MODULAR

CASE STUDY

LOCATION:
Brazil

OBJECTIVE:
To reduce haul truck fuel consumption

OUTCOME:
82,795 L annual fuel savings by eliminating excessive engine throttle during dumping

Reduce Haul Truck Fuel Consumption

A MineCare customer shares how minor modifications to operator behavior during the dumping cycle can generate significant fuel savings.

Challenge

Today's mining haul trucks consume huge volumes of fuel as they move hundreds of thousands of tons around the clock. Mine managers are always looking for ways to reduce this considerable operating cost. In this case study, we'll explore how a Modular customer identified a potential opportunity to save fuel during the dumping cycle. They were surprised to find that a simple change in operator behavior could result in significant annual fuel savings.

"The MineCare system enabled us to improve more than just equipment reliability, identifying and correcting operator behavior that wastes fuel."
—Corporate Reliability Advisor

Solution

With a fleet of 72 240-ton haul trucks, the mine knew they had a huge opportunity to save fuel. Modular engineers selected a control group of roughly 1/3 of the fleet, and installed a set of MineCare trends to capture fuel consumption and engine speed while dumping. Using DISPATCH production data, results were extrapolated to reveal a substantial cost saving opportunity.

Data Capture & Analysis

When the customer asked for an explanation behind spikes in fuel consumption during dumping, Modular Engineers went to site to capture data. Using the MineCare trending application, they set up triggers to collect both engine speed and fuel consumption for each of the following scenarios:

» Scenario 1: Engine Speed >1500 RPM, bed up (dumping)

» Scenario 2: Engine Speed >1900 RPM, bed up (dumping)

For a one-month period, events were recorded when a trigger indicated a load was being dumped with engine speed in excess of 1900 RPM.

Using the DISPATCH system, the weekly load average for the 26 truck control was calculated to be 5763. Compared to the average weekly alarms of 1728, this produced a probability of 30% that a given dumping cycle exhibited excessive engine speed.

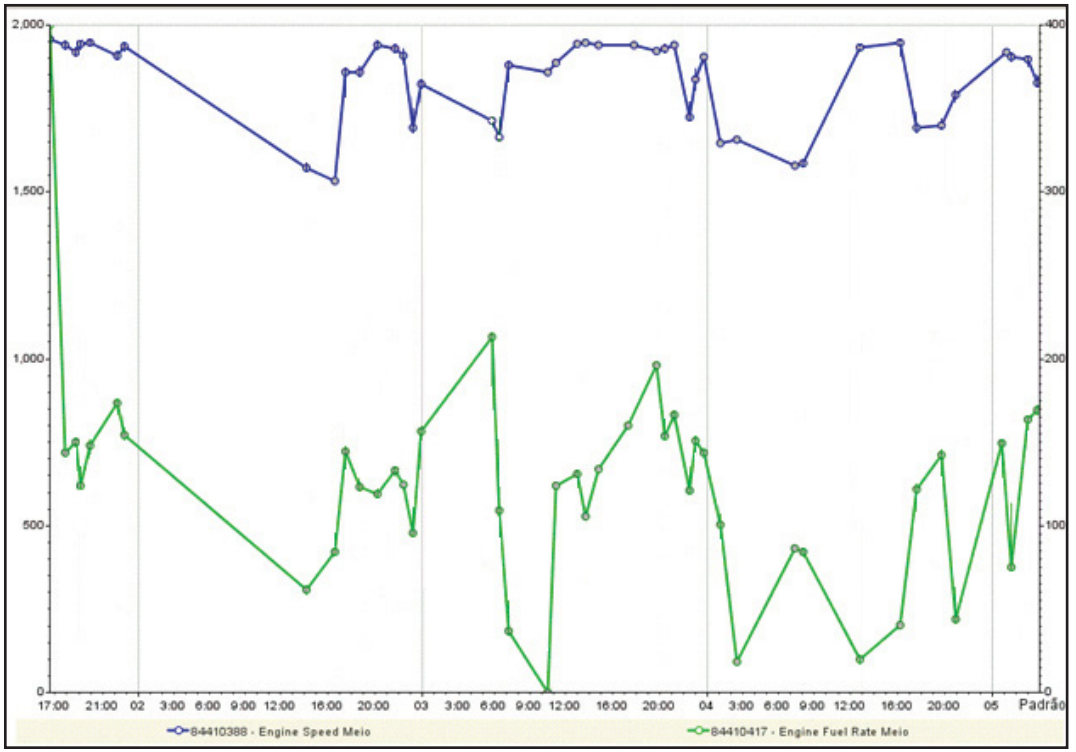

Figure 1: A MineCare trend graph shows the relationship between engine speed (blue) and fuel consumption rate (green).

DATE RANGE	# ALARMS (EXCESSIVE RPM WITH BODY UP)	% TRUCKS AFFECTED
03 - 09 May	1564	27.14
10 - 16 May	1928	33.45
17 - 23 May	527	9.14
24 - 30 May	2289	39.72
31 May - 06 June	2334	40.50
Avg # Alarms per Week	**1728**	**29.99%**

Data Capture & Analysis

Using empirical analysis, it was discovered that average fuel consumption rate nearly doubles when engine speed increases from 1500 to 1900 RPM.

