



**Built for Efficiency  
Engineered for Profit**  
Up to 65% Lower Operating Costs

**Swap Power. Keep Moving.**  
Interchangeable Power Modules

**FLEXIBLE & FUTURE-READY**

AVAILABLE TIER 5 LOCOMOTIVES:

**Diesel Hybrid | Dual Fuel Hybrid | CNG/RNG Hybrid | Battery Electric**

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## The Lowest-Cost Mile in Rail

**Delivery in 6-9 Months**  
FRA concurrence achieved  
on all delivered units

### **Maximize Profitability with OptiFuel Locomotives**

Fuel economy is one of the largest drivers of railroad operating cost. OptiFuel locomotives deliver up to 65% fuel savings versus conventional diesel, significantly reducing cost-per-mile while maintaining performance across switching and line haul operations. The result is a step-change reduction in operating expense and total cost of ownership.

### **Next-Generation Modularity, Maximum Flexibility**

OptiFuel's modular power and fuel architecture enables rapid module exchange in ~1 hour, allowing operators to right-size horsepower, optimize fuel strategy, and adapt to changing routes, duty cycles, and regulatory requirements over time.

### **Proven Performance. Built for Continuous Operation.**

OptiFuel locomotives are engineered for real-world railroad duty cycles, delivering >95% fleet availability through high-reliability systems and simplified maintenance – keeping locomotives in service, not in the shop.

### **Regulatory Confidence Without Compromise**

Every OptiFuel locomotive is designed for compliance with evolving emissions standards. Diesel hybrid, dual-fuel hybrid, natural gas hybrid, and battery-electric configurations achieve near-zero criteria emissions, aligned with proposed Tier 5 NOx and particulate thresholds, with zero or near-zero greenhouse gas emissions depending on fuel selection.

