

Find Out How to Reduce Fuel & Maintenance Expenditures by \$87K per Locomotive, And Decrease GHG Emissions, with an Idle Reduction System from ACS-RS

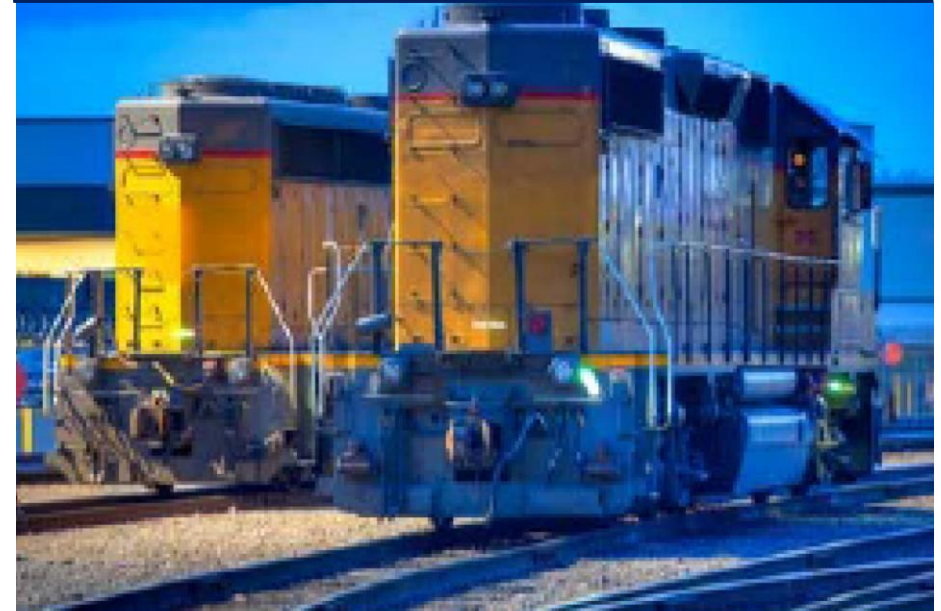
In Use



Moving cars around and positioning them to form a train

Typically Seven Hours Per Day

Parked



When not in use, Locomotive Engines cannot be turned off for an extended time periods:

- Risk of not being able to restart due to battery discharge
- A variety of on-board systems may need to remain operational

A Yard Locomotive could idle for 17 hrs/day, equating to:

- 87 Gallons of additional fuel use
- 2000+ lbs of additional GHG emissions

ACS Railroad Solutions Introduces the Next Generation in Idle Reduction Technology



AESS systems are a common method to reduce idle time but the binary nature of how they operate can often mitigate their effectiveness

The ACS-RS Electrolyte system provides all the functionality of an AESS, supplemented by a 33 kWh L-I Energy Module that can overcome many of the inefficiencies of a legacy AESS system



When the Locomotive Engine is in an off state

HVAC system is not operational	→	HVAC system fully operational - Crew is kept comfortable eliminating a primary reason for an AESS override
Lighting, Safety, Analytic and all other peripheral systems not operational	→	Most peripheral systems stay operational - Lighting remains active, Video footage and Predictive maintenance/locomotive analytic data continue to be captured
Brake Air pressure not maintained	→	Make-up air compressor is powered - Air brake pressure is maintained, eliminating one of the most common causes of an engine restart
Lead-Acid battery charge dissipates	→	Lead-Acid batteries are recharged - Ensure reliable restarts, L-I batteries can even assist the restart as required

ACS-RS Electrolyte System Can Reduce Idle Time Between 62% - 84%

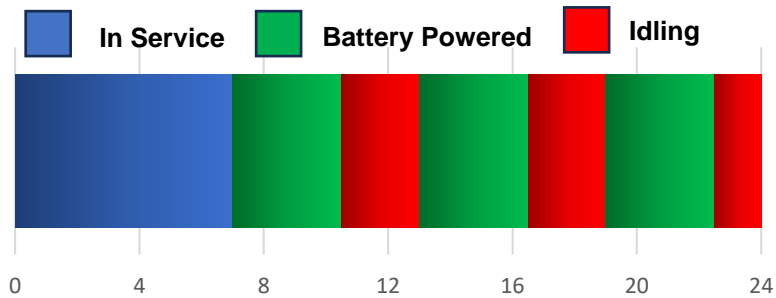


A Low Horsepower Locomotive can idle up to 4500 hours a year, based on it being in service 270 days a year/7 hours a day

