

Advanced analytics can help achieve 5–10 percent hauling fuel optimization in open-pit mining

Commentary

Metals mining contributes 3–4% to global CO₂ emissions. For open-pit mining, ~45% of **carbon emissions** are typically Scope 1, of which ~35% come from fuel consumed in **hauling**.



Fuel optimization achieved by harnessing existing data and machine learning **can reduce carbon emissions immediately** while alternative technologies to diesel for off-highway trucks are developed and scaled.

Case example

Open Pit Mine



55 mining trucks
220 tonnes



50MI annual fuel consumption
30–40% of hauling cost



Over 130,000 tonnes CO₂
emitted by trucks annually

US \$4M–7M annual savings

Fuel 5–10% fuel reduction
(US \$3M–6M)

CO₂ emissions reduction Up to **15,000 tonnes**
(US \$0.5M–1.1M carbon credit)

A proven machine-learning platform enables discovery of correlations and highlights **drivers of fuel consumption based on a truck fleet's past performance** by connecting fleet management, enterprise asset management, machine IoT, and other operational data (e.g., tire pressure, road layout and quality sensors, fuel quality). In addition, creation of a **digital twin** makes it possible to solve for fuel efficiency while maintaining productivity and integrating with both internal and external datasets.

 **Targeted upskilling** of a small group of operators (20%) can realize a majority of fuel-saving opportunities (80%)

 Focusing on a **few segments of the haul road network** will have the greatest impact on fuel savings

 **Exhaust temperatures** between **560–590°C** lead to better fuel efficiency

 Targeting a certain range of **gear shift counts** per cycle (round trip) results in optimal specific fuel consumption

As ore grades decrease and pits become deeper, hauling—and its associated costs—are now of greater importance to maintain mine opex. McKinsey experience shows that leveraging proven machine-learning-based solutions, along with a change in management strategy, can improve hauling fuel efficiency relatively quickly and with limited investment.

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