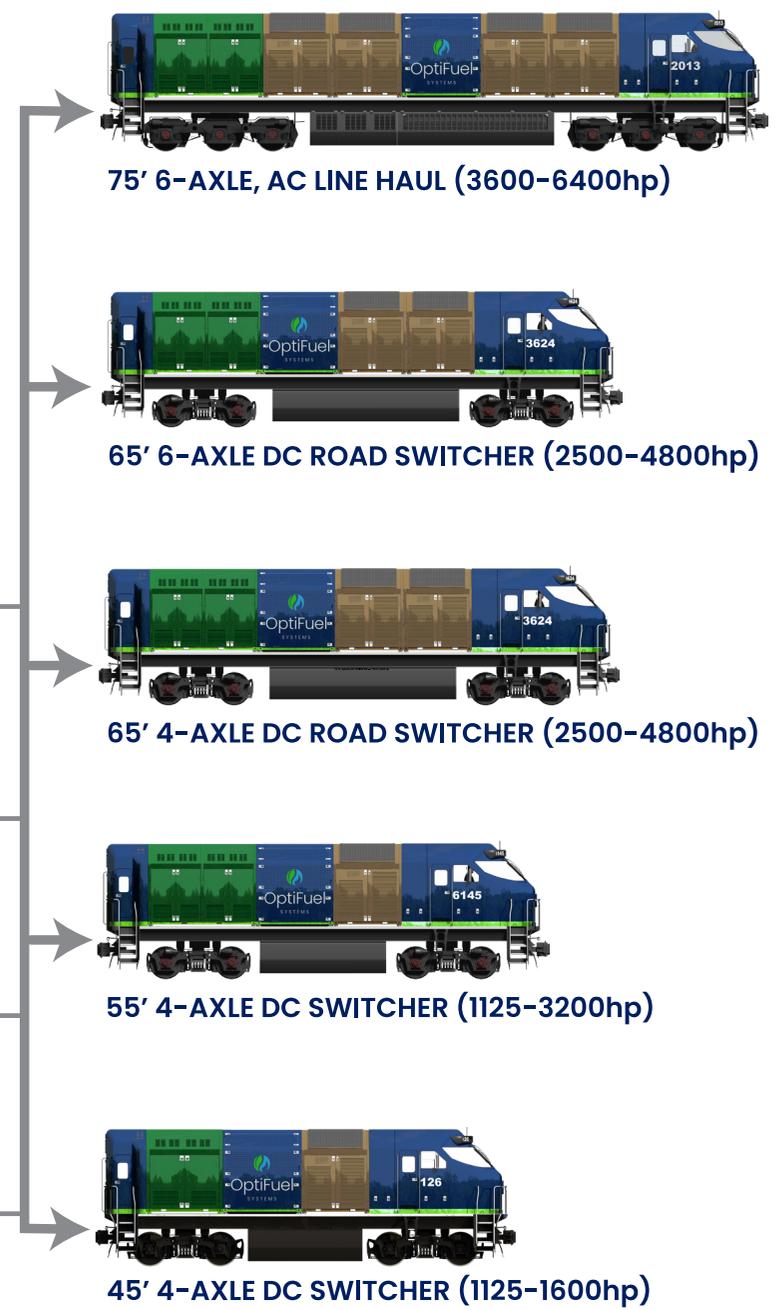
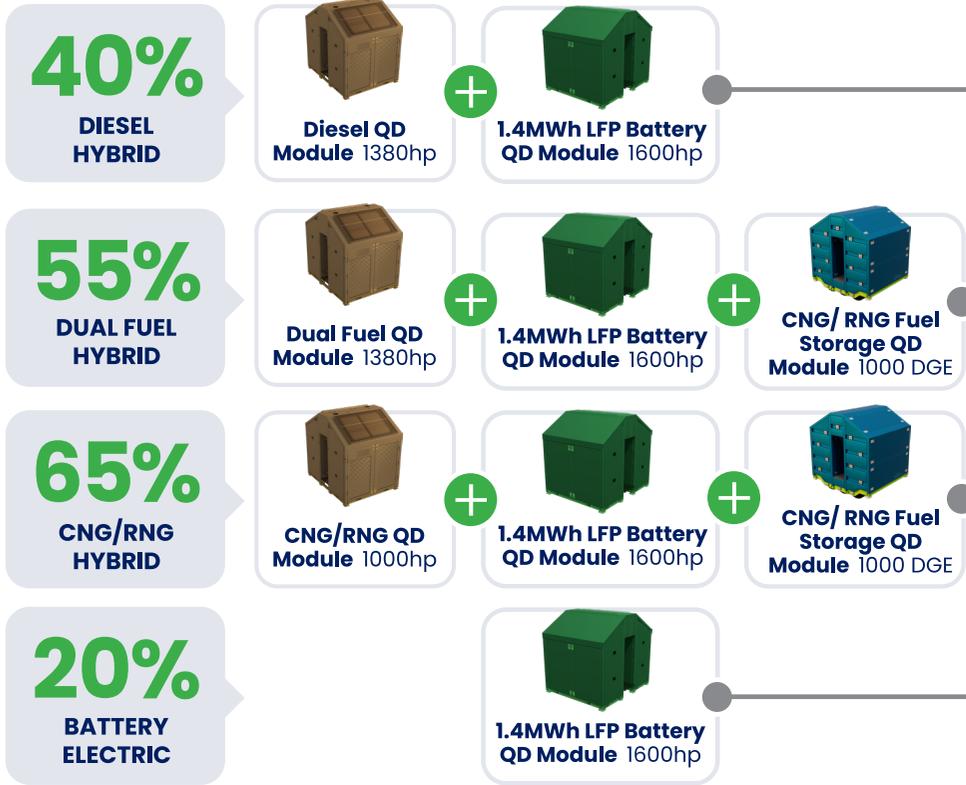
# Modular Power – Unrivaled Flexibility

Built to customize, swap out and reconfigure – without replacement

## Up To 65% Operational Cost Savings in Fuel, Labor & Maintenance

Modular Tier 5 Hybrid Locomotives

### AVERAGE FUEL COST SAVINGS



# Switcher Locomotives

Optimized for Yard, Port, Terminal, and Industrial Operations.  
Lowest Operating Cost Per Switching Hour. Built-In Autonomy.

