



# Idle Reduction Technologies

EPA Region 1 Workshop

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# Where Are We?



# Our Mission

*To develop superior engine heating solutions  
that help our customers:*

- Improve operating efficiencies
- Extend engine life
- Reduce emissions
- Reduce fuel consumption



# Applications

In many applications (heavy duty trucks, locomotives, generator sets, gas pipeline compressor stations, construction & mining equipment, etc.), heating large diesel engines above 100F allows them to start easily with minimal engine wear and provide full power quickly without idling.



# Idle Reduction

We've been doing it since 1942



**HOTSTART**  
SINCE 1942

# Today's Operator



Today's switchyard locomotive is operated via remote control. No demand for creature comforts.



Today's long-haul truck is an apartment-on-wheels. Big demand for creature comforts.

# Keeping Engine Above 100F

- Bus and Truck engines (300-850 CID)
  - 750-1500 watts to the coolant.
- Locomotive engines (4,000-15,000 CID)
  - 18,000-30,000 watts to the coolant
  - 0-6,000 watts to the oil





# Let's Examine Locomotive Idling



A GP38-2 locomotive consumes 4.5 gallons per hour of fuel at normal idle. When outside temperatures drop to 10-15F, the locomotive is idled at notch 3 to keep the engine warm. At notch 3 the locomotive consumes 11 gph.



# % Time Spent Idling?

	<u>Line Haul</u>	<u>Switch</u>
EPA	38.0%	59.8%
AAR	54.0%	75.4%

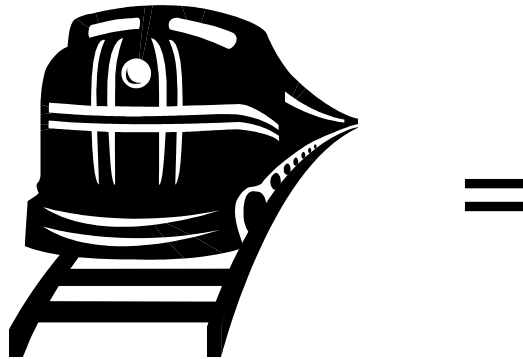
AAR = American Association of Railroads



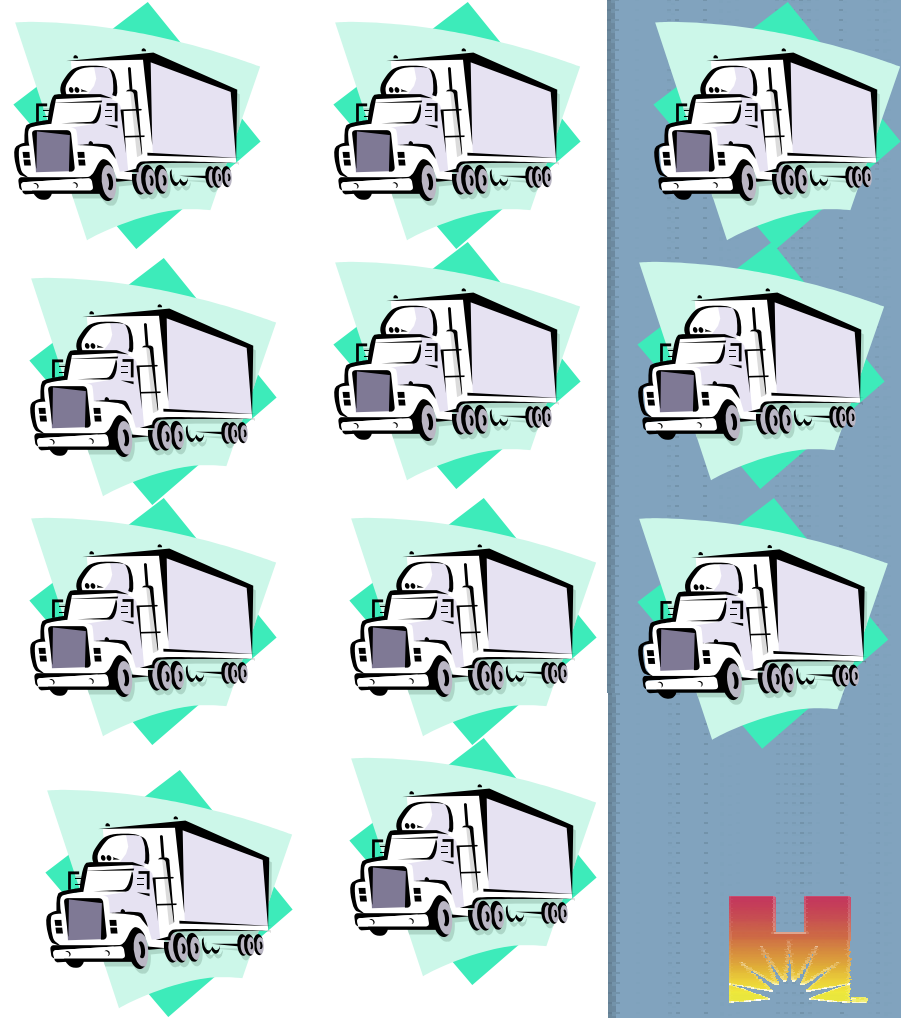
# How much fuel is wasted?

