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# New England Railroad Club Mechanical Night

January 26, 2006



Better economics, better environment.

*Green Goat?*



# Production Locomotive: GG20B



# Hybridization is a cost effective “conversion”

**From GP 9  
locomotive...**



- ▶ Complete teardown and overhaul
- ▶ Replacement with new components

## ... to Hybrid

- ▶ Performance
- ▶ Reliability
- ▶ Low operating Cost
- ▶ Low emissions
- ▶ Safety

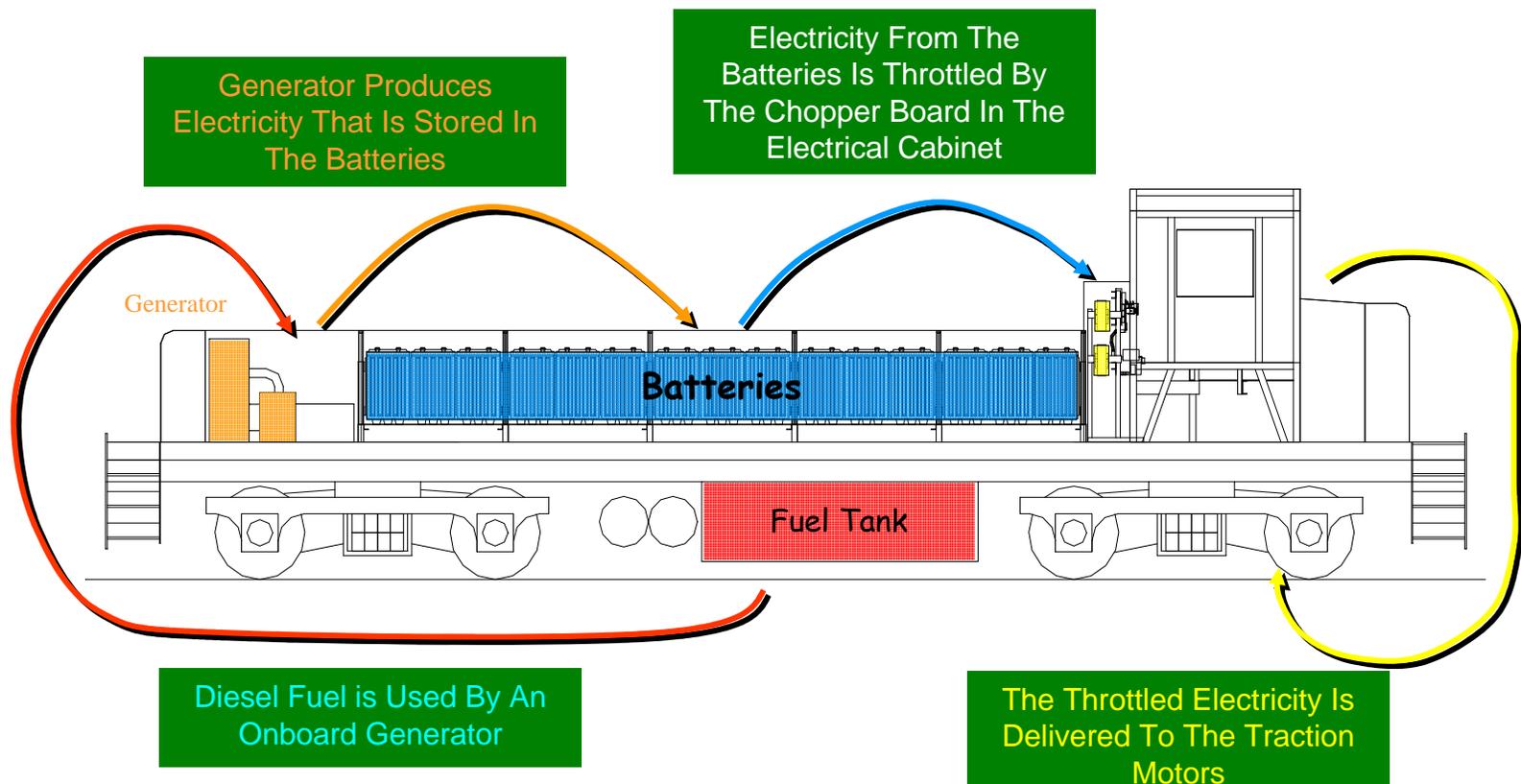




## *Railpower*<sup>TM</sup> Locomotive Models

<u>Model</u>	<u>Horsepower</u>	<u>Service</u>	<u>Engines</u>
GG20B	2,000	Yard	1
RP20BH	2,000	Local / Yard	2
RP20BD	2,000	Local / Yard	3