## FRA CONCURRENCE

Advance Capabilities. Standard.

### OPERATIONAL SAVINGS

## 20%–65% Lower Fuel Costs

- ~20% - Battery Electric
- ~40% - Diesel-Hybrid
- ~55% - Dual-Fuel Hybrid
- ~65% - CNG/RNG Hybrid
- Regenerative braking and hybrid quick-power minimize fuel use during idle and low-load operations

## FUTURE-READY AUTOMATION Fleet Intelligence

- >95% fleet availability supported by high-reliability systems architecture and redundant engine-start
- Quick-Disconnect (QD) technology enables module exchange ~1 hour using a standard crane or forklift
- 360° situational awareness with integrated remote-operation capability for next-gen operations

### LONGEVITY & PERFORMANCE

## Includes 5-Year Warranty

- 1.4 MWh, 945 VDC LFP battery module rated for ~4,000 cycles, supporting 10–15 years of service life
- 12V sodium-ion starter batteries rated for ~4,000 cycles, providing ultra-reliable, safe engine starting in extreme weather conditions
- Full operational flexibility: locomotives can operate in battery-electric mode or hybrid mode
- Comprehensive warranty: 5-year standard warranty with optional 10-year extended coverage



## 45 FT, Tier 5, 4-AXLE DC HYBRID SWITCHER

45 Ft, 4-AXLE, DC HYBRID SWITCHER MODELS	Existing Trucks & Traction Motors <sup>1</sup>	Rebuilt Trucks & Traction Motors <sup>2</sup>	FUEL COST SAVINGS
1600 hp Battery Electric (1.4 MWh)	\$1.92 M	\$2.2 M	20%
1300 hp Diesel Hybrid (CNG/RNG)	\$1.85 M	\$2.13 M	40%
1300 hp Dual Fuel Hybrid (Diesel-CNG/RNG)	\$2.31 M	\$2.59 M	55%
1125 hp Natural Gas Hybrid (CNG/RNG)	\$2.31 M	\$2.59 M	65%

## 55 FT, Tier 5, 4-AXLE DC HYBRID SWITCHER

55 Ft, 4-AXLE, DC HYBRID SWITCHER MODELS	Existing Trucks & Traction Motors <sup>1</sup>	Rebuilt Trucks & Traction Motors <sup>2</sup>	FUEL COST SAVINGS
1600 hp Battery Electric (1.4 MWh)	\$2.24 M	\$2.53 M	20%
3200 hp Battery Electric (2.8 MWh)	\$2.87 M	\$3.15 M	20%
1300 hp Diesel Hybrid	\$2.2 M	\$2.49 M	40%
1925 hp Diesel Hybrid	\$2.4 M	\$2.68 M	40%
1300 hp Dual Fuel Hybrid (Diesel-CNG/RNG)	\$2.66 M	\$2.94 M	55%
1925 hp Dual Fuel Hybrid (Diesel-CNG/RNG)	\$2.85 M	\$2.68 M	55%
1125 hp Natural Gas Hybrid (CNG/RNG)	\$2.64 M	\$2.92 M	65%
1750 hp Natural Gas Hybrid (CNG/RNG)	\$2.83 M	\$3.12 M	65%

<sup>1</sup>Tier 5 emissions readiness: designed to meet 0.2 g/bhp-hr NO<sub>x</sub>; <0.01 g/bhp-hr PM (anticipated future standard)

<sup>2</sup>Pricing assumes customer-provided trucks and traction motors; additional cost applies if not supplied

<sup>3</sup>Fuel savings estimates assume \$2.50/DGE diesel and \$1.25/DGE CNG and are compared to baseline diesel locomotives manufactured between 1960–1980

