The N-ViroMotive Product Line: Multi-Engine GenSet Ultra Low Emissions Road-Switcher Locomotives

National Railway Equipment Co.

HISTORICAL BACKGROUND

- *1995* EPA – Washington develops clean air initiatives modeled for the Class I railroads
- *1998*- Initial regulations are developed for Tier 0 / Tier I / Tier II emissions standards for the railway industry
- *1998*- Memorandum of Understanding between the Air Resources Board of California and the UP & BNSF
- *1998*-Commitments are made and critical paths are developed by the UP & BNSF to show good faith effort toward emissions reductions in the LA Basin (switchers) and intrastate transport (line haul). Overall objective is to meet Tier II emissions standards for the locomotive fleet average operating within California by January 1, 2010.
- *1999*- Timelines are established for implementing Tier 0 / Tier I / Tier II emission standards
- *2000-2001* UP and BNSF approach suppliers for developing an ultra low emitting road-switcher locomotive

National Railway Equipment Co.

HISTORICAL BACKGROUND

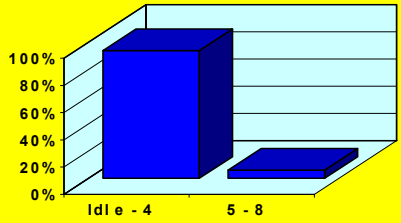
- 2001-2005 Development phase for a GenSet diesel-electric locomotive utilizing IGBT technology and Tier III certified industrial engines
- 2005 – First GenSet locomotive to be EPA certified and to be recognized by ARB as an Ultra Low Emitting Locomotive
- 2005-2006 – First ULEL GenSet locomotive to be manufactured and field tested at the Port of Long Beach with the UP and the Pacific Harbor Lines
- 2006 – First ULEL GenSet locomotive to demonstrate high dispatch and continuous tractive effort parallel to a six axle locomotive in a 126 car double-stack train consist
- 2007 – First ULEL GenSet locomotives to be EPA certified to 3.0 GPBHP hour of NOx in both switching and line haul duty cycles
- 2007 – First ULEL GenSet locomotives to demonstrate 50%-65% fuel savings at more than twenty beta sites throughout North America

TODAY'S EQUIPMENT

- EPA Certified
  ARB Recognized
- Fuel Reduction
  Average Savings of 50%+
- TE Enhancement
  Efficiency of 65%+
- Engine Durability
  Continuous HP Rating
- SOA Electronics
  Advanced Control Tech.
- Modular Design
  Reduced Lead-times

EPA REQUIREMENTS: SWITCHER DUTY CYCLE

Notch Position	engines running	engine rpm	total horsepower	duty cycle	horsepower weighted
Idle	1	900	25	59.8%	14.95
1	1	1300	125	12.4%	15.50
2	1	1500	225	12.3%	27.68
3	1	1500	425	5.8%	24.65
4	1	1800	650	3.6%	23.40
5	2	1600	850	3.6%	30.60
6	2	1500	1000	1.5%	15.00
7	2	1500	1250	0.2%	2.50
8	2	1800	1400	0.8%	11.20



Idle - 4	94%
5 - 8	6%

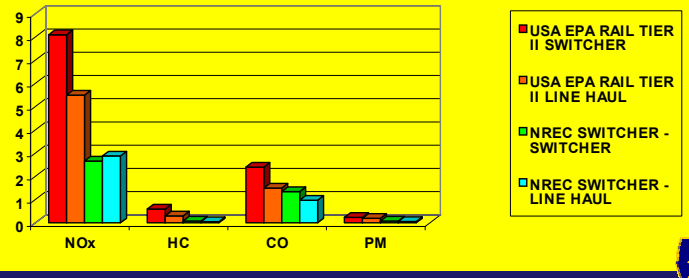
EPA REQUIREMENTS: HORSEPOWER/RPM

Throttle Notch	Eng 1 BHP	Eng 1 THP	Eng 1 RPM	Eng 2 BHP	Eng 2 THP	Eng 2 RPM	Eng 3 BHP	Eng 3 THP	Eng 3 RPM	Loco BHP	Loco THP
Idle	67	0	1200							67	0
1	228	145	1500							228	145
2	388	305	1500							388	305
3	685	585	1800							685	585
4	547	447	1800	390	373	1500				937	820
5	661	561	1800	485	469	1500				1146	1030
6	594	494	1800	514	494	1800	429	412	1500	1537	1400
7	667	567	1800	587	567	1800	587	567	1800	1841	1701
8	697	597	1800	686	664	2000	686	664	2000	2069	1925