# Hybrid Technology

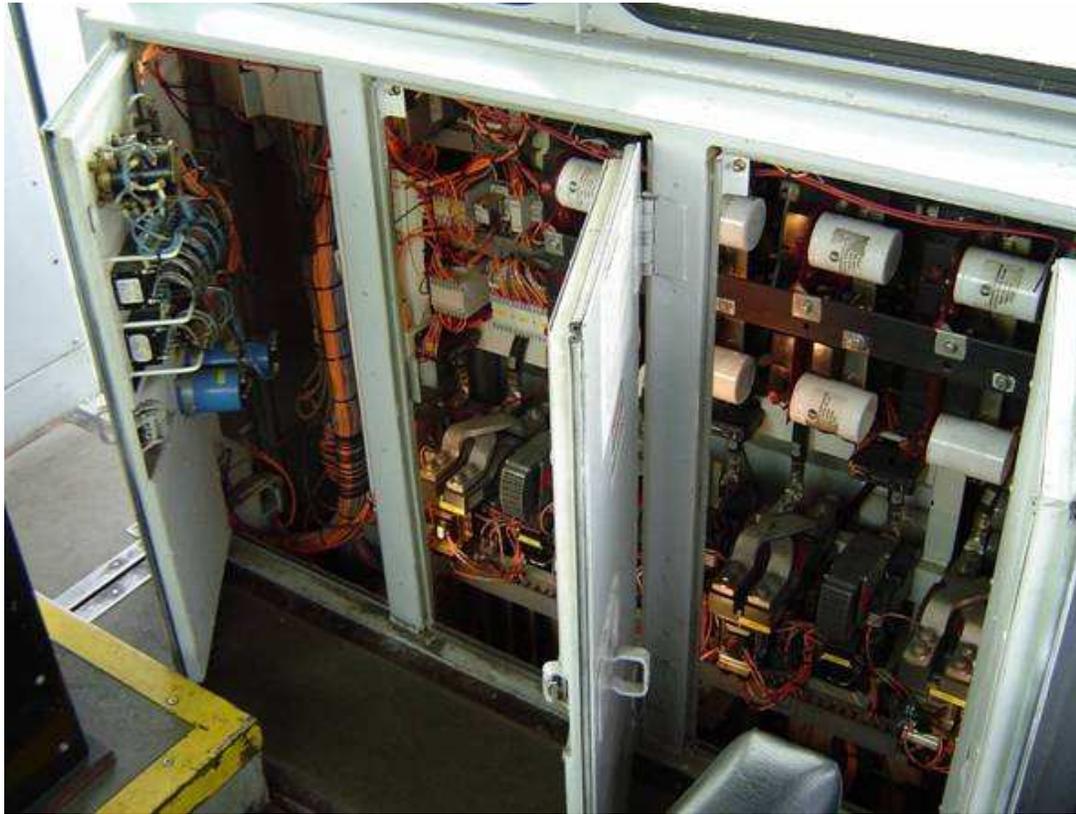


# Main Battery Pack



- Latest technology VRLA, AGM type batteries
- Maintenance free, long battery life
- High round trip efficiency.

