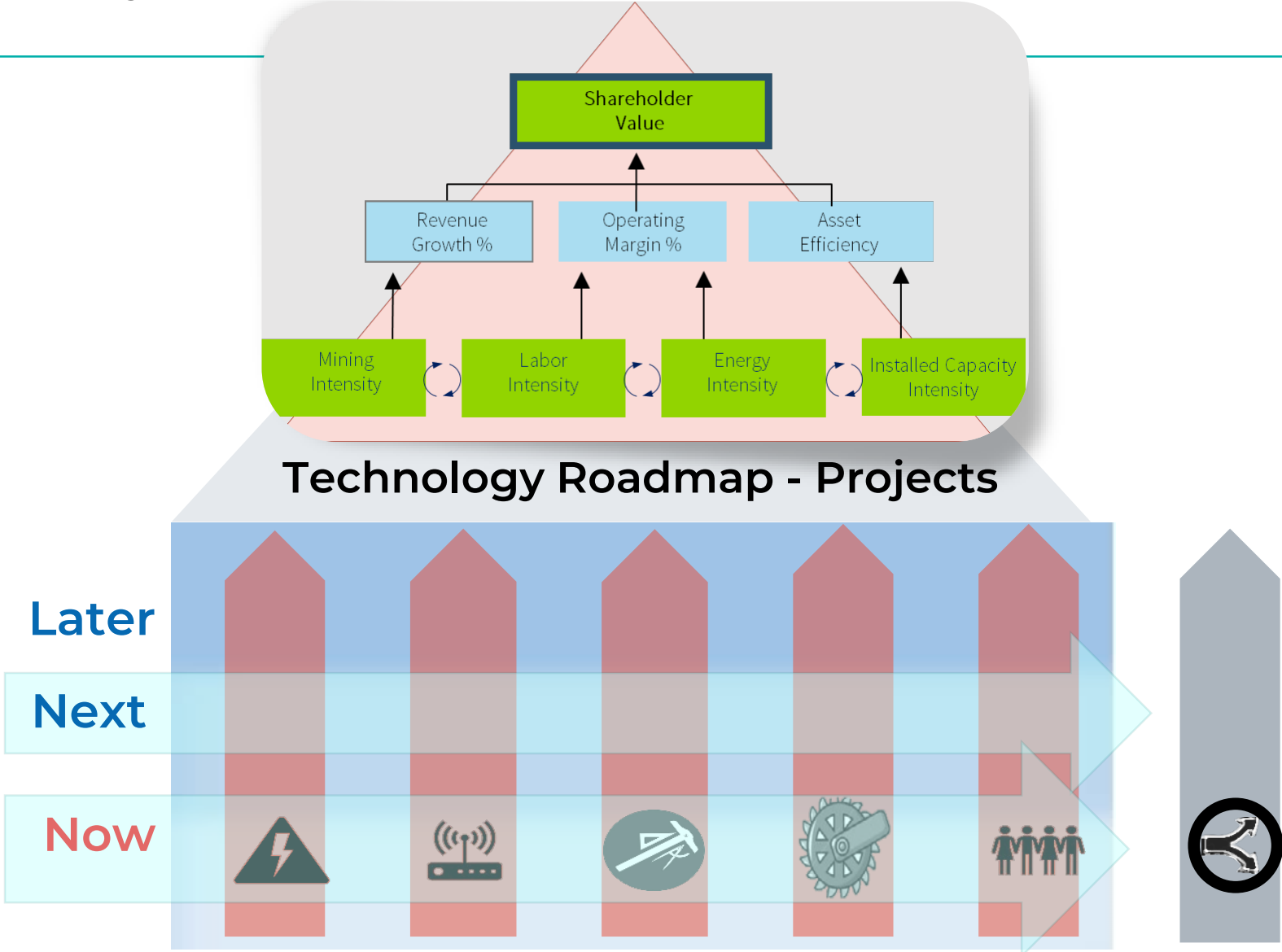
Mobile Miner 40V

Mobile Miner 55V

Mobile Miner 22H