- Assume locomotive has 92% availability
  - $8,760 \text{ hrs/yr} \times 92\% = 8,059 \text{ in-service hours/year}$
- Assume EPA Switcher Duty Cycle
  - $8,059 \text{ hrs/yr} \times 59.8\% = 4,819 \text{ idle hrs/year}$
- Assume no notch 3 idling.
- GP38-2 consumes 4.5 gph at normal idle
  - $4.5 \times 4,819 = \underline{21,685 \text{ g/yr}}$
  - 59 g/day

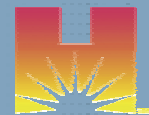
# 21,685 gallons/year!



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One idling locomotive consumes as much fuel as 11 idling trucks assuming truck consumes 0.8 gph, 8 hrs/day, 300 days/yr (see EPA420-R-02-025).



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SINCE 1997

# Idling Problems



- Fuel consumption
- Oil consumption
- Emissions
- Noise
- Souping-up
- Engine wear

# Why Idle?

- Avoid difficult start-ups
  - Cold engine ( $T < 100\text{F}$ )
  - Weak batteries
- Ready for immediate service
- Freeze Protection – no antifreeze
  - Must keep engine  $> 32\text{F}$



# Idle Reduction Technologies

*In general, across all applications, idle reduction technologies fall into three distinct categories:*

- Shore power, plug-in systems
- Stand-alone heating systems
- Automatic start-stop systems



# Idle Reduction Technology Using Shore Power



Kim Hotstart's plug-in engine heating system (left) and battery charger (middle) are used on Chicago's METRA commuter locomotives (right) and in EPA Region 1 by New England Southern Railroad, Maine Central Railroad, Massachusetts Central Railroad, Bay Colony Railroad and others.





# Locomotive Shore Power

- Advantages
  - Proven Technology
    - 1<sup>st</sup> installation in 1965
    - Over 2,000 installations
  - Low Maintenance
  - \$3,000-\$14,000 Investment
  - Very Low \$/ton NOx Reduced
- Disadvantage
  - Have to park near external power source to shutdown



# Stand-Alone Solution



Kim Hotstart's DDHS (Diesel Driven Heating System) was developed in response to the railroads who wanted the flexibility to shutdown their locomotives anywhere and still be able to easily restart the engine when needed.