# Electrical Cabinet



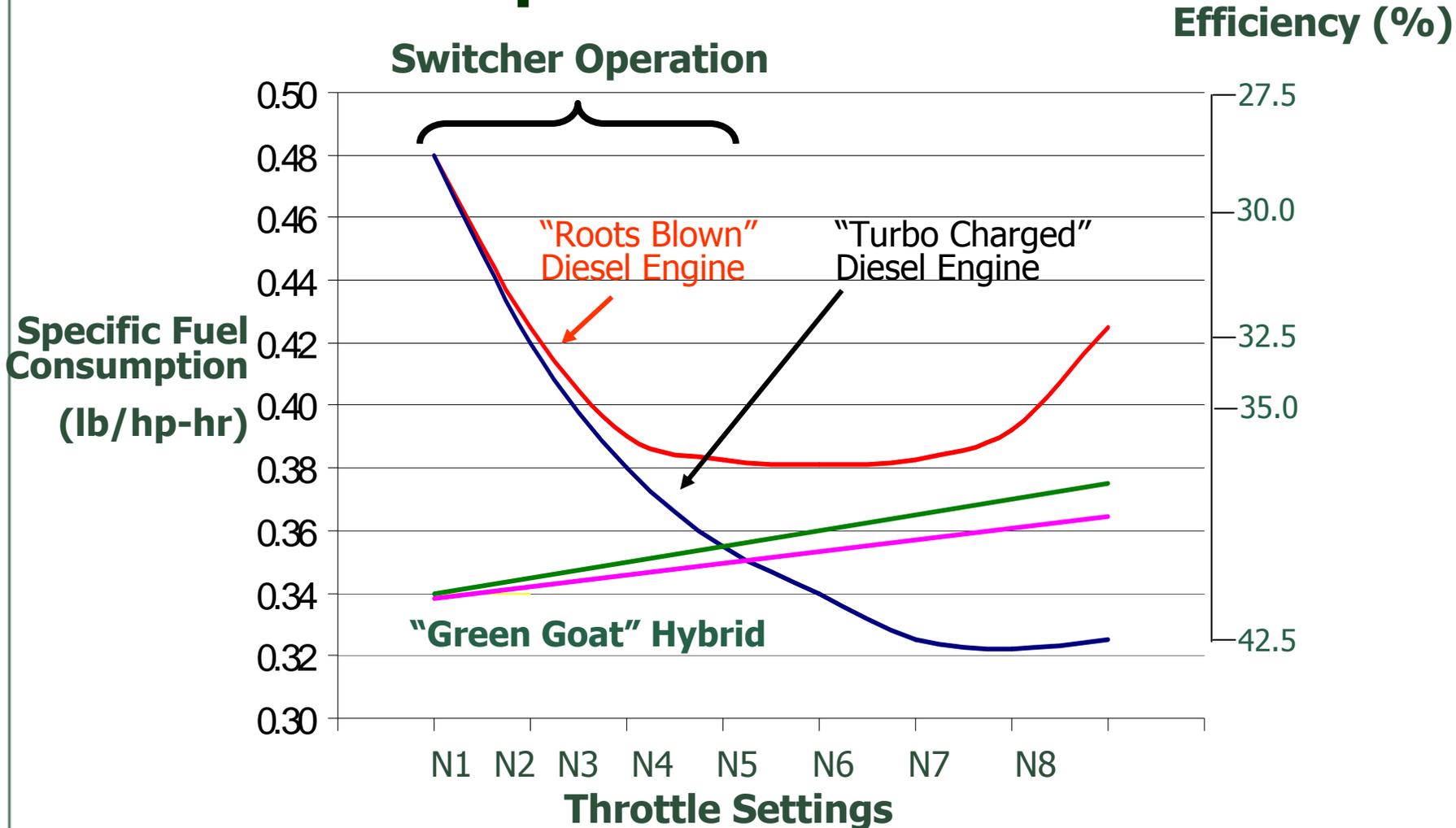
- DC-DC Power converter
- Microprocessor control

