Electric Utility Perspectives on Electric Technologies for Diesel Engine Run-Time Reduction

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Electric Power Research Institute

• Founded in 1973 as a nonprofit research center for the U.S. electric utility industry
• Annual budget of $300M, approximately 700 employees
• Four sectors
  – Generation (fossil, renewable, distributed)
  – Nuclear
  – Environmental
  – Power Delivery and Markets
    • Electric Transportation
• EPRI Industry Reports (free to the public)
  – Electricity Sector Framework for the Future
    http://www.epri.com/corporate/esff/
  – The Electricity Technology Roadmap Initiative
    www.epri.com/corporate/discover_epri/roadmap/
Electric Transportation Research at EPRI

- EPRI has a 25-year history of innovation in advanced vehicles, including:
  - Plug-in hybrids, battery electric vehicles, fuel cell vehicles
  - Advanced battery development, fast charging, component design
  - Modeling and simulation, control system development
  - Engineering, environmental, economic, and market analysis
  - Nonroad ET—electric material handling, TSE, airport GSE
EPRI Objectives

• Conduct credible analyses based on independent, objective operating data and technical information
• Develop new products or technology in collaboration with industry partners
• Conduct demonstration projects in order to:
  – Demonstrate promising new technologies or products
  – Enable market transformation for new products
    • Customer education
  – Collect independent and objective operating data
• Support or facilitate utility participation in TSE projects
  – In-kind funding
• Assist with development of standards and safety procedures and make recommendations to appropriate organizations
EPRI Activities

• Analysis
  – “Truckstop Electrification Study” – October 2001

• Demonstrations
  – Onboard truck equipment with 120VAC Shorepower – EPA Smartway Transportation Grant (EPRI and SMUD)
  – Alabama IdleAire Demonstration Project (EPRI and Alabama Power)
  – Electric Transport Refrigeration Unit economic (Jul-04) and technical (Oct-04) analyses and software tools (EPRI with Southern Calif. Edison and SMUD)
    • Looking for a good eTRU demonstration project
## EPRI Initial View of TSE Benefits

<table>
<thead>
<tr>
<th>Parked-Truck Power Option</th>
<th>Investment</th>
<th>Charges / Costs / Savings</th>
<th>Payback Period</th>
<th>NO\textsubscript{X} Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heavy-Duty Diesel Idling</strong>&lt;br&gt;1,831 hrs/year @ 1.5 gal/hr, $1.50/gallon</td>
<td>$0</td>
<td>-$4,120 annual fuel cost only</td>
<td>baseline</td>
<td>225 lbs/year/truck baseline</td>
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<tr>
<td><strong>On-Board Heating/Cooling w/ Shore Power</strong>&lt;br&gt;1,400 hrs/yr @ 1.5 kW</td>
<td>$2,000 Truck Owner&lt;br&gt;$1,400/space Truckstop (or Depot)</td>
<td>~$2,450 annual savings - energy&lt;br&gt;$4 per 8 hrs parking (12 hrs/day use)</td>
<td>1 year&lt;br&gt;1 year</td>
<td>166 lbs/year/truck avoided&lt;br&gt;518 lbs/year/space avoided</td>
</tr>
<tr>
<td><strong>Off-Board Electrical Heating/Cooling @ 4 kW</strong>&lt;br&gt;</td>
<td>No investment Truck Owner&lt;br&gt;~$6,000/space IdleAire&lt;br&gt;&lt;$200/space Utility</td>
<td>$700 annual savings - energy (700 hrs/yr) see note&lt;br&gt;~$10 per 8 hrs parking (12 hrs/day use)&lt;br&gt;17,500 kWh/yr/space</td>
<td>No investment&lt;br&gt;~2 years&lt;br&gt;&lt;2 years</td>
<td>77 lbs/year/truck avoided&lt;br&gt;486 lbs/year/space avoided</td>
</tr>
<tr>
<td><strong>Transport Refrigeration Unit Electric-Standby @ 6-kW load 800 hrs/yr</strong>&lt;br&gt;</td>
<td>$2,600 Trailer Owner&lt;br&gt;$3,400 / space Truckstop (or Depot)</td>
<td>$4,000 annual savings - energy&lt;br&gt;$8 per 8 hrs parking (12 hrs/day use)&lt;br&gt;26,280 kWh/yr/space</td>
<td>8 months&lt;br&gt;1 year&lt;br&gt;&lt;2 years</td>
<td>122 lbs/year/trailer&lt;br&gt;585 lbs/year/space avoided</td>
</tr>
</tbody>
</table>
Insights to Date

• As with our initial study, there are a number of different assumptions and projections for the cost/benefits of TSE

• A primary motivation of our demonstration projects is the collection and dissemination of objective operating data

• Utility and diesel combustion emissions will improve significantly over time, so the value of the pollution benefits are a moving target, but currently high
  – Electric technologies clean up even the oldest equipment

• The benefits of petroleum and greenhouse gas reduction are expected to increase in value

• Transforming traditional industry practice (idling) will take the expected amount of time, as with any new technology
Electric Utility Perspectives

• Each utility is a unique combination of:
  – Generation mix
  – Customer base
  – Geographic locale
  and so on. . .
  – Regulatory environment
  – Economic health
  – Environmental challenges

• However, utilities are interested in TSE, idle reduction
• Primary motivations may include:
  – New load (especially off-peak)
  – Local source emissions reductions
  – Community service
  – Use of electric technologies as customer solutions
Selected Industry Quotes

“An 80-space installation adds 400kW of peak load and can generate about $51,000 per year in new revenue”

“Electric TRU demonstrations are good local source emissions reductions projects. By working with a single organization, we can help ensure that the project achieve its proposed benefits”

Electro-technologies can be important tools for our customers to cost-effectively meet environmental compliance requirements—which is a requirement for the continued health of our customers’ businesses.
Infrastructure and Standards

• The two shorepower techniques are largely compatible
  – Low-power: 120 VAC, 15-20 amp
  – High-power: 240 VAC, 30 amp (or 208 VAC)
  – Installed capacity does affect the infrastructure expense

• TRUs with electric standby are more complex
  – Numerous electrical and connector requirements, up to 480 VAC.
  – Additional safety concerns

• Utilities largely view these installations as another industrial customer. They’ll just hook up power and throw the switch.

• However, one should not assume that all utilities desire load growth.
Summary

• Reducing diesel fuel consumption by displacement with electricity will reduce pollution and greenhouse gas emissions, create jobs, lower the trade deficit and reduce national petroleum dependence

• There is a significant, but not universal, interest in TSE projects at the utilities

• However, revenue may not justify complete funding of a project by a utility
  – Participation more likely as a member of a larger collaboration

• There is a lot of interest in the environmental benefits of TSE technologies and the potential for emissions credit
  – Need more in-use operating data on the various products and technologies