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The Diesel Retrofit Experience

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Diesel Emissions and the 5 R's of Emissions Reduction

- Diesels are reliable, durable, fuel-efficient (lower CO_2 emissions), high torque engines that are inexpensive to operate and easy to repair.
- But, they co-produce particulate matter, nitrogen oxides, carbon monoxide and hydrocarbons.
- EPA and CARB Strategies for Reduction
  - Retrofit
  - Repower
  - Rebuild
  - Refuel
  - Replace

What is Retrofit?

- Retrofit involves the addition of an emissions control device to a vehicle to reduce the exhaust emissions.
- Retrofits can be very effective at eliminating up to 90% of pollutants.
- Examples of retrofit emissions control devices include: DOC, DPF, EGR, LNT, SCR and crank-case emissions devices.
- Used in both on-road and off-road sectors.

Who is Paying for Retrofit?

- The EPA's National Clean Diesel Campaign, has been primarily funded by the Congressional DERA, part of the 2005 Energy Policy Act.
- Highlights from EPA's 2016 report to Congress
  - From 2009-2013, awarded $520 million to retrofit or replace 58,800 engines.
  - Installed 18,000 DOCs, reducing HC emissions by 58,700 tons and CO emissions by 58,700 tons.
  - Installed 3,000 DPFs, reducing PM emissions by 12,000 tons.
  - Reduced NOx emissions by 312,000 tons!
  - Estimates **$11 billion in health benefits** over the lifetime of these engines.

7 Keys for Successful Retrofit

1. Engineer for the Application
   - Use of verified/approved technologies
   - EPA/CARB verify technologies for specific engine families and MYs and/or maximum emissions levels
   - Need to be sized for engine displacement and back pressure limitations.
   - May need to custom design connectors and packaging for the technology to fit

7 Keys for Successful Retrofit

2. The vehicle must be well-maintained
   - Gross emitters are not good candidates
   - Follow pre-installation checklist
   - Continued maintenance and regular inspections
3. Available fuels dictate options
   - Fuel sulfur levels (50 ppm max) will impact catalysts.

7 Keys for Successful Retrofit

4. Vehicle duty cycles / exhaust temperatures define the options for DPFs, for regen strategies.
5. Professional installation in necessary to ensure integrity and proper operation.
6. Use of on-vehicle monitors and diagnostics
7. Training and education of vehicle operators, installers, and maintenance personnel.

Summary

- Experience with diesel retrofit over the past dozen years has shown:
  - Retrofit is a cost-effective method for reducing emissions from in-use vehicles and fleets in both the on-road and off-road markets.
  - Application matching is a necessary step to find a retrofit solution.
  - Even passive solutions need maintenance!
  - Success requires cooperative effort between technology providers, operators and maintenance personnel.

References

- Manufacturers of Emissions Catalysts Association (MECA) website: https://www.meca.org/diesel-retrofit
- Diesel Technology Forum: https/www.dieselforum.org/policy/
- ICCT Publication: https://www.theicct.org/sites/default/files/publications/Diesel-Retrofits_ICCT_Consultant-Report