



Glencore Sudbury INO

Hidden Depths: Electric Mines and the Transition to Battery Electric Vehicles in Mining Building the mine of the future through Craig Mine - Onaping Depth Project in Sudbury

Presented by Peter Xavier, Vice President BEV Mines to Mobility Conference, May 25th, 2022

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Mining in Ontario (OMA's <u>State of the Ontario Mining Sector</u> report) Sudbury Highlights

Regional Contributions of Major Ontario Mines (2019)

- Ontario mining operations generate benefits in each of Ontario's four regions.
- The majority of contributions at the regional level occur in the Sudbury region with total annual economic contributions of approximately \$7.5 billion in gross output, \$3.3 billion in GDP, \$1.2 billion in wages, and over 20,517 FTE jobs.
- In the Northwest region, mining operations contribute approximately \$2.4 billion in gross output, \$1.5 billion in GDP, \$600 million in wages, and 6,000 FTE jobs at direct, indirect, and induced levels annually.
- Additionally, on an annual basis, Ontario's mining companies contribute a total of \$1.9 billion to Northeast region's output, \$1.7 billion to GDP, \$1 billion in wages, and sustain 16,278 FTE jobs.
- In South Ontario, the mining sector's contributions are estimated at \$1.7 billion in gross output, close to \$1 billion in GDP, \$500 million in wages, and over 5,810 FTE jobs.

Estimated Annual Total Economic Contributions in Ontario's Regions

Indicator		Sudbury	Northwest	Northeast	South	Ontario	
	Gross Output (2019 CAD\$)	\$7.5B	\$2.4B	\$1.9B	\$1.7B	\$13.5B	
	GDP (2019 CAD\$)	\$3.3B	\$1.5B	\$1.7B	\$1B	\$7.5B	
	Wages (2019 CAD\$)	\$1.2B	\$0.6B	\$1B	\$0.5B	\$3.3B	
ۯٛڹٛ	Employment (FTEs)	20,517	6,000	16,278	5,810	48,605	
OMA State of the Ontario Mining Sector			Note: Figures dis regional economi Sources: OMA Ini	Note: Figures display total of direct, indirect, and induced economic contributions to Ontario's regional economies. Figures represent annual contributions based on mineral production in 20 Sources: OMA Industry Survey, Statistics Canada			



Source: <u>State of the Ontario Mining Sector</u>, published by the Ontario Mining Association (OMA) in partnership with Ontario's Ministry of Northern Development, Mines, Natural Resources and Forestry



Mining in Ontario (OMA's State of the Ontario Mining Sector report)

Key Observations

- The majority of Ontario mining companies have adopted environmental technologies in their operations, including:
 - Electrification of mining fleets and mobile equipment;
 - Low carbon technologies;
 - Conversion to natural gas;
 - Water treatment technology to mitigate pollution and recycle water;
 - Air purification technology to maintain air quality underground; and,
 - Energy efficiency technology, such as ventilation on demand to reduce power consumption.

Altogether, these technologies help Ontario's mining companies to meet stringent environmental targets.

- Three-quarters of Ontario's mining companies participate in carbon pricing schemes that aim to lower GHG emissions and spur innovation.
- More than half of Ontario mines have set carbon reduction targets, and almost 40% have established long-term net zero targets. Of those that have not yet established targets, several indicated they are currently developing such targets.

Sources: OMA Industry Survey



OMA State of the Ontario Mining Sector











Glencore Nickel Business and Sudbury Operations

SUDBURY INTEGRATED NICKEL OPERATIONS

Our products in life

The commodities that we mine, produce and market around the world



The products we produce and market play an essential role in modern life.

From the copper, cobalt and nickel powering the electric vehicle revolution, to the energy products helping keep the lights on, what we do touches every part of life as we know it.





Glencore is a key player in the global battery recycling market One of the world's largest processors of secondary battery materials



2020 marked Glencore Nickel's 30th year of processing secondary feed including end-of-life materials, production scrap and waste streams.