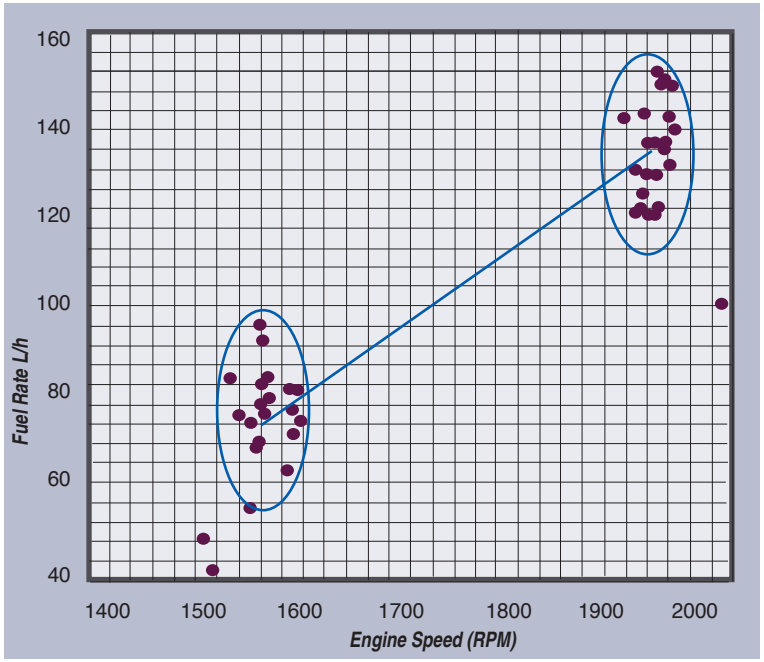

Figure 3: Notable increase in fuel consumption rate between 1500 and 1900 RPM

	Normal Idling Engine Speed		Excessive Engine Speed	
	RPM	L/h	RPM	L/h
Truck 1	1.557	69,45	1.918	128,68
	1.592	81,55	1.913	120,96
	1.590	71,92	1.915	124,57
Truck 2	1.559	70,35	1.908	129,65
	1.590	77,32	1.915	141,81
	1.598	75,03	1.909	120,38
Truck 3	1.562	92,62	1.935	148,96
	1.585	63,97	1.934	133,84
	1.566	84,06	1.940	130,51
Truck 4	1.559	95,72	1.920	135,40
	1.541	76,18	1.928	121,28
	1.531	84,07	1.942	147,81
Truck 5	1.551	56,07	1.897	140,76
	1.561	83,01	1.921	119,72
	1.560	78,66	1.939	141,06
Truck 6	1.506	49,24	1.936	135,41
	1.515	42,50	1.945	137,86
	1.568	79,96	1.925	135,26
Truck 7	1.586	81,75	1.929	150,99
	1.564	76,54	1.926	128,71
	1.551	74,59	1.933	148,43
Average	1,526 RPM = 74.50 L/h		1,925 RPM = 134.38 L/h	

Figure 4: Average fuel consumption rate nearly doubles when engine speed jumps from 1500 RPM to 1900 RPM

Theoretical Fuel Savings Estimation

The engineering team calculated that the dump time per truck averaged 20 seconds based on historical performance data gathered from the DISPATCH system. The data showed that dumping time was not affected by engine speed, i.e. operators pushing the accelerator pedal while dumping did not raise the bed any faster than those that didn't. However, this behavior did consume 80% more fuel.

Combining data gathered from both systems, a theoretical maximum annual fuel savings was calculated on a per truck basis. The total cost savings associated with solving excessive engine RPM during dumping can be extrapolated to the entire truck fleet using the annual cost savings/truck across a range of 30% to 100% of total loads. This provides an expected minimum savings based on the 26 truck control group, but also a potential maximum savings assuming all truck operators exhibit the behavior.

At 30% of the total loads, the 72 truck fleet fuel savings can be estimated at 83,000 L per year. However, the total potential cost savings at 100% of loads is over 275,000 L per year. This scenario would save 736 metric tons of CO2 from being released into the atmosphere—the amount it would take 157 acres of pine or fir forests to annually sequester, or equivalent to recycling 247 metric tons of waste every year.

	Actual Sample (30% of Loads)	Theoretical Worst Case (100% of Loads)	Best Practice (0% of Loads)
Average Dump Time	20 seconds	20 seconds	20 seconds
Average Fuel Rate	92.46 L/hr	134.38 L/hr	74.5 L/hr
Avg. Fuel (consumed while dumping)	.514 L	.747 L	.414 L
Average Loads/week	222	222	222
Total Fuel Consumed While Dumping Per Year	**5,933.6 L**	**8,623.4 L**	**4,779.2 L**

Maximum Annual Fuel Savings per Truck: 3,844.2 L

Conclusion

Assuming an average fuel price of US$1.21/L, the expected range of savings for this customer is between $100,000 and $335,000 per year. This demonstrates that a relatively simple exercise in researching operator behavior can translate to real and substantial annual cost savings, and shows that the MineCare system can be used to alter operator behavior, directly impacting operating costs.

POTENTIAL COST AVOIDED: $335,000

More detailed information on the technical calculations of this case study is available. Please contact your Modular account manager for more information on how the MineCare system can empower your maintenance team to achieve excellence.

LEGAL NOTICE

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