Chapter 11: LOCOMOTIVES

This chapter describes the minimum criteria and requirements for Carl Moyer Program locomotive projects. Local air districts may set more stringent requirements based upon local priorities. Definitions of locomotive terminology can be found at the end of this chapter.

1. Projects Eligible for Funding

Carl Moyer Program funding for California's larger "Class 1" freight railroads is generally limited due to the availability of Goods Movement Emission Reduction Bond Program (Prop 1B) funding, and the South Coast and Statewide Memoranda of Understanding (MOU) with these railroads (See Table 11-1).

Table 11-1
Summary of Locomotive Funding Opportunities

Railroad Class	Moyer Funding Opportunities
Class 1 Freight Railroads[1] (Burlington, Northern and Santa Fe Railroad and Union Pacific Railroad)	Very limited opportunity. Projects in California's goods movement trade corridors are generally ineligible for funding due to the availability of Prop 1B Bond funds.[2] These projects may be eligible for Carl Moyer Program funding on a case-by-case basis if Prop 1B Bond funding is unavailable.
Class 3 Freight Railroads and Passenger Railroads	Class 3 and passenger railroad projects are not limited.

1 - The South Coast MOU further limits funding eligibility for Class 1 freight railroad new purchase or engine remanufacture/repower projects in the South Coast. Class 1 freight railroads are also ineligible for ILD project funding due to the Statewide MOU. See Section IV(A) of this chapter for details.
2 – See Section VI for a definition of California's goods movement trade corridors.

Project Types: Five types of locomotive projects are eligible for Carl Moyer Program funding:

- **Alternative technology switcher (or other cleaner-than-required new locomotive)**
- **Idle limiting device (ILD)**
- **U.S. EPA certified engine remanufacture kit or repower**
- **ARB verified retrofit**
- **Head end power unit (HEP)**

2. Maximum Eligible Funding Amounts

Table 11-2 summarizes the maximum percentage of total project cost eligible for Carl Moyer Program funding. All Projects are also subject to the cost-effectiveness threshold defined in Chapter 2 – General Criteria. Local air districts have the authority to set more stringent project requirements. Projects must also meet all relevant criteria in Section 4 of this chapter.

Table 11-2:
Maximum Percent Funding for Carl Moyer Program Locomotive Projects

Railroad Class/Type	Alt. Technology Switcher	Idle Limiting Device (ILD)	Refurbishment or Certified Remanufacture Kit
Class 1	50 percent	not eligible	50 percent
Class 3 and Passenger	85 percent	50 percent (passenger locomotives on case-by-case basis)	Tier 0+: 75 percent* Tier 1+: 80 percent* Tier 2+: 85 percent*

** "+" is used to refer to the new U.S. EPA locomotive engine remanufacture standards (U.S. EPA, 2008)*

3. Project Criteria

These criteria provide the minimum requirements for Carl Moyer Program locomotive projects.

(a) **General Locomotive Project Criteria**

(1) Class 1 freight locomotive projects in California's goods movement trade corridors, as defined in Section VI (Definitions) of this chapter, are only eligible for Carl Moyer Program funding on a case-by-case basis. Case-by-case project approval shall only be made if Proposition 1B Goods Movement Emission Reduction Program (GMERP) bond funding is unavailable for these projects.

A. GMERP bond funding is considered available for locomotive projects in a goods movement corridor each fiscal year from the time a local agency within the corridor is approved bond funding by ARB for locomotive projects until all bond locomotive project funds in that corridor are committed to specific projects via executed contract.

B. Locomotives that cannot meet GMERP eligibility requirements for percent of operation within California as determined during the project case-by-case evaluation are not subject to the requirements of Section (A), above.

(2) Class 1 locomotives subject to the South Coast MOU are only eligible for Carl Moyer Program funding on a case-by case basis. These locomotive projects must be excluded from the fleet average emission rate calculations which demonstrate compliance with the MOU provisions. The baseline emission rates used to determine emission reductions and cost-effectiveness for these locomotive projects reflect the Tier 2 emission rates for line-haul and switch locomotives identified in Appendix Table B-18.

(3) Class 2 railroad locomotives are subject to the same federal remanufacture requirements as Class 1 locomotives. There are currently no Class 2 railroad operators based in California. Should

a Class 2 railroad apply for Carl Moyer Program funds, project eligibility and parameters shall be evaluated on a case-by-case basis. Section 6 of this chapter provides definitions of railroad classes.

(4) Military and industrial railroads are considered Class 3 railroads for the purposes of the Carl Moyer Program.

(5) Locomotive project activity must be based upon fuel consumption. Districts may propose alternate project activity, such as actual usage data logged electronically by one or more locomotives, for case by case approval.

(6) Carl Moyer Program funds cannot be used to pay for labor or parts used during routine maintenance.

(7) For all liquefied natural gas-diesel or other dual fuel locomotive projects, fuel consumption by fuel type must be monitored for the duration of the project life.

(8) All locomotive projects receiving more than $50,000 per locomotive in Carl Moyer Program funds must include the purchase and installation of an ILD if the locomotive is not already equipped with such a device and installation is technically feasible. Please see Part (c) of this section for ILD project minimum requirements.

(9) Projects in which a Carl Moyer Program grant is made to a locomotive manufacturer or other third party, who in turn leases the project locomotive to an end user, are eligible for funding on a case-by-case basis. Factors to be considered include project life, lease terms, reporting and enforceability provisions, and other project parameters.