In 2021, we recovered 17,900 tonnes of recycled materials containing 4,400 tonnes of nickel, 1,500 tonnes of cobalt and 870 tonnes of copper.

- Glencore Nickel has a long history and is a key participant in battery recycling supply chains.
- Glencore treat the majority of North American
 Co-containing battery scrap materials and is also
 active in European and Asian scrap markets
 processing material through its Canadian,
 Norwegian and Australian facilities.



Sudbury Integrated Nickel Operations, a Glencore Company (Sudbury INO)





Our materials are sent to our port facilities in Quebec City, and to final destination at Glencore's Nikkelverk refinery in Norway.

Sustainability Health & Safety, Environment and Community



Our People

- Highly engaged, Zero Harm culture five times recipient of prestigious John T. Ryan Provincial Safety Award since 2013
- 1200 employees, 1,200 contractors

Environmental Performance

 ISO 14001 certified sites including Port of Quebec

Community Engagement

- Indigenous Partnership Participation Agreement/MoU signed with Wahnapitae, Atikameksheng Anishnawbek, Sagamok Anishnawbek and Métis Nations of Ontario
- Proactive participation in various community initiatives and programs
- Investment of approximately \$19 million over past 12 years







Strathcona Mill



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Sudbury Smelter







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SUDBURY INTEGRATED NICKEL OPERATIONS

Craig Mine Onaping Depth Project & Battery Electric Vehicle



Craig Mine – Onaping Depth Project



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- Feasibility Study Completed in end of 2016
- Received full project approval in Dec 2017
- Blasthole mining approach
 supported by a single shaft
 development
 - 100% battery electric operated mobile fleet
 - Energy efficiency
 - Ventilation savings (lower flow)
 - Cooling system savings
 - Improved health benefits
 - Increased opportunity to improve production profile

Onaping Depth Project Battery Electric - Benefits

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 reductions:

- 1.7 Mm³ Natural Gas
- 2.2ML Diesel Fuel
- 76GWhrelectricity
- 12,120t GHG CO2e Emissions

	Diesel		B	attery Electric
Ventilation	300 m³/s	-40)% →	180 m³/s
RAR Diameter	5.0 m	-24	₩ →	3.8 m
Refrigeration	BAC = 19.2 MWr CSC = 25.3 MWr	-31	% →	BAC = 14.6 MWr CSC = 19.6 MWr
Ventilation Fan Power	10,900 kWe	-44	4% →	6,100 kWe

	Diesel Heat Load per Unit (kWt)	BEV Heat Load per Unit (kWt)
8yd LHD	362	124
40t Haul Truck	456	150

Craig Mine – Onaping Depth Project Permanent Refrigeration Plant





Battery Electric Vehicle





ONAPING

DEPTH PROJECT

Epiroc Suite of Primary Equipment





- Fleet meets our duty and operational simulated requirements
- Epiroc scores high on safety, design and testing of the entire battery system
- Offer large capacity batteries
- Uses standard CCS charging protocol
- Battery swap system
- Universal & compatible





- Scores high on safety, design and testing of the entire battery system
- Uses standard CCS charging protocol
- Battery supplier same as Kovatera
- Onboard charging







- Scores high on safety, design and testing of the entire battery system
- Uses standard CCS charging protocol
- Batteries supplier same as MacLean
- Onboard charging



Batteries



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- Both have on board battery management systems (BMS) ٠
- Both have integrated cooling systems ٠
- Both have safety systems built into the design •
- Both use Lithium-Ion technology



- Take advantage of re-generation
- Battery swapping vs batteries stay in vehicle
- Charging strategy (fixed vs opportunity, duration and range anxiety)
- Charger sizes
- Charging management systems
- Parking and charging locations
- Machine productivity as in vehicle charging time is unavailable time
- Operator impact on battery effectiveness
- Machine and battery maintenance
- Emergency response plans