EPA REQUIREMENTS:
MULTIPLE DIESEL ENGINE GENSETS
EPA TIER II COMPLIANT

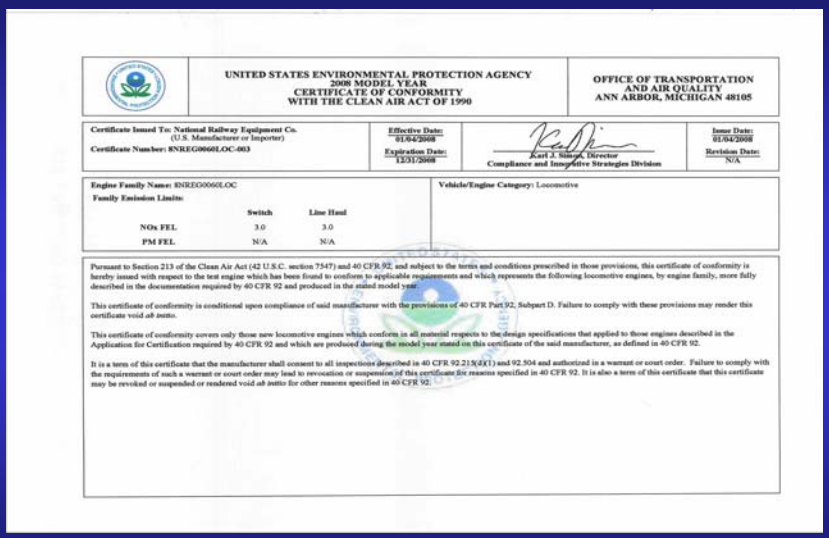
USA EPA EMISSIONS LIMITS FOR LOCOMOTIVES VS. NREC's N-VIROMOTIVE

EMISSIONS	EPA TIER II RAIL		N-VIROMOTIVE			
(G/BHP-H)	SWITCHER	LINE HAUL	SWITCHER	% LOWER	LINE HAUL	% LOWER
NOx	8.1	5.5	2.67	67%	2.88	48%
HC	0.6	0.3	0.08	87%	0.06	81%
CO	2.4	1.5	1.34	44%	0.98	35%
PM	0.24	0.2	0.08	67%	0.07	67%



National Railway Equipment Co.

EPA CERTIFICATION



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2008 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT OF 1990

OFFICE OF TRANSPORTATION AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: National Railway Equipment Co. (U.S. Manufacturer or Importer)
Certificate Number: 8NREG0060LOC-003

Effective Date: 01/04/2008
Expiration Date: 12/31/2008

Karl J. Simon, Director
Compliance and Innovative Strategies Division

Issue Date: 01/04/2008
Revision Date: N/A

Engine Family Name: 8NREG0060LOC
Family Emission Limits:

	Switch	Line Haul
NOx FEL	3.0	3.0
PM FEL	N/A	N/A

Vehicle/Engine Category: Locomotive

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR 92, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engine which has been found to conform to applicable requirements and which represents the following locomotive engines, by engine family, more fully described in the documentation required by 40 CFR 92 and produced in the stated model year.

This certificate of conformity is conditional upon compliance of said manufacturer with the provisions of 40 CFR Part 92, Subpart D. Failure to comply with these provisions may render this certificate void *ab initio*.

This certificate of conformity covers only those new locomotive engines which conform in all material respects to the design specifications that applied to those engines described in the Application for Certification required by 40 CFR 92 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR 92.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 92.213(a)(1) and 92.504 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR 92. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR 92.

FUEL REDUCTION

- Engine efficiency through technology advancement 1954 to 2006
- Idle Limiting electronically monitored and controlled
- Engine restart at 10 degrees F through ethylene-glycol coolant
- Power on demand: using only the HP required by the application
- Engine load sharing to achieve more optimum performance
- TE differential (IGBT) facilitates more work with less overall hp

FUEL CONSUMPTION SAVINGS

Locomotive Duty Cycle	Hours of Operation Daily	Average Fuel Consumption	Cost of Fuel	Dollars Saved Per Day
Road – Switchers Switchers	20	320 gallons	$3.25	$520.00
Road – Switchers Switchers	16	256 gallons	$3.25	$416.00
Road – Switchers Switchers	12	192 gallons	$3.25	$312.00
Road – Switchers Switchers	10	160 gallons	$3.25	$260.00
Road – Switchers Switchers	8	128 gallons	$3.25	$208.00

Above are calculated fuel savings utilizing the 3GS-21B N-ViroMotive locomotive in comparison to conventional EMD, GE and Alco four axle road-switching locomotives rated between 1,800 – 2,100 HP.