Realizing value

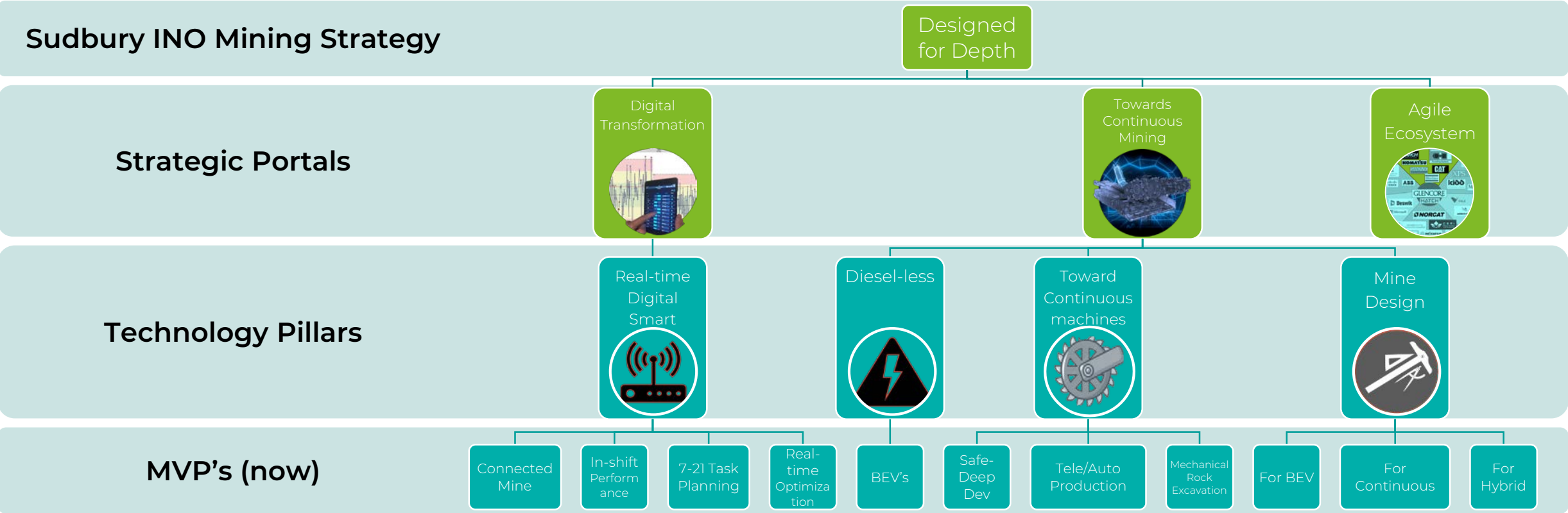
Putting it together – configured for success



