



Battery Powered Mobile Equipment

October 2015



BATTERY OPERATED MOBILE EQUIPMENT

KIRKLAND LAKE GOLD

Kirkland Lake Camp

- ◆ The Kirkland Lake gold camp has been in production for over 100 years
- ◆ One of the highest grade gold camps in the world
- ◆ Almost 25 Moz's has been produced to date, from seven mines
- ◆ KGI owns five former producing high grade mines with historical production of ~22 Moz's of gold
- ◆ Average head grade of 0.44 opt or 15.1 g/t
- ◆ Currently only mining and exploration on one of these past producers

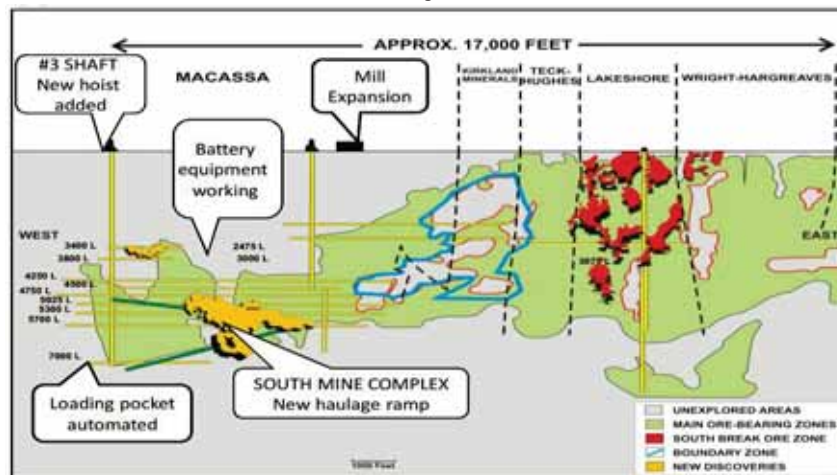
TSX:KGI 7 klgold.com

BATTERY POWERED MOBILE EQUIPMENT

HISTORY

WHY THE SHIFT TO BATTERY POWERED MOBILE EQUIPMENT?

- New ore zone found below 5000L;
- Expansion of production from 82koz Fiscal 2011 to 155koz Fiscal 2015;
- Limited short term expansion options;
- Conventional electric offer limited flexibility.



BATTERY POWERED MOBILE EQUIPMENT

PARTNERS

- Artisan – Battery designer and fabricator
 - California
- RDH – Equipment builder
 - Sudbury
- Adria – Charger constructor
 - Rouyn-Noranda



BATTERY POWERED MOBILE EQUIPMENT

BENEFITS

VENTILATION

- 12 x 3yrd LHDs
 - Typically powered with 174bhp (130kWhr) engine;
 - 208,800cfm.

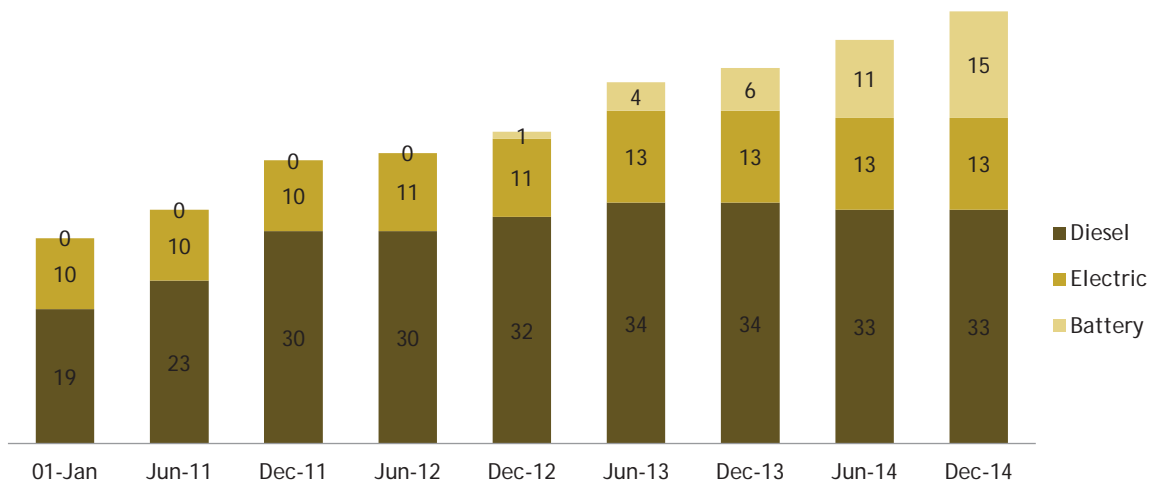
- 3 x 20 ton Haul Trucks
 - Typically powered with 300bhp (170 kWh) engine;
 - 90,000cfm.