# Standard Control Stand

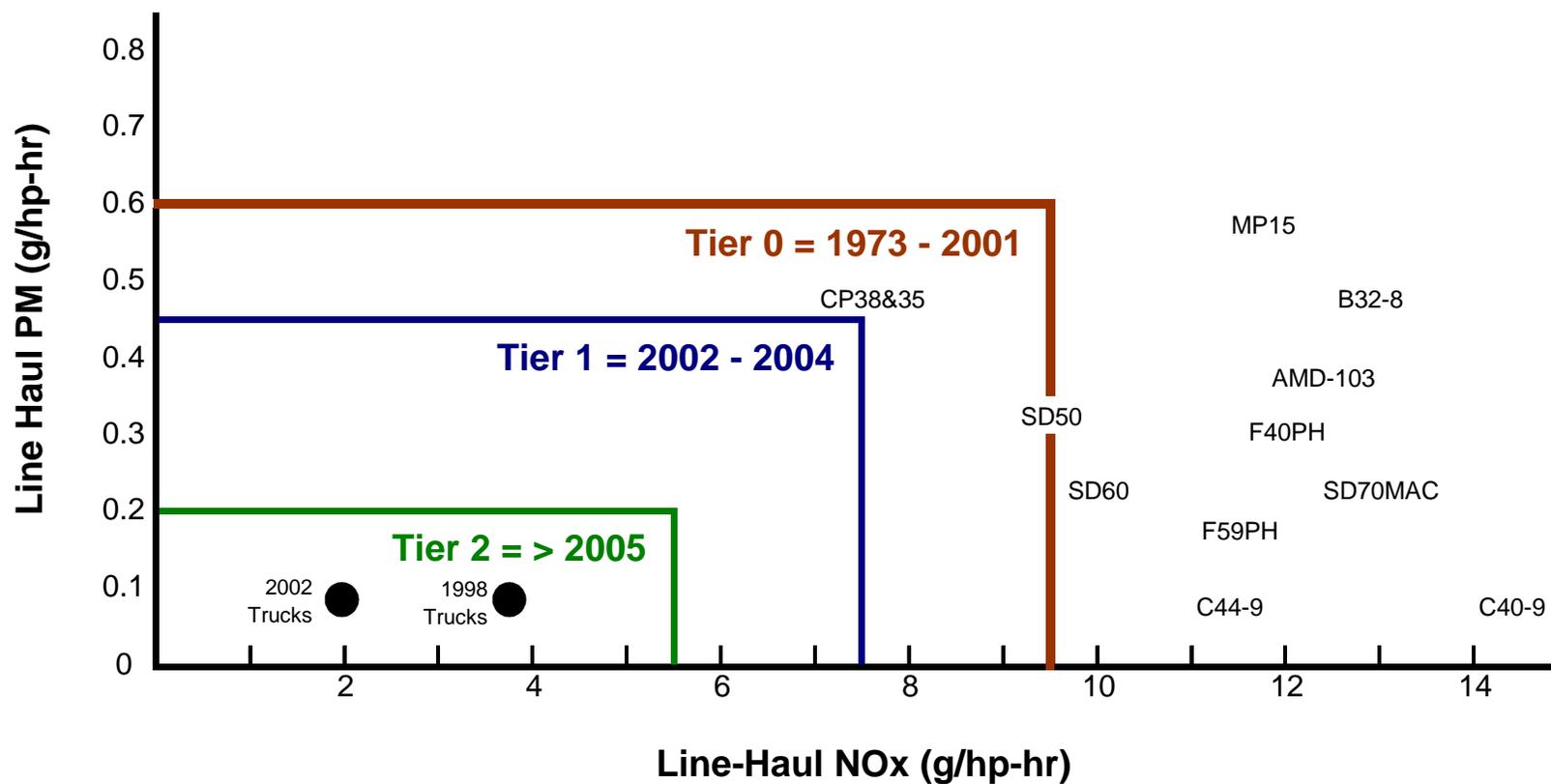


- ▶ Standard Control Stand
- ▶ High operator familiarity
- ▶ View screen for diagnostics

# Fuel Consumption Characteristic



# EPA Locomotive Exhaust Emissions Regulations



Source: Southwest Research Institute

# Typical Emission Reductions

Operating Schedule	NOx Emissions (Tons/year)	
	GP-38	Green Goat
40 hours / week	5.1	0.7
24/7 service	21.5	3.0

- ▶ Assumes conventional locomotive rebuilt to Tier 0 emissions
- ▶ PM similarly reduced
- ▶ 98% reduction in NOx and PM after SCR/DPF treatment on Green Goat

# Environmental Benefits

- ▶ 80-90% reduction of NOx/diesel particulate as standards
  - ▶ 98% reduction optional
- ▶ 50%+ reduction of greenhouse gases
- ▶ Virtually eliminates noise pollution
- ▶ Easily meets EPA Tier 2 and expected Tier 3
- ▶ Exceeds local government requirements
- ▶ Recycle and re-use parts of old locomotives
- ▶ Availability of emissions credits / government grants
- ▶ Drastically reduces complaints (noise) from railway neighbours

# Hybrid locomotives provide

- ▶ High operator acceptance
- ▶ Superior tractive effort and adhesion
- ▶ 30-80% fuel savings, low operating cost
- ▶ Better availability
- ▶ Large emissions reduction