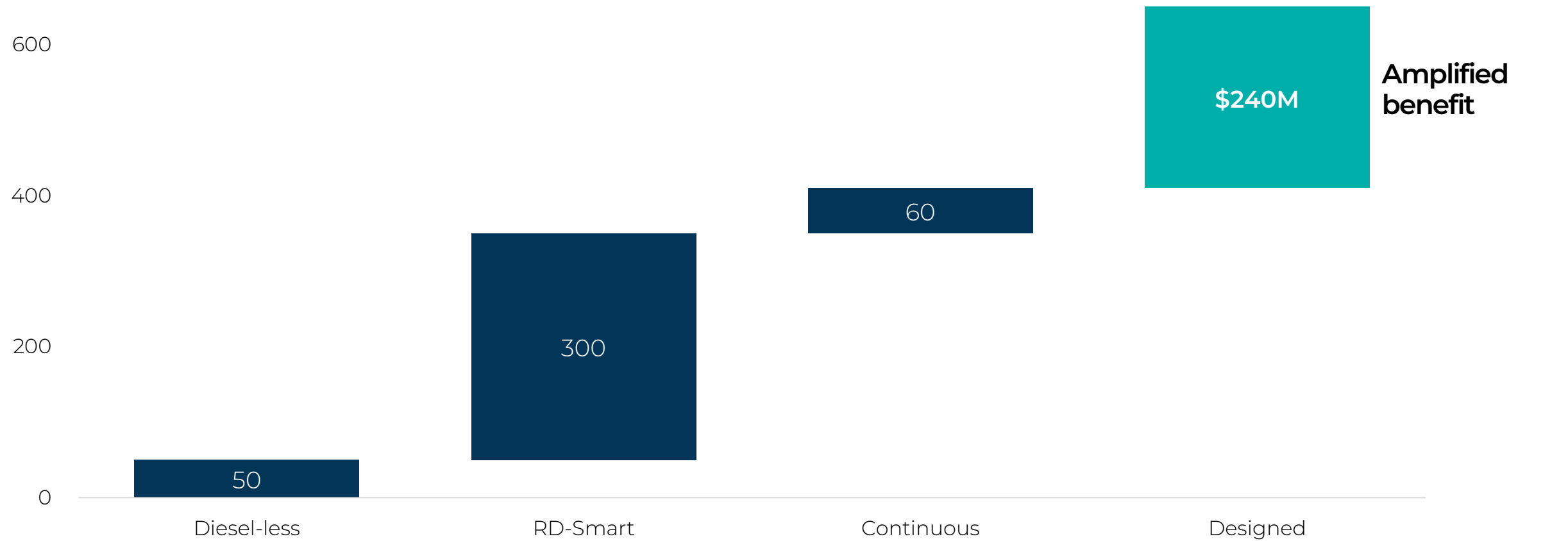
Our future mines

Safely and sustainably designing for depth

Zero Emission	Real Time Information	Maximized Asset Utilization	Safe, Efficient Mining	Industry Collaboration	Minimize Waste Generation
					
Diesel-less	Real-time Digital Smart	Continuous Automated Operations	Mine Designed for Depth	Agile Ecosystem	Concentrate along the path
Completely Electric Mines	Fully integrated digital operations management	Leveraging Step Change in Mining Technology	Engineering out Deep Mining Challenges	Working with our peers to develop solutions	Reduce our environmental footprint
					

