TENNESSEE CLEAN FUELS

Memphis Fire Department Idle Reduction Technology Case Study

East Tennessee Clean Fuels Coalition

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Top-Level Summary

In 2020, the City of Memphis Fire Department (MFD) introduced idle reduction technologies to its ambulance fleet to minimize fuel waste, idle wear, and air pollutants from its emergency vehicles. Contracting with ZeroRPM, MFD had an auxiliary power unit installed in one of their ambulances to test this technology. In that first year, MFD mitigated over 2,200 hours of idle time which translates to over 2,000 gallons of diesel fuel saved… and all the related emissions eliminated.

(ABOVE) Four Memphis Fire Department Freightliner ambulances with ZeroRPM idle-reduction technology.

Narrative

Auxiliary Power Units, or APUs, are battery units that provide power to auxiliary power needs in a vehicle. In an ambulance those power needs include operating medical equipment, refrigerators, and HVAC systems, and with the use of an APU they can be operated when the main engine is shut off. These APUs can save up to 1.5 gallons of diesel use per vehicle hour (depending on the fleet and how it operates), and reduce the associated pollutants emitted, like nitrogen oxides (NOx) and particulate matter. Reducing these emissions improves health outcomes for the EMS crews that drive the ambulances, the patients that ride in them, and the emergency room staff and visitors that they frequent… as well as the larger local community. APUs are getting more and more use aboard fire apparatus and ambulance units, with proponents saying the reduced run time and wear and tear on the main engine mean greater savings in terms of fuel, maintenance, cost per run, and return on investment in the APU.

In the emergency medical field, the standard operating procedure requires that an ambulance be kept ready and warmed. This is done for a few reasons:

- an ambulance must be prepared to respond to a call with minimal delays,
- patient treatment requires a temperature-controlled environment, particularly in extreme cold or heat,
- refrigeration and communications systems in the ambulance require sustained power,
- onboard equipment requires electricity to maintain appropriate charge levels, and
- emergency lights and other auxiliaries need power to operate.

This has traditionally meant that EMS crews must run the ambulance's diesel engine to maintain power and cooling/heating to the ambulance, a practice known as "idling," which is known to waste fuel and increase localized air pollution. For ambulances, idling wastes anywhere from 0.75 to 1.5 gallons per hour; over the course of a 24-hour shift, that's 18-36 gallons of fuel wasted.

Since the pilot ambulance in 2020, MFD has installed idle reduction APUs in 12 other vehicles, all Class 6 medium-duty ambulances (with gross vehicle weight ratings of 20,000 lbs). The acquisition of three of those APUs were supported by Volkswagen "Environmental Mitigation Trust" settlement funding in Tennessee, and the acquisition of seven more was supported by the "Reducing Diesel Emissions for a Healthier Tennessee" (RDE4HT) grant program, managed by East Tennessee Clean Fuels (ETCF).

The effort by the Memphis Fire Department to make this transition was led by Deputy Chief of EMS Angie Shelton-Sullivan and was aided by the Shelby County, City of Memphis, Division of Planning and Development. The Department was initially approached by ZeroRPM, and they had heard positive reviews from other departments that had already begun implementing the technology. EMS Fleet Lieutenant Ian Walsh was trained by ZeroRPM on vehicle operation, system technology, and data collection.

(ABOVE) Chief Jonathan Haley shows off the ZeroRPM auxiliary power unit in one of the MFD ambulances.

(LEFT) Close up of the front AC compressor, a piece of the overall APU.

Once fully set up, the ambulances will automatically push recent idle reduction equipment operational data to the MFD's home network when they arrive back at the garage. An online dashboard gives staff access to all the stored data for easy viewing and exporting (as needed). According to Chief Jonathan Haley, Grants Officer at MFD, ZeroRPM's Learning Management System through the web portal was a useful source for learning how to implement, use, and troubleshoot the new technology.

Outputs & Outcomes

Since 2020, the Memphis Fire Department **has saved over $96,000 in fuel costs across all 13 vehicles**. That equates to 260 short tons of carbon dioxide (CO_2) reduced and 25,110 total idle hours mitigated, which is a 54% total reduction. The total diesel fuel saved to date is 23,604 gallons. Through the dashboard that MFD uses, they can see a further breakdown on the savings wherein almost 50% came from fuel used to cool the patient area, and another 15% came from heating that area. Through hot summers and cold winters, the ZeroRPM idle reduction reduced diesel fuel consumption while keeping all the ambulance's vital systems operational.

Reducing NOx and particulate matter results in improved health outcomes for patients that ride in the ambulances, EMS personnel and staff, as well as staff and other patients in the hospital's ambulance bay and adjoining emergency rooms (where emissions can flow during patient drop off).

(ABOVE) Two Memphis Fire Department EMT staff stand in front of one the idle reduction-equipped ambulances.

Best Practices & Lessons Learned

Of course, new technologies will always come with some lessons learned. MFD's EMS Fleet Lt. Ian Walsh detailed an issue with the fan clutches going out causing overheating while the AC ran in the summer months. He also documented electrical issues with some of the units, though this was revealed to be a problem with the installation, rather than originating from any of the ZeroRPM components. Overall, when problems arise, Walsh attests that they have been able to troubleshoot the issues relatively quickly. Still, after a few years of

use, Chief Haley suggested that they could benefit from a more regimented process for troubleshooting from ZeroRPM, as well as a longer warranty service time.

Conclusions

Over the past four years, the positive impact of the idle-reduction technology has been felt in the Department and across the community. A reduction in vehicle idling means less wear and tear on the engine itself, which results in the vehicle needing about a third of preventable maintenance as compared to a vehicle that does not have the reduced engine hours from using the new equipment. From a fiscal perspective, it took less than five years for the MFD to make its money back on the technology, thanks to the money saved by the loss of service time needed to maintain the vehicle. On a more immediate level, the benefit of the APUs is felt by the ambulance crew and the community they serve by the reduced background noise and exhaust fumes. Chief Haley highlighted specifically the impact it makes when transporting patients through a hospital's ER bay with 8-10 ambulances and very little airflow, as well as the noticeable increase of time between needing to refuel the ambulances.

Chief Haley explained MFD's greatest takeaways from APU usage in a 2022 interview:

> *"As everybody realizes that we need to move to more sustainable practices in the transportation sector, we are trying to do our part and given the technology available for ambulance operations currently, ZeroRPM was a great entry point for us. It was accessible and easily implemented. And after we saw the cost benefits, they were significantly favorable. It's a win, and the proof is there and it is working for us. We'll keep doing it and keep looking for other opportunities to move the needle and get to a greener fleet."*

MFD plans to include the APUs in all new vehicles moving forward and has 11 more currently on order. Overall, the Memphis Fire Department's example has been a great success story in APUs and their ability to curb idling and the associated fuel usage, costs, and emissions. In the future, they are interested in learning about and exploring more opportunities to implement hybrid technologies in vehicles in the Department.

External Links

Memphis Fire Department: https://www.memphistn.gov/mfd/
ZeroRPM: https://www.zerorpm.com/
RDE4HT: https://www.tncleanfuels.org/rde4ht-reducing-diesel-emissions-for-a-healthier-tennessee/