- Total air offset of 298,800cfm.
- Mine total airflow <300,000cfm.



BATTERY POWERED MOBILE EQUIPMENT

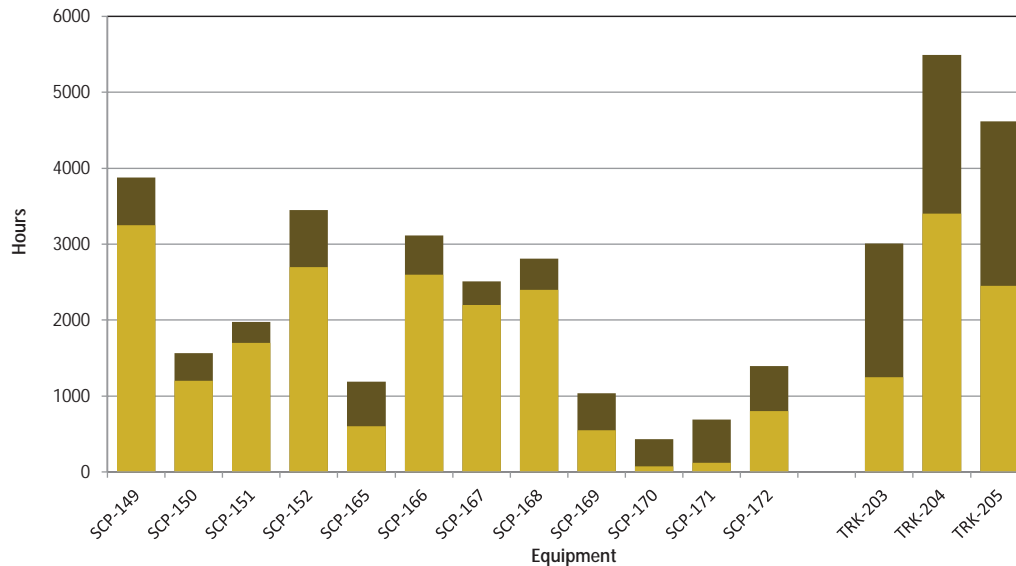
UNDERGROUND MOBILE FLEET BREAKDOWN



BATTERY POWERED MOBILE EQUIPMENT

UTILIZATION

TOTAL RUNTIME JAN 2015 AND OCT 2015



BATTERY POWERED MOBILE EQUIPMENT

CAPEX

EQUIPMENT PURCHASES

SCOOP		TRUCK		SPARES	
<u>3 Yard</u>	<u>\$940,000</u>	<u>20 Ton</u>	<u>\$1,650,000</u>	<u>Batteries</u>	<u>\$1,400,000</u>
LHD	\$700,000	Truck	\$1,010,000	Scoop Batteries (x8)	\$1,200,000
Battery (x1)	\$150,000	Batteries (x3)	\$550,000	Truck Battery (x1)	\$200,000
Charger (x1)	\$90,000	Charger (x1)	\$90,000		

SCOOP		TRUCK		SPARES	
12 Units	\$11,280,000	3 Units	\$4,950,000	n/a	\$1,400,000

Total
\$17,630,000

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OPERATING EXPENSES

In Fiscal 2015, battery LHDs averaged:

- 164% of diesel LHD cost per hour;
- 125% of conventional electric LHD cost per hour.