N-VIROMOTIVE BETA TEST SITES
COMPARATIVE FUEL CONSUMPTION

Railroad Account Identification	Beta-Site Location	N-ViroMotive Model	Performance Testing Period	Operational Fuel Savings Estimates
Alaska Railroad	Alaska	2GS-14B	21 Days	50%+
Canadian National	Illinois	3GS-21B	21 Days	50%+
Canadian Pacific	Alberta	3GS-21B	60 Days	50+%
California Northern	California	2GS-14B	30 Days	50%+
DGNO	Texas	3GS-21B	21 Days	40%+
EJ&E	Illinois	3GS-21B	14 Days	50%+
Fort Worth & Western	Texas	3GS-21B	365 Days	50%+
Indiana Harbor Belt	Indiana	3GS-21B	14 Days	50%+
Indiana Railroad	Indiana	3GS-21B	14 Days	67%+

N-VIROMOTIVE BETA TEST SITES
COMPARATIVE FUEL CONSUMPTION

Railroad Account Identification	Beta-Site Location	N-Viromotive Model	Perf. Testing Period	Operational Fuel Savings Estimates
MBCR/MBTA	Massachusetts	3GS-21B	210 Days	50%+
Nashville & Eastern	Tennessee	3GS-21B	14 Days	50%+
Norfolk Southern	Pennsylvania	3GS-21B	120 Days	45%+
Nova Chemical	Alberta	3GS-21B	28 Days	50%+
Pacific Elevator	British Columbia	2GS-14B	14 Days	50%+
Pacific Harbor Lines	California	3GS-21B	30 Days	50%+
Providence & Worcester	Massachusetts	3GS-21B	24 Days	50%+
Tacoma Rail	Washington	2GS-14B	21 Days	65%+
Volpe	Texas	3GS-21B	21 Days	50%+

National Railway Equipment Co.

TRACTIVE EFFORT

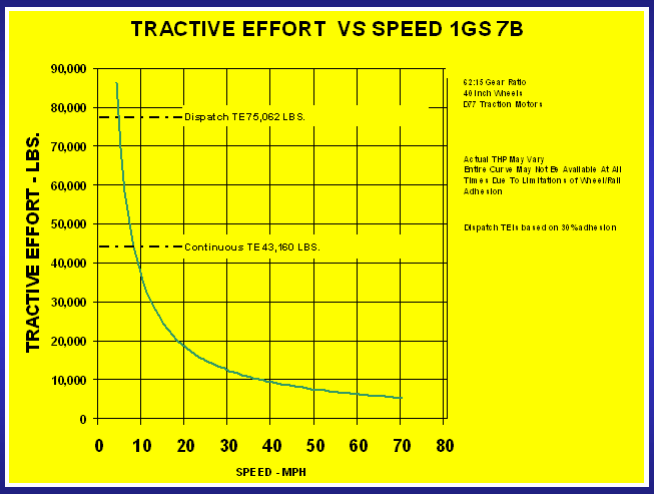
- IGBT Technology
- Individual Traction Motor Controls
- N-FORCE Microprocessor

National Railway Equipment Co.

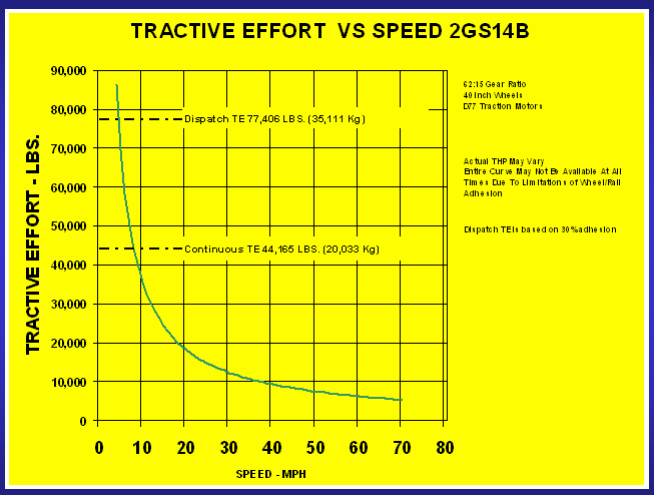
TRACTIVE EFFORT

National Railway Equipment Co.

