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Workshop on Maritime Energy and Clean Emissions

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1. **Railroad Emissions and Energy Usage**
    1. Energy usage
        1. consume over 4 billion gallons annually
        2. individual companies are the largest private consumers of diesel fuel
        3. efficiency has improved 19% since 1990 and 69% since 1980
            1. revenue ton-miles per gallon of fuel
    2. Emissions efficient
        1. on an emissions per ton-mile basis, very efficient
        2. on a gram per brake horsepower basis, higher than trucks
        3. NOx the major pollutant of concern to EPA
            1. 5 percent of NOx inventory
            2. only 0.1 percent of PM inventory
            3. only 0.2 percent of HC inventory
2. **EPA Rulemaking History**
    1. In late 1980's, California became interested in regulating locomotive emissions because of South Coast Air Basin concerns
    2. EPA completed study of locomotive emissions in 1990
    3. Railroads decided to try to work out a win-win-win situation
    4. Parties' goals
        1. EPA wanted to reduce overall emissions
        2. CARB need to come up with an attainment plan for the South Coast
        3. Railroads wanted cost-effective regulations that are uniform nationwide
    5. Definition of problem important: not in EPA's or California's interests to impose costly regulations that would cause diversion of traffic from rails and result in more pollution
    6. Solution
        1. Nationwide EPA regulations containing three stages (Tier 0 standards initially, Tier I standards are now effective, and Tier II standards become effective 2005)
        2. A voluntary agreement between the railroads and CARB providing for the accelerated introduction into the SCAQMD of low-emitting locomotives
    7. EPA Regulations
        1. Key aspect: address retrofitting
            1. locomotive turnover very slow
            2. post-1973 engines must meet EPA standards when rebuilt

            1. standards at time of rebuilding are standards originally applicable
        2. NOx oriented: EPA estimates NOx emissions will be reduced 2/3 from baseline levels
        3. PM and HC reductions of 50%
        4. Realistic useful-life period
            1. air quality benefits
            2. preemption
        5. In-use testing: railroads and manufacturers
3. **Future Regulation**
    1. Fuels
        1. Rationale for fuels regulation -- needed for aftertreatment devices
        2. No fuels regulation until equipment needs it -- locomotives can't make use of it
        3. RRs actually purchase three types of fuel -- off-highway diesel, EPA-spec diesel, CARB-spec fuel
    2. Tier 3?
4. **Unique Barriers to Adoption of Emissions Control Equipment**
    1. No ram air
    2. Space limitation affect additional equipment
        1. operate in confined space
        2. large horsepower (up to 6,000) requires potentially large devices
    3. Medium speed operation
5. **Research Programs**
    1. Builder Research
    2. CARB/RR research program
        1. agreement for state to refrain from imposing fuel requirements
        2. RRs testing particulate filters and low-lube oil consumption technologies
    3. DOE Research
        1. DOE spending $ 85 million on truck energy/emissions research in FY 2002
        2. DOE spending approx. $250,000 on comparable rail research
            1. RRs want more
            2. unique industry problems:
        3. DOE research requires industry contribution
6. **Potential Research Projects**
    1. Ongoing research and implementation
        1. idling reduction
            1. ZTR's SmartStart
            2. EcoTrans Technologies' K-9 auxiliary unit
        2. reduce rolling resistance through rail lubrication
        3. AC locomotives
        4. combustion process improvements, e.g., combustion chamber design, fuel injection
    2. Future research

1. aftertreatment devices
2. exhaust gas recirculation
3. recovery of dynamic brake energy and other parasitic losses
4. lighter-weight materials for rail cars
5. aerodynamic improvements
6. alternative engines and fuels
    1. Railpower Technologies' Green Goat
        1. traction motors powered by a battery
        2. function of diesel engine is to charge battery