# Customizable Power & Traction

# Heavy Duty Road Switcher and Line Haul Locomotives



65 FT, TIER 5, 4-AXLE DC HYBRID ROAD SWITCHER			
65 Ft, 4-AXLE, DC HYBRID SWITCHER MODELS	Existing Trucks & Traction Motors <sup>1</sup>	Rebuilt Trucks & Traction Motors <sup>2</sup>	FUEL COST SAVINGS
3200 hp Battery Electric (3.2 MWh)	\$3 M	\$3.28 M	20%
4800 hp Battery Electric (4.2 MWh)	\$3.6 M	\$3.89 M	20%
3000 hp Diesel Hybrid	\$3 M	\$3.28 M	40%
4400 hp Diesel Hybrid	\$3.6 M	\$3.89 M	40%
3000 hp Dual Fuel Hybrid (Diesel-CNG/RNG)	\$3.45 M	\$3.74 M	55%
4400 hp Dual Fuel Hybrid (Diesel-CNG/RNG)	\$4.06 M	\$4.34 M	55%
2500 hp Natural Gas Hybrid (CNG/RNG)	\$3.45 M	\$3.74 M	65%
3500 hp Natural Gas Hybrid (CNG/RNG)	\$4.06 M	\$4.34 M	65%

65 FT, TIER 5, 6-AXLE DC HYBRID ROAD SWITCHER			
65 Ft, 6-AXLE, DC HYBRID SWITCHER MODELS	Existing Trucks & Traction Motors <sup>1</sup>	Rebuilt Trucks & Traction Motors <sup>2</sup>	FUEL COST SAVINGS
3200 hp Battery Electric (2.8 MWh)	\$3.15 M	\$3.53 M	20%
4800 hp Battery Electric (4.2 MWh)	\$3.75 M	\$4.12 M	20%
3000 hp Diesel Hybrid	\$3.15 M	\$3.53 M	40%
4400 hp Diesel Hybrid	\$3.75 M	\$4.14 M	40%
3000 hp Dual Fuel Hybrid (Diesel-CNG/RNG)	\$3.6 M	\$3.99 M	55%
4400 hp Dual Fuel Hybrid (Diesel-CNG/RNG)	\$4.2 M	\$4.59 M	55%
2500 hp Natural Gas Hybrid (CNG/RNG)	\$3.6 M	\$3.99 M	65%
3500 hp Natural Gas Hybrid (CNG/RNG)	\$4.2 M	\$4.59 M	65%

75 FT, TIER 5, 6-AXLE AC HYBRID LINE HAUL			
75 Ft, 6-AXLE, AC HYBRID SWITCHER MODELS	Existing Trucks & Traction Motors <sup>1</sup>	Rebuilt Trucks & Traction Motors <sup>2</sup>	FUEL COST SAVINGS
4800 hp Battery Electric (4.2 MWh)	\$4.89 M	\$5.05 M	20%
6400 hp Battery Electric (5.6 MWh)	\$5.49 M	\$5.66 M	20%
4400 hp Diesel Hybrid	\$4.89 M	\$5.05 M	40%
5800 hp Diesel Hybrid	\$5.49 M	\$5.66 M	40%
4400 hp Dual Fuel Hybrid (Diesel-CNG/RNG)	\$5.34 M	\$5.51 M	55%
5800 hp Dual Fuel Hybrid (Diesel-CNG/RNG)	\$5.95 M	\$6.11 M	55%
3600 hp Natural Gas Hybrid (CNG/RNG)	\$5.34 M	\$5.51 M	65%
4600 hp Natural Gas Hybrid (CNG/RNG)	\$5.95 M	\$6.11 M	65%

<sup>1</sup>Tier 5 emissions readiness: designed to meet 0.2 g/bhp-hr NOx; <0.01 g/bhp-hr PM (anticipated future standard)

<sup>2</sup>Pricing assumes customer-provided trucks and traction motors; additional cost applies if not supplied

<sup>3</sup>Fuel savings estimates assume \$2.50/DGE diesel and \$1.25/DGE CNG and are compared to baseline diesel locomotives manufactured between 1960-1980

# Irrefutable Value

## The Smart Move for Modern Rail Operations

Designed to lower operating cost, deliver reliable performance, and protect long-term fleet value. Delivering up to 65% fuel savings versus conventional diesel locomotives under comparable duty cycles.

