### Challenge
- Each site hauls 200,000+ tons of material/day
  - Consistent and predictable hauling routes
- Experiencing wild variations in fuel usage
- Fuel accounts for up to 30% of energy usage
- Tried many things to optimize fuel
  - Paths, speeds, & investing in newer trucks
- Early modeling suffered from
  - Biasing
  - Overtraining

### Solution
- Transform unstructured time series data
- Build model to estimate fuel burn rate per truck
  - Benchmark actual values against observed
- Model generalized well across the fleet
  - Doesn't overfit for certain trucks/truck models
- Push real-time data to user-friendly dashboard
  - Adjust parameters & explore results

### Impact
- Found most important factors for consistent fuel burn:
  - Oil level & quality indicators
  - Based on sensor data and last tune-up
- Load weight
- Able to precisely forecast fuel consumption
- Able to prevent trucks from performing poorly
  - Detect anomalies
  - Perform maintenance proactively
- Decreased operating expenses by millions per year

**Problem type:** Forecasting & predictive maintenance

**Universal relevance:** Unexpected variability makes it difficult to manage business performance. Understanding the causes of the variability leads to processes that improve consistency and generate reliable outcomes.