

# **On-Board Idle Reduction Technologies for Heavy-Duty Trucks**



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U.S. Department of Energy

***Alternatives to Truck Engine Idling Workshop***

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# 21<sup>st</sup> Century Truck Partnership

**VISION:** Our nation's trucks and buses will safely and cost-effectively move larger volumes of freight and greater numbers of passengers while emitting little or no pollution and dramatically reducing dependency on foreign oil

- Industry-government partnership
  - 15 industry partners, 4 Federal agencies
- Five key technology focus areas to support RD&D
  - ✓ Engine Systems
  - ✓ Parasitic Losses
  - ✓ Safety
  - ✓ Heavy-Duty Hybrids
  - ✓ Idle Reduction





# 21st Century Truck Idle Reduction Activities

**GOAL:** Reduce Idling Fuel Use and Emissions by 85%

- Develop and demonstrate advanced 5 kW auxiliary power units (APUs) that are quiet, weigh <200 lb, consume <0.25 gal/h diesel fuel @ full load and meet Tier 2 Bin 10 emissions for under \$200/kW by 2007
- Develop and demonstrate 5-30 kW fuel cell APUs that use multiple fuels and operate at > 35% efficiency for under \$400/kW by 2012
- Develop new codes and standards for electrification of trucks and truck stops
- Incentives and regulations that encourage users to find more efficient and environmentally-sustainable ways to meet power needs at rest
- Educational efforts for truck and bus owners/operators to eliminate unnecessary idling



# Idle Reduction Technologies for Heavy-Duty Trucks – DOE’s Advanced Vehicle Testing Activity (AVTA)

**GOAL:** Maximize the introduction and use of on-board idle reduction technologies in heavy-duty trucks



## Objectives

### 1) Technology Benchmarking/Demonstration

Develop objective in-use information on the performance of on-board idle reduction technologies by characterizing cost; fuel, maintenance, accessory, and engine life savings; payback; and user impressions

### 2) Identify and implement strategies to overcome critical cost barriers inhibiting broad market introduction

### 3) Conduct education and outreach to increase the knowledge, awareness, and acceptance of idle reduction technologies within the trucking industry and public at large



# AVTA's Idle Reduction Technologies Activities to Date

- Extensive communications with trucking industry to ascertain issues surrounding introduction of idle reduction technologies
    - Fleets
    - Owner/Operators
    - Truck OEMs
    - Idle reduction technology manufacturers
- Primary barriers: Initial cost (payback period); objective in-use data on system performance; reliability and maintenance requirements; driver education, training, and overall receptiveness
- Two workshops conducted
    - Characterize data collection/demonstration parameters
    - Identify cost reduction strategies
  - Data collection/demonstration plan
  - Data collection/demonstration projects
  - Technology introduction plan
  - Pending solicitation for truck OEM on-line installation



# DOE Idle Reduction Fleet Demonstration Projects

GOAL: Gather objective in-use information on the performance of available & near-term technologies by characterizing:

- Specifications and costs
  - System descriptions
  - Capital and installation costs
  - Payback period
- Other evaluation information
  - Engine and component wear
  - Resale value
  - User impressions
- Vehicle operation
  - Fuel consumption (truck idle and idle reduction system)
  - Engine oil consumption and changes
  - Maintenance (truck and idle reduction system)





# DOE Idle Reduction Fleet Demonstrations – Caterpillar

- Team: Caterpillar, International Truck, and Cox Transfer
- Five new idle reduction trucks; Five control
- Trucks idle about 1840 hours/year
- MorElectric™ Technology
- Electrically driven accessories
- Three main components
  - HVAC unit
  - Generator
  - Auxiliary Power Unit (APU)
    - 0.2 gallons/hour fuel use vs. 0.9 gallons/hour for C13 engine
- Project start 4Q, FY03; Culminates 4Q FY05





# Caterpillar Fleet Demonstration – Status

- International working design details of installed hardware
- Agreed upon alternate component location to address weight distribution issues
  - Minimize potential loss of payload and customer functionality
- To minimize cab modifications - selected 2-piece HVAC design to leverage existing production air handling hardware (fans, water HX, ducting, ...)
- Designing interface wiring harness to mate International and MorElectric™ system
- Lab development testing
  - HVAC optimization in climatic chamber
  - EMI testing
  - APU shake table accelerated endurance testing
  - Software control development
- Truck assembly
  - Control trucks began assembly June 21, MorElectric™ trucks July 20
  - MorElectric™ hardware factory installed



# DOE Idle Reduction Fleet Demonstrations – Schneider National

- Team: Schneider National, Inc.; Freightliner, LLC; Webasto Thermosystems, Inc.
- 100 trucks with heating systems; 19 trucks with cooling systems
- Trucks idle approximately 480 hrs/year
- Webasto Cab Cooler
  - New product that utilizes a phase change cooling storage technology
  - Medium is charged during normal tractor operation using the existing air conditioning system
- Webasto Air Top 2000 cab heater
  - Self contained diesel fueled air heater
  - Offered as standard installation option from Freightliner
- Projects start 4Q, FY03; Culminates 2Q, FY05