Idle Reduction Time Scenarios – 24 Hr. Operational Period

Scenario #1 (Worst Case) - Locomotive service time is consecutive and all systems fully powered

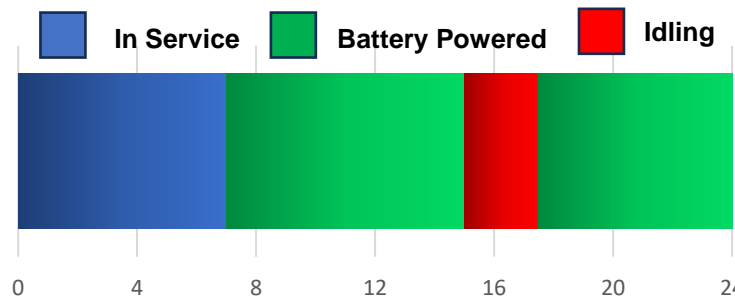
- Locomotive systems are run off of L-I powerpack for 3.5 Hours
- L-I powerpack recharges for 2.5 hours while locomotive idles



- Idle Time Reduced by 10.5 Hrs (62%)
- Yearly Fuel & Maintenance Savings of \$81K (@ \$4.00/gal)

Scenario #2 (Best Case) - HVAC systems not engaged

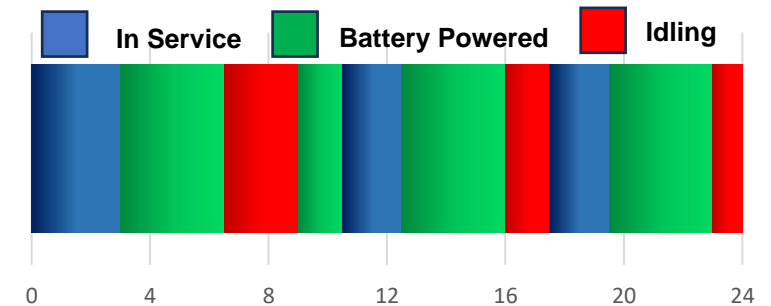
- Locomotive systems are run off of L-I powerpack for 8 Hours
- L-I powerpack recharges for 2.5 hours while locomotive idles



- Idle Time Reduced by 14.2 Hrs (84%)
- Yearly Fuel & Maintenance Savings of \$107K (@ \$4.00/gal)

Scenario #3 (Real World) – Locomotive Service Time is random and all systems fully powered

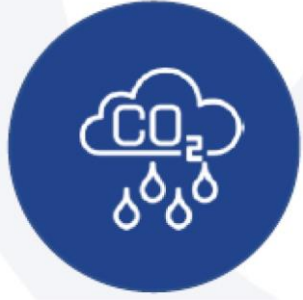
- Locomotive systems are run off of L-I powerpack for 3.5 Hrs. or until Locomotive goes into service
- L-I powerpack recharges for 2.5 hours while locomotive idles or is in Service



- Idle Time Reduced by 11.4 Hrs (67%)
- Yearly Fuel & Maintenance Savings of \$87K (@ \$4.00/gal)

Battery Power and Recharge Times Based on Norfolk Southern Pilot Program

The ACS-RS *Electrolyte Power System* Also Provides a Variety of Non-Financial Benefits



Reduced Green House Gas Emissions

- Proportional decrease in both running and cold start emissions (Approx 2000 lbs./day)
- Reduction in:
 - NOX
 - SO2
 - CO
 - CH4
 - CO2
 - O3
- Reduction in other EPA regulated pollutants
 - Unburned Diesel Fuel
 - Engine oil slip into exhaust