### Operating Cost Advantage

- Built for real-world railroad operations, OptiFuel locomotives deliver up to 65% total fuel savings vs conventional diesel locomotives depending on configuration, and achieve an estimated 50% maintenance cost reduction, while maintaining the performance, reliability, and flexibility required across switching and line haul service
- Integrated hybrid energy storage (0.5–1.4 MWh standard) optimizes fuel use across real-world operations
- Regenerative braking and onboard power systems enable continuous battery recharge and reduced fuel burn
- Battery-supported operation at idle and low-duty notches reduces unnecessary engine run time
- Modular power systems reduce engine wear, simplify maintenance, and lower lifecycle cost
- OptiFuel locomotives are equipped with future-ready automation and fleet intelligence, including 360-degree situational awareness and integrated remote-operation capability, supporting next-generation operations while remaining fully compatible with existing railroad workflows

### Recharging Systems

- Rapid recharge in ~1 hour to support continuous yard operations
- MCS-compliant charging systems (960 kW–3.5 MW)
- Scalable to fleet size and duty cycle requirements

### CNG / RNG Refueling

- Immediate fuel cost reduction with dual-fuel capability
- Turnkey CNG/RNG infrastructure (mobile or pipeline-connected)
- Integrated with existing diesel fueling islands
- Enables simultaneous diesel and natural gas fueling with no operational disruption

### Performance & Availability

- Over 95% availability, engineered for continuous service
- Advanced DC and AC traction systems with regenerative braking maintains tractive performance across duty cycles
- Redundant power architecture ensures consistent performance and operational reliability
- Configurable for extended range operations, including line haul service up to 2,000 to 2,500 miles without refueling

### Operational Flexibility

- Trackside module exchange in ~1 hour using standard lifting equipment, enabling rapid maintenance, repair, and upgrade without removing the locomotive from service
- Full power system reconfiguration in as little as 2 days, enabling conversion between diesel-hybrid, dual-fuel hybrid, natural gas hybrid, and battery-electric configurations

### Warranty & Longevity

- 5-year standard warranty with optional extended coverage
- Designed for 30-year service life with modular upgrade pathways
- Future-ready platform supports power, fuel, and technology upgrades without full locomotive replacement

### Emissions Performance

- Exceeds proposed Tier 5 criteria emissions: 0.2 g/bhp-hr NO<sub>x</sub>, <0.01 g/bhp-hr PM
- Enabled by significantly lower fuel consumption and optimized duty cycles, OptiFuel Gen 3 locomotives reduce – or in some configurations, eliminate – emissions

# Built For Efficiency. Engineered for Profit.

Up to 65% lower operating costs.

## Swap Power. Keep Moving.



### QUICK-DISCONNECT (QD) TECHNOLOGY SWAP MODULES IN ~ 1 HOUR

- Minimizes downtime
- Maximizes fleet availability
- Supports future reconfiguration



**WALK RIGHT THROUGH IT**  
2 foot internal walkway allows safe continuous access through the locomotive

### CHOOSE TODAY. RECONFIGURE ANYTIME.

Reconfigure locomotive power in as little as 2 days

## QUICK-POWER QD MODULES

### INTERCHANGEABLE POWER MODULES Choose Your QD Power Module

- Diesel Hybrid QD Module – 1380 hp
- Dual Fuel Hybrid QD Module – 1380 hp
- 100% CNG/RNG Hybrid QD Module – 1000 hp
- 1.4 MWh (1600 hph) Battery Power QD Module
- 690 Hp Diesel Hybrid PLUS 465 kWh (625 hph) LFP Battery QD Module
- 690 Hp Dual Fuel Hybrid PLUS 465 kWh (625 hph) LFP Battery QD Module
- 500 Hp CNG Hybrid PLUS 465 kWh (625 hph) LFP Battery QD Module