# Schneider National Fleet Demonstration – Cab Cooling

## **Cab Cooling** (July - October 2003, Southwest U.S.)

- 19 Webasto Cab Coolers
- Performance (includes insulating privacy curtains):
  - Fully-charged cools bunk for 10 hrs up to ambient 85°F, 7 hrs at 90°F, beyond 90°F further degradation
  - Requires 6 hours of charging for best performance
  - No unit failures
  - Retrofit installation not recommended (30 hrs, highly technical)
- Driver feedback:
  - More positive than actual results
  - Better air flow would improve performance
  - Improve cab insulation
- Results:
  - MPG, idling target (80% improvement in idling performance against control group), and payback are disappointing



# Schneider National Fleet Demonstration – Cab Heating

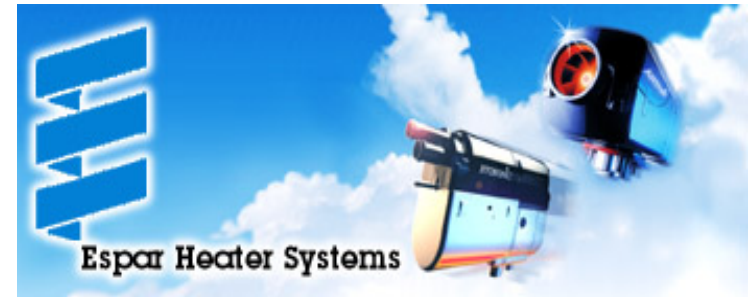
## Cab Heating (December 03-April 04, 48 State Operation)

- 100 Webasto Cab Heaters
- Performance (no cab modifications)
  - Retrofit <3hrs
  - Maintains 70°F at ambient temperature of 0°F
  - 5 failures related to glow pins and installation issues
  - Average fuel consumption .07 gal/hr, tractor .85 gal/hr
  - Idle time reduced to average 8.7% versus control 22.3%
  - At \$1.50/gal, payback in fourth year even at low control idling of 22%
- Driver Feedback:
  - Very Positive
  - Keep interior at 70°F constantly
  - Need temperature control adjustment



# DOE Idle Reduction Fleet Demonstrations – Espar

- Team: Espar Inc.; Wal-Mart Transportation, LLC; Truck manufacturer TBD
- 20 trucks with combined heating and cooling systems
- At least two trucks used for control
- Espar Airtronic Bunk Heater
  - Diesel fueled air heater
- Hydronic 5 Engine Pre-heater
  - Diesel fueled coolant heater for engine pre-heat



- D.C. Airco
  - Rooftop mounted electric air conditioning unit
  - Operates on starting or auxiliary batteries
- Project award Spring FY04





# Solicitation for Truck OEM On-line Installation

**FOCUS:** Installation of full function (heating, cooling, and electrical), on-board idle reduction technologies into heavy-duty trucks as factory (preferably) or dealer-installed options

## Scope

- Technology/engineering development to cost effectively integrate systems into vehicle design and assembly process by MY06
- Full engineering documentation
- Cost savings of on-line installation versus aftermarket installation

## Solicitation Parameters

- Teaming requirements – Truck OEM (lead), idle reduction technology manufacturer, and fleet (preferably)
- \$300-500K in total funding; 2-3 awards
- 50/50 cost share
- Summer 2004 release
- Award 1Q, FY05
- Project duration 2 years



# AVTA's Future Activities for Idle Reduction Technologies

- Education and outreach (FY04-FY05)
  - Work with trade press to increase awareness and acceptance
  - Increase awareness of increased resale values of idle reduction equipped trucks
  - Outreach on successful fleet applications
  - Outreach on fuel/cost, maintenance...savings from demonstration projects
  - Health benefits
- Coordinate with Idle Elimination Manufacturers Association in addressing policy and institutional barriers (FY04-FY05)
- Extend data collection/demonstration projects (FY06, if warranted and funding available)
- Additional solicitation for on-line installation of idle reduction technologies at truck OEMs targeting year 2008 emission and fuel consumption requirements (FY06, if warranted and funding available)



# National Idle Reduction Planning Activity

- **GOAL:** Improve Efficiency, Emissions, and Safety of freight and passenger transport through increased utilization of idle reduction technologies.
- Joint Interagency effort with DOE, DOT, EPA, US Army
- Addressing Truck, Bus, and Rail idling
- Held Government/industry National Idle Reduction Planning Conference in Albany, NY in May 2004.
- Plan development underway with participation from Federal and State Government Agencies, DOE National Laboratories, and Industry Representatives from truck, bus, rail, engine, and idle reduction technology manufacturers.
- Plan to be released in March 2005 with implementation to immediately follow.



# For More Information

## Advanced Vehicle Testing Activity

Dedicated to testing advanced technology vehicles to support commercial deployment



- Advanced Vehicle Testing Activity (AVTA)
  - [www.ott.doe.gov/otu/field\\_ops/field\\_ops.html](http://www.ott.doe.gov/otu/field_ops/field_ops.html)
- Idle reduction technology
  - [www.ott.doe.gov/otu/field\\_ops/idle.html](http://www.ott.doe.gov/otu/field_ops/idle.html)
- FreedomCAR and Vehicle Technologies
  - [www.eere.energy.gov/vehiclesandfuels](http://www.eere.energy.gov/vehiclesandfuels)

