Technical Breakdown: MPG Efficiency Gain

1. The Energy Penalty of Fatigue

Every time a fatigued driver triggers a telematics event (e.g., harsh braking), the vehicle loses kinetic energy. To regain cruising speed, the engine must enter a high-torque state, consuming excess fuel.

- **The Benchmark:** Research by the **Oak Ridge National Laboratory (ORNL)** and **VTTI (Virginia Tech Transportation Institute)** identifies that a standard Class 8 truck wastes **0.25 to 0.5 gallons** of diesel per aggressive "Stop-Start" cycle. We use **0.25 gal** as our conservative floor.

2. The Segmented Calculation

We do not apply savings to the entire fleet simultaneously, as alert drivers are already performing near the efficiency ceiling.

- **Prevalence (50%):** We identify the half of the fleet currently operating at risk (ReadiScore < 70).
- **The Delta (8.36 events):** These drivers generate an average of 8.36 *excess* events per 450 miles compared to the alert baseline.
- **The Waste:** $8.36 \text{ events} \times 0.25 \text{ gallons} = \mathbf{2.09 \text{ gallons}}$ of fuel waste per shift for these drivers.

3. The Fatigue Science Intervention

By implementing predictive fatigue monitoring, we reduce that specific waste segment by **40%**.

- **Gallons Saved per Truck:** $2.09 \text{ gal} \times 40\% = \mathbf{0.836 \text{ gallons}}$ recovered per shift.
- **Annual Savings (100 Trucks):** In a 100-truck fleet with 50% prevalence, this recovers roughly **10,800 gallons** per year.

4. Translating to Fleet-Wide MPG

- **Baseline:** 100 trucks driving 450 miles for 260 days at 6.5 MPG will consume **1,800,000 gallons**.
- **With FS:** The fleet now consumes **1,789,200 gallons** to travel the same distance.
- **The Result:** A **~0.6% to 1.2% total fleet-wide MPG improvement**, depending on mileage intensity.