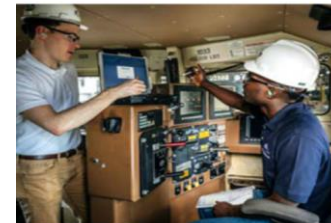
More Reliable Engine Starts

- ACS-RS *Electrolyte Power System* trickle charges the Lead Acid Batteries so they are ready to go when the Locomotive needs to restart
- For optimum results, pair with the ACS-RS Battery Cranking Monitor to provide in-cab display of battery voltage levels

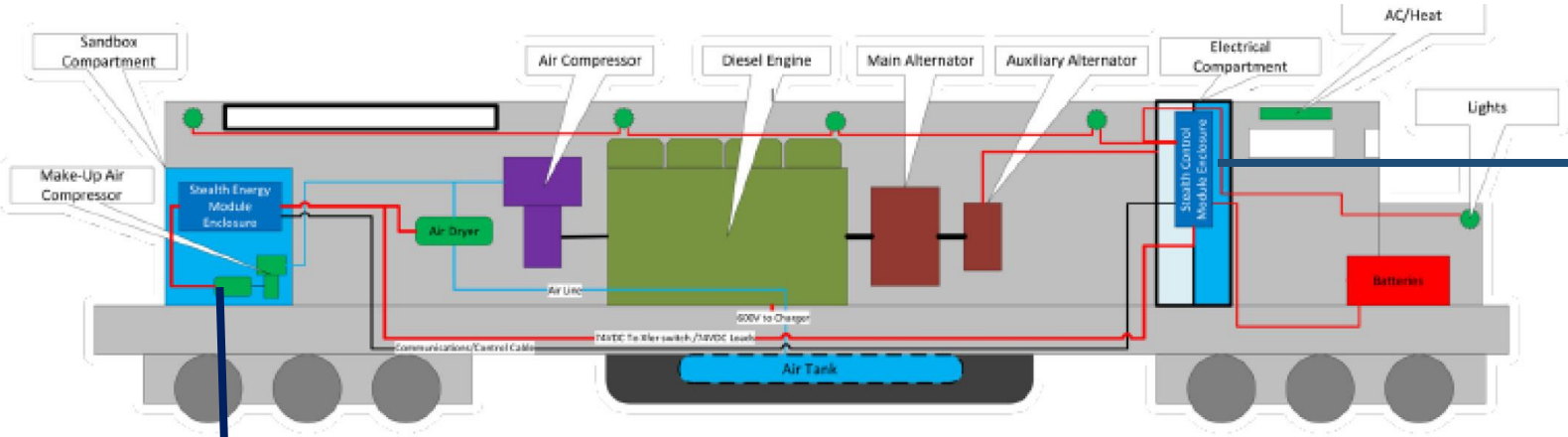


Enhanced Crew Comfort & Safety/Improved Community Relations

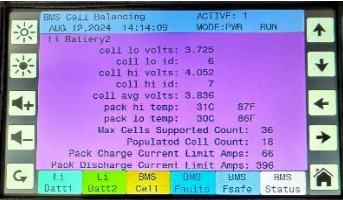
- Crew can continually operate in a temperature controlled environment
- Walkway, Steps and Cab fully lighted to improve safety
- CIC and TIR systems continue to operate
- Reduce noise and odorous emissions for the surrounding communities



Simple & Clean Integration Into Your Locomotive Using Industrially Hardened Components



Locomotive Control System Mounts in the Cab Electrical Cabinet



Enclosed Energy Module Installed in Sandbox

Energy Module Interior/L-I Battery Pack

Make-Up Air Compressor

L-I Battery Energy Module and Make-up Air Compressor Mount in the Sandbox in the Long Hood of the Locomotive

- The 33 kWh Energy Module is comprised of 18 individual battery cards which are mounted in series inside of an industrial enclosure
- The enclosure has heating and cooling capability to ensure the Energy Module operates within its optimum temperature range
- Make-Up Air compressor is powered via Energy Module
- Cabinet is internally wired to applicable industrial grade quick disconnects to facilitate easy install & maintenance.

Based on Technology Proven in Other Harsh-Duty Applications



Idle Mitigation

Remote Power



Ambulances



Tug-Boats



Earth Moving Equipment



Irrigation Systems