In Fiscal 2015, battery trucks averaged:

- 65% of diesel LHD cost per hour.

Concerns:

- Data includes some capex costs (motor upgrades, cooler improvements, etc.);
- Lifecycle costs not known (limited hours to date);
- Relatively new equipment, does not capture high cost repairs of cell replacement, or potential cost if a component experiences premature failure.



BATTERY POWERED MOBILE EQUIPMENT

OPERATING METHODS

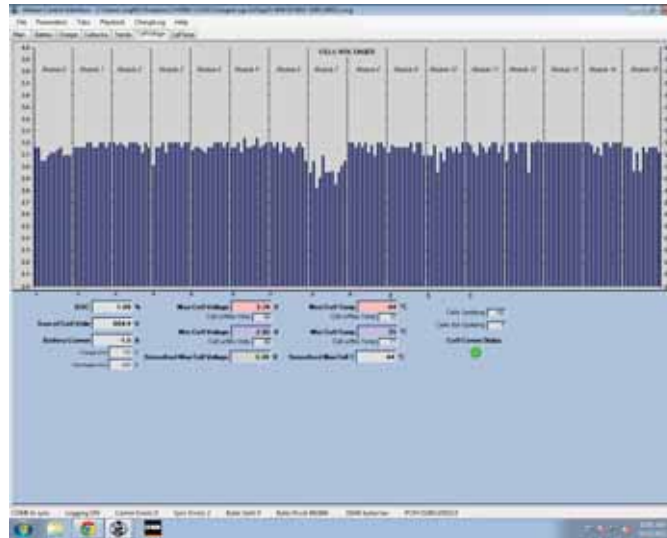
Standardized Components (Charger, Cells, Modules, Controls and Software).



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OPERATING METHODS

Software Troubleshooting Tools



BATTERY POWERED MOBILE EQUIPMENT

OPERATING METHODS

Replace battery, instead of very fast charge (Charge in 3 hrs, Change in 15 mins).



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CHALLENGES

Past:

- LHD motor and coupler failures;
- LHD/Truck cooling system;
- Motor loss of torque interlock;
- LV and HV connectors and latches;
- Software issues (SoC loss, etc.).



Current:

- Ambient Heat
 - Performance limited at 30°C ambient, reviewing options to increase heat rejection from battery packs.
- Battery Construction
 - Cell board issues, causing unnecessary performance loss;
 - Damage due to rough LHD application.
- Experienced technical support
 - Extensive training required, steep learning curve, a dedicated group to work on battery equipment has been created.

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UNKNOWNNS

Battery replacement cost

- Do we consistently get 2000 cycles per cell?

Future cell prices

- Price declining with increased market volume, how low will it go?

Ability to deal with battery heat

- How effectively will we be able to increase power capacity by cooling battery?
- What is the best tradeoff between cost/reliability and machine performance?

Adaptability to the operation

- How will technology scale to smaller and larger units?
- 1.5 yd , 2yd units being developed for narrow stops.

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FLEET EXPANSION

New Orders:

- Atlas Copco:
 - MT20 Truck (First unit ug);
 - ST7 3.5yd LHD;
 - ST2GS 2 yd LHD.



Retrofit of Existing Fleet

- Artisan converting Sandvik 202 to battery power. 1.5yd LHD (Target end of 2015)

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FLEET EXPANSION

Targeted Performance Increases

- Faster travel speed
- Longer run time
- Increased reliability



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A FEW QUESTIONS TO CONSIDER

- What are the vent requirements (design vent for base load or peak load)?
- Is there sufficient air to clear blast, control heat?
- Will increased ventilation be required during operation? May have to increase vent anyway.
- Is it quicker to increase ventilation versus the lead time for battery equipment?
- How will equipment be maintained, does maintenance have the resources?



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QUESTIONS?