# Idle Reduction Using DDHS



- No external plug-in. Allows locomotive to be shut down anywhere.
- Operates automatically.
- Uses EPA Certified 3-Cylinder, 27hp diesel engine.
- Engine is direct-coupled to centrifugal water pump.
- Waste heat is transferred through heat exchangers to locomotive coolant and oil.
- Operates at multiple speeds to produce required heat.
- Maintains locomotive coolant between 100-120F.
- Powers cab heaters and charges batteries through 72vDC alternator.
- Successful field experience since 1998 with reported ambients down to -38F.
- Selected for first EPA locomotive idle reduction project.
- Installed on 14 different locomotive models by 11 different railroads.

# Walkway Installation



**HOTSTART**  
SINCE 1982

# DDHS Consumes Little Fuel Compared to Locomotive

<u>Throttle Setting</u>	<u>Idle (gph) —</u>	<u>Notch 3 (gph)</u>
SW12/SW15	3.0	9
GP7/GP9	3.7	8
GP38-2 SD38-2	4.5	11
GP40-2 SD40-2	5.1	11
DDHS	0-1.23	0-1.23



# Adding SmartStart Adds Benefits

- Autoshutdown of locomotive
- Autorestart of locomotive
- Maintains brake pressure
- Fuel savings reports
- Remote monitoring (Optional)
- Failsafe redundancies
- Year round system





# EPA-Chicago Project Results

- Fuel Savings per day = 42.7 gallons
- Fuel Savings per year = 14,339 gallons
- NOx reduced per year = 2.4 tons
- PM reduced per year = 0.07 tons
- Noise pollution reduced 8-15 decibels





# Win-Win-Win



Cleaner environment for our citizens!

Fuel Savings!

Reduced air and noise pollution!



Left to Right

Tom Skinner, EPA

Marcia Jiminez, Chicago

Craig Hill, BNSF

# Opportunities in Region 1?

- Perhaps not the best targets
  - Class 1 railroads (BNSF, CSX, Norfolk Southern, etc.)
    - Already implementing idle reduction solutions.
  - Military bases
  - Industrial (plants, mills, ports, etc.)
  - Tourist railroads
  - Amtrak
- **Best Targets**
  - Commuter Railroads
  - Short Line Railroads

# Opportunities by State

218 Short Line & Commuter Locomotives

- Massachusetts (88)
- Maine (61)
- Vermont (28)
- New Hampshire (27)
- Connecticut (14)
- Rhode Island (?)

# Opportunities in Massachusetts

- MBTA Commuter Rail (55)
- Providence & Wooster (21)
- Massachusetts Central (7)
- Pioneer Valley (5)
- STS Rail System
  - Springfield Terminal
  - Boston & Maine
  - Maine Central



# Opportunities in Maine

- Bangor & Aroostook (40)
- St. Lawrence & Atlantic (9)
- Belfast & Moosehead (6)
- Maine Coast (4)
- Aroostook Valley (2)

# Opportunities in New Hampshire

- Green Mountain (7)
- New Hampshire Northcoast (6)
- New Hampshire & Vermont (3)
- Berlin Mills (3)
- Quincy Terminal (3)
- Claremont Concord (2)
- Milford Bennington (2)
- New Hampshire Central (1)



# Opportunities in Connecticut

- Housatonic (8)
- Connecticut Central (3)
- Central New England (3)





# Opportunity in Region 1

- Assumptions
  - 218 locomotives
  - 90% not equipped with solution
  - Use EPA-Chicago results for reductions in fuel consumption, NOx and PM.
- Total available reductions
  - 2.8 million gallons of diesel per year
  - 471 tons of NOx per year
  - 14 tons of PM per year



# Opportunity by State

State	# Locos	Fuel (mgal/yr)	NOx (tpy)	PM (tpy)
MA	88	1.1	190	5.5
ME	61	0.8	132	3.8
VT	28	0.4	60	1.8
NH	27	0.3	58	1.7
CT	14	0.2	30	0.9
RI	0	0.0	0	0.0
Total	218	2.8	471	14

Please let us know  
how we can help.



Thank You!