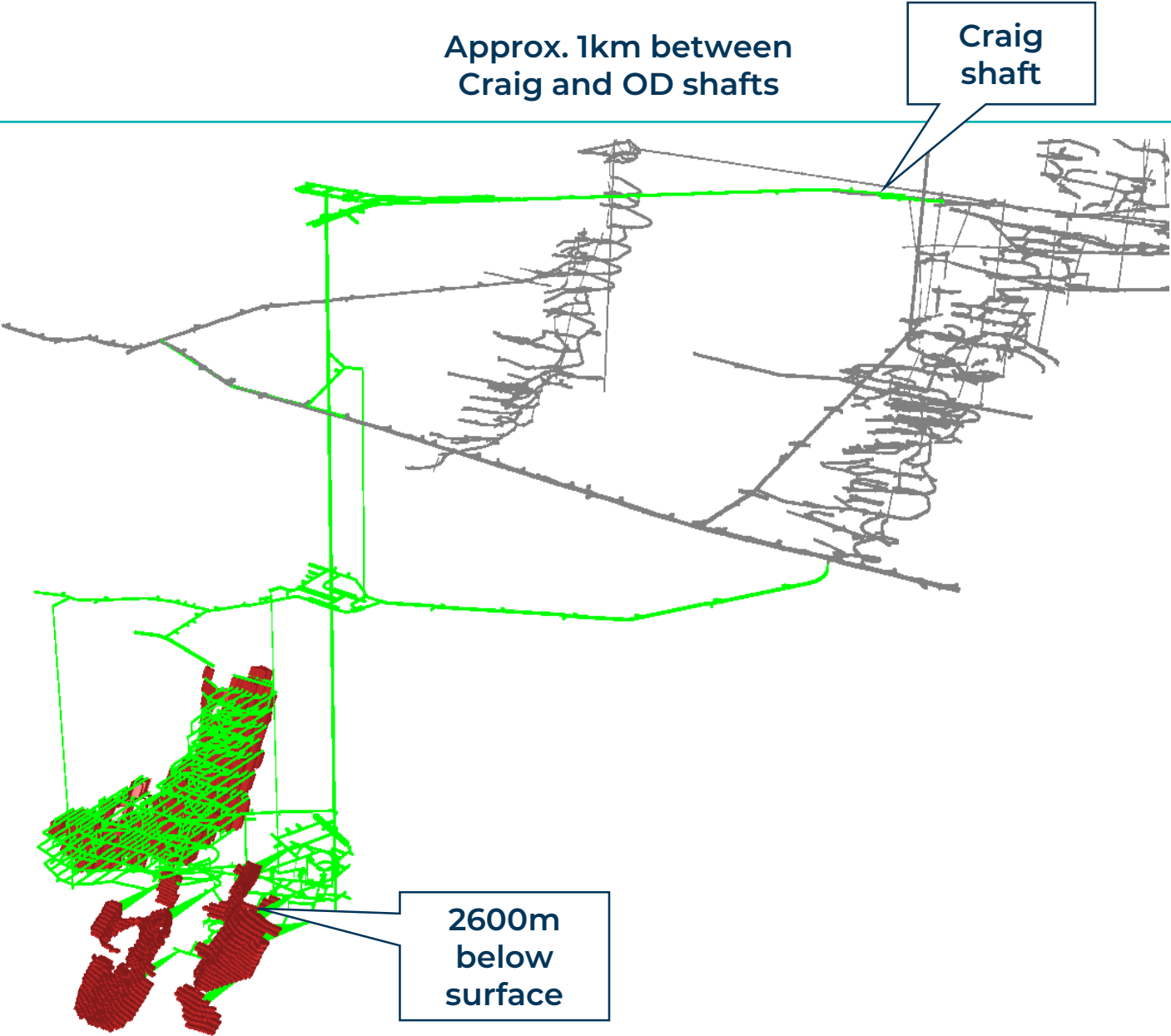


Opportunity Value (\$M)





- Feasibility Study completed end of 2016
- Received project approval of US \$700m in Dec 2017
- Bottom up mining approach supported by a single shaft development
- 100% battery electric operated mobile fleet



100% BEV BENEFITS

- Energy Savings (41%)
- Ventilation savings (40%)
- Cooling System Size (-31%)
- Shaft Diameter (-23%)
- Improved health benefits
- Increased opportunity to improve production profile

ELIMINATED

- Return Air Ventilation Ramp
- Fresh Air Raise
- (3) Ventilation Fans
- (5) Ore Passes (replaced w/ battery electric haul trucks regenerating power down ramp)

ANNUAL GHG EMISSIONS REDUCTIONS

- Diesel: 17,130
- Reduction: 44%
- Battery: 9,620 tCO₂e/yr

AGILE ECOSYSTEM

Industry Trend Setters



canadamining
innovationcouncil



22+ Companies & OEM's

AVAILABILITY

- Prime movers are the main concern (needed mid 2022)
- 40T trucks available now
- First 14T LHD available 2019
- Multiple OEM 14T/18T LHD Operating in 2020
- 40T+ trucks available in 2020

All testing to date showing better than feasibility study metrics (less heat produced, ergonomic, cost to run) and all equipment performing at least as good as theory – CAT, Maclean, FVT, Artisan

EQUIPMENT TRIALS

2016

- UT150 MineCat at Fraser
- UT150 MineCat at NRS

2017

- Papa Bravo personnel carrier at OD
- Maclean Bolter gen 3 at NRS
- Atlas Copco Bolter at NRS
- UDMN project – IFI 250HP Marcotte shotcrete carrier converted to BEV
- CAT 7T LHD BEV Dec 2017 – Field Follow
- Maclean Boom Truck Trial at NRS – Q4 testing and trial

2018

- T&W Commander being tested at Onaping Depth

