

# ADVANCED ENERGY SOLUTIONS

## EMD® Joule

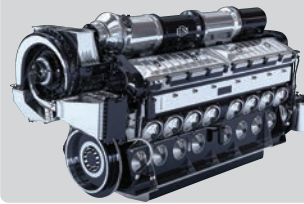
### Battery Electric and Hybrid Locomotives

- Zero exhaust emissions capable
- Available with up to 14.5 MWh, providing industry-leading locomotive performance across seven model types
- Announced deployments with six global railroads



## Renewable & Bio Fuels

- Assessing long-term component durability and operational impact
- Worldwide operational experience with bio and renewable blends
- Testing of up to 100% bio or renewable fuels



**Over 25,000**  
EMD® engines  
capable of operating  
using 20% biodiesel

### Liquefied Natural Gas (LNG) and Dynamic Gas Blending (DGB)

- Global revenue service demonstrations

### Future Fuels: Hydrogen, Methanol, and Ethanol

- Leveraging Caterpillar Engine Research
  - Performance Simulation
  - Fuel Injector Developments

## Hydrogen Fuel Cell

- Collaboration with Caterpillar, BNSF, and Chevron
- Technology evaluation and demonstration



**WE KEEP YOU ROLLING**

**Progress Rail**  
A Caterpillar Company

# RESILIENT TECHNOLOGY SOLUTIONS

## Talos™ Train Automation

### Energy Management

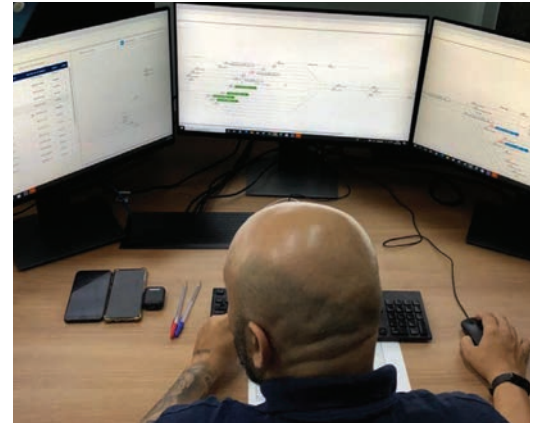
- Leverages machine learning and artificial intelligence to encode locomotive engineer behavior, analyze train runs and optimize train operation
- Up to 15% higher overall fuel savings and emissions reductions
- Improved train handling to reduce the risk of derailment
- Increased network capacity



## Nitro Suite

The Nitro suite combines artificial intelligence, data science and modern software engineering to improve operational efficiencies. The suite includes NitroMP, NitroPacing, NitroETA, NitroYard, and NitroRPC. Filling the gap between the tactical planning and operations, Nitro Suite products enhance the ability of humans to choose the best course of action to improve operations. The Nitro Suite can:

- Increase safety, efficiency, capacity, and ETA/ETD accuracy
- Improve network velocity by up to 14%
- Reduce dwell time up to 10%
- Realize fuel savings up to 5%



## PowerView™ Suite

From our locomotive event recorder, to fuel monitoring, to our PowerView Connect remote monitoring, we have what you need to keep your railroads rolling safely while saving time and money.



## PR Uptime™

Serves as a next-generation analytics platform to monitor locomotives and fleets, empowering operators to minimize road failures and optimize performance.

- Optimizes railroad ability to make proactive decisions on the track, in the shop, and in the yard.