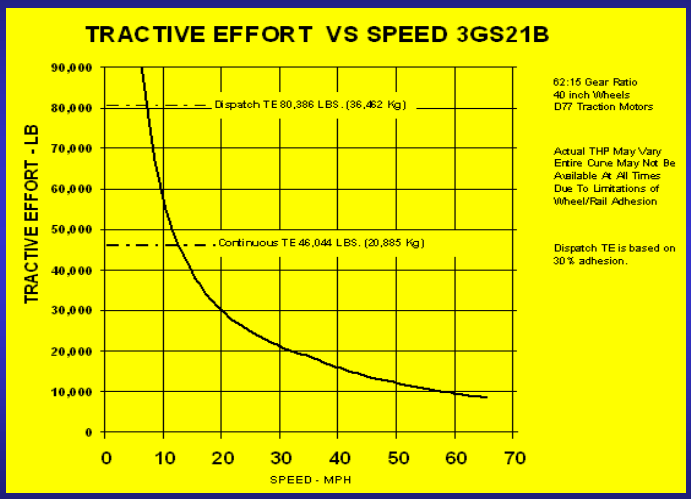
TRACTIVE EFFORT



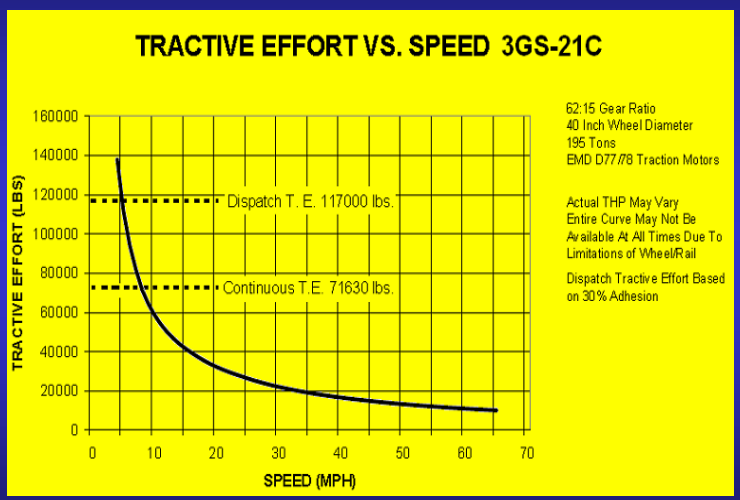
TRACTIVE EFFORT



TRACTIVE EFFORT



TRACTIVE EFFORT



ENGINE DURABILITY : CUMMINS QSK19 TIER III

Engine Type	= In-Line, 4-Cycle, 6-Cyl
Displacement	= 1159 cu. In. 19 Liters
Rated Power	= 510-700 BHP 379-522 kW
Aspiration	= Turbocharged Air-to-Air Charge Air Cooled

- Locomotive design certified as EPA Tier II Railroad Compliant (NREC EPA Certificate)
- Full Authority Electronic Controls
- Cummins Modular Common-Rail Fuel System
- Over 10,000 QSK19 Engines in Industrial Applications with over 500 installed in NREC Locomotives

N-FORCE

Microprocessor Electronic Control System

- *N-Limit - idle limiting system*
- *N-Force – anti-wheel slip system*
- *N-Vision – Operator Interface Display with fault log*
- *N-Sure - Battery Sure Start*
- *N-Lights*

N-FORCE

NRE Electronics **"N-FORCE"**

N-FORCE

AXLE SPEED SENSING EQUIPMENT

N-VISION

OPERATOR INTERFACE PANEL WITH FAULT LOG

National Railway Equipment Co.

N-SURE

BATTERY SURE START

National Railway Equipment Co.

N-LIGHT

National Railway Equipment Co.

MODULAR DESIGN: THE GENSET IN PROCESS

National Railway Equipment Co.

MODULAR DESIGN: INSTALLED GENSET

National Railway Equipment Co.

LOCOMOTIVE IN PROCESS

Cab in Process

National Railway Equipment Co.

LOCOMOTIVE IN PROCESS

Frame in Process

LOCOMOTIVE IN PROCESS

Electrical Cabinet in Process

LOCOMOTIVE IN PROCESS

Cab Console

National Railway Equipment Co.

TODAY'S N-VIROMOTIVE GENSET EQUIPMENT

- **Lowest emitting freight locomotive worldwide**
  - 80%+ reduction in NOX & PM's compared to other 4 axle units
  - Tier II Railroad compliant & Tier III Off-Highway Certified
  - ULEL Recognized by the Air Resources Board of California
- **Dramatically improved tractive effort**
  - 50% - 65% + improvement in TE adhesion efficiency
- **Fuel Savings**
  - 40% to 70% dependent on the locomotive duty cycle
- **Reduction in on-going routine maintenance costs**
  - 55% to 70% thru engine load sharing and modular design
- **Ultra quiet operating locomotive**
  - Cab sound level (throttle notch 8) at 79 dB(A)