## FUEL STORAGE QD MODULES

### NATURAL GAS STORAGE – CNG/RNG

- 1,000 Diesel Gallons Equivalent (DGE)
- 5,000 psi
- Refuel in under 30 minutes



## 1.4 MWh (1600 hph) TRACTION BATTERY QD MODULE



**4000 CYCLES**  
10-15 YEARS

**945 VOLTS**

### INTERCHANGEABLE POWER MODULES Swap Power. Keep Moving.

- Field-proven Locomotive and Autonomous Rail Vehicle high voltage LFP traction batteries
- Mounting to meet FRA, EU, and GB/T recommended locomotive shock and vibration requirements



### COULOMB SOLUTIONS, Inc. Supplying N. America's Commercial EV Market

- US owned and operated
- North American engineering and service provider for CATL, the world's top supplier of lithium-ion batteries
- Most widely used commercial vehicle LFP batteries on earth

### FIRE SAFETY Safer Than NMC

- Fire safety meets stringent "no fire propagation, no explosion" passenger bus safety standards

### CHARGE CYCLES + LOWEST OEM PRICING 4,000 Battery Charge/Discharge Cycles

- Superior cycles compared to NMC battery
- Charging in as little as 1 hour using DC Fast Chargers or Megawatt Charge Systems
- Lowest OEM pricing in the industry
  - Lower costs to railroad customers for the world's highest quality LFP Li-ion battery systems!

## AUTONOMY-READY LOCOMOTIVES



### BUILT TO GROW WITH YOUR RAILROAD Lower costs now. More options later.

### DRIVE EFFICIENCY Modernize Fleet Economics

Reduce operating costs today with a locomotive that delivers more efficient power and supports a smarter long-term replacement path.

### BUILT TO ADAPT Preserve Future Flexibility

Avoid dead-end technology decisions with a locomotive designed to support future control, automation, and evolving operating needs.

### READY FOR AUTOMATION Keep Your Options Open

Open architecture gives railroads a practical path to future automation while preserving the flexibility to work with the right technology partners over time.

### Lower risk. More flexibility. Better long-term value.

OptiFuel gives railroads a modern replacement path that lowers operating costs today, supports remote control systems already in service, and helps address workforce constraints while preserving a practical path to future automation.

**Address Workforce Constraints**  
Support a railroad workforce that is stretched thin and increasingly difficult to replace.

**Reduce Human-Factor Exposure**  
Create a path to more consistent execution and fewer risk-sensitive operating tasks.

**Support Next Gen Operators**  
Build around a workforce that increasingly expects digital tools, automation, and modern operating environments.

A smarter locomotive decision for the railroad you run today – and the one you're building for tomorrow.

# Turnkey Infrastructure Solutions



## Effortless Infrastructure. Quantifiable Opex Reductions.

OptiFuel removes infrastructure barriers to fleet modernization. Whether deploying diesel hybrid, dual-fuel hybrid (diesel-CNG), natural gas (CNG) hybrid, or battery-electric locomotives, our turnkey solutions enable immediate fuel savings and operational efficiency – with minimal disruption to existing operations.

Diesel hybrid locomotives operate within existing infrastructure, with dual-fuel hybrid, natural gas hybrid, and battery-electric configurations are supported by fully integrated fueling and rapid charging systems delivered and maintained by OptiFuel.

### Turnkey, Scalable Infrastructure Solutions

Maximize uptime, reduce operating cost, and scale infrastructure with fleet deployment – without adding operational complexity.

- Modular infrastructure deployment aligned with locomotive rollout
- Minimal site modification required for installation and expansion
- Integrated maintenance and support provided by OptiFuel
- Designed to maintain continuous operations during deployment

## OptiFuel GrantPro™

Grant Strategy Built for Railroads

A comprehensive, no-cost grant support program for short line railroads and ports.

OptiFuel provides end-to-end grant support – from program identification and proposal development to post-award compliance and reporting – through a collaborative, railroad-focused process.



Grant  
Identification  
& Strategy



Proposal  
Development



Engineering &  
Tech Support



Post-Award  
Compliance

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