(b) **Alternative Technology Switcher Purchase**

Alternative switcher locomotives funded by the Carl Moyer Program include gen-set locomotives (multi-engine switcher) and electric-hybrid locomotives. Multi-engine switchers are typically powered by two or three off-road engines, while electric-hybrids use a small diesel engine to charge batteries that provide locomotive power. These locomotives typically include an existing locomotive frame significantly refurbished with a new engine or engines, batteries, electronics, controls, and other equipment. The replacement engines have a much lower horsepower rating and emissions than the typical switch locomotive engine. U.S. EPA considers an alternative technology switcher a new locomotive if it includes at least 75 percent (by value) new parts.

(1) An alternative technology switcher must achieve a NOx emission rate of 3.5 g/bhp-hr and a PM emission rate of 0.14 g/bhp-hr.

(2) New locomotives with an aggregate engine power rating greater than or equal to 1,006 horsepower (750 kW) must be certified by U.S. EPA to achieve this emission level (or cleaner).

(3) New locomotives with an aggregate engine power rating less than 1,006 horsepower are not required to be certified by U.S. EPA to locomotive standards. If not certified as a locomotive by U.S. EPA, the engines in the lower horsepower locomotives must be certified by ARB, and may be evaluated and considered for funding based upon the project engine on-road or off-road certification and corresponding Carl Moyer Program emission factor on a case by case basis.

(4) U.S. EPA certified emission rates for the project locomotive are found at www.usepa.gov/otaq/certdata.htm On the U.S. EPA spreadsheets, "L/H" refers to a line haul locomotive, "SW" refers to a switcher, and "THC" refers to total hydrocarbons. The U.S. EPA emission factors must be adjusted as follows: THC must be converted to ROG by multiplying by 1.053, and NOx and PM must be multiplied by .94 and .86, respectively, to account for the use of ultra low sulfur diesel.

(5) Baseline emissions for an alternative technology switcher project reflect Tier 0 emission rates for Class 1 and intercity passenger and commuter locomotives and uncontrolled emission rates for Class 3 locomotives and small passenger locomotives related to tourism.

(6) An alternative technology switcher must use the cleanest engine available certified to either the on-road or off-road engine standards.

(7) For alternative technology switcher projects, fuel consumption for the new locomotive may differ from baseline fuel consumption. Districts may utilize one of two approaches:

1) Assume a fuel consumption rate factor of 20 bhp-hr/gal for an alternative technology gen-set switcher.
2) Start with the brake specific fuel consumption (typically BSFC on the engine specification sheet), in lbs/bhp-hr, divided by the density of diesel fuel to estimate the fuel consumption rate for the new locomotive engine(s). Fuel consumption for the new locomotive is then estimated by taking the estimate of total work for the baseline locomotive, in bhp-hr/yr, divided by the estimated fuel consumption rate, in bhp-hr/gal, of the new locomotive engine(s).

3) Districts may propose an alternate method of estimating the fuel consumption of a new locomotive for case by case approval.

(8) Alternative technology locomotives which are not switch locomotives may be considered for funding on a case-by-case basis.

(9) Project life.

A. Class 1 alternative technology switcher projects in air districts other than the South Coast must have a minimum project life of ten years. ARB may approve a project life of less than ten years for these locomotives on a case-by-case basis.
B. All other locomotive projects have a minimum project life of three years. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap.

C. The maximum project life for a locomotive new purchase project is 20 years.

(c) **Idle-Limiting Device**

Installation of an ILD can significantly reduce emissions from locomotives, which typically spend 40 to 60 percent of their operating time in the idle duty cycle.

(1) ILD projects for Class 1 and intercity passenger and commuter locomotives are not eligible for Carl Moyer Funding.

(2) If not already required by a rule, regulation, MOU, or other legal mandate, the Carl Moyer Program may pay up to 50 percent of the purchase and installation cost for an ILD for Class 3 and Small Passenger locomotives.

(3) ILD emission reductions are calculated by applying the ILD factors in Appendix Table B-19. Appendix E provides details regarding use of the ILD factors.

(4) All ILDs must comply with applicable durability and warranty requirements.

(5) The maximum project life for a locomotive ILD project is ten years. A locomotive is not eligible for additional Carl Moyer Program funding during the ILD project life.

(d) U.S. EPA-Certified Engine Remanufacture Kit or Locomotive Refurbishment

Engine remanufacture kits typically include new fuel injectors, cylinder head assemblies, pistons, and other engine components. Class 1 freight locomotives and passenger locomotives are required to remanufacture their engines to the tier corresponding to the original engine manufacture date, as identified in Table 8-3. Engine remanufacture kit projects for these railroads must therefore be surplus to this federal requirement. Engine remanufacture kits must be also certified by U.S. EPA and meet all of the following criteria to be eligible for Carl Moyer Program funding. Locomotive refurbishments (or repowers) are also eligible for funding.

(1) Purchase and installation of the cleanest available tier U.S. EPA-certified remanufacture kit or refurbishment (engine repower) is eligible for Carl Moyer Program funding. Applicants must provide evidence that the kit for which funding is requested is the cleanest available kit certified for use on the project locomotive.

(2) Remanufacture kits must be demonstrated not to increase in-use emissions of NOx, ROG, or PM emissions.

(3) Locomotive engine remanufacture and refurbishment projects must achieve at least a 30 percent NOx reduction beyond baseline emission levels.

(4) Alternative-fueled engines must be ARB- or U.S. EPA-certified to achieve a reduced emission level in a locomotive application. Alternative-fueled engines not certified to achieve a reduced emission limit in a locomotive application may be eligible for funding on a case-by-case basis.

(5) Baseline emissions reflect the emissions tier level required by federal locomotive remanufacture standards.

A. Class 1 and passenger railroad, see Table 8-3
B. Class 3 and small passenger locomotives use the uncontrolled emission rates in Appendix Table B-18, unless the locomotive engine has already been upgraded to emit at a cleaner (Tier 0-2) emission level. In this case, baseline emissions would reflect existing engine Tier emission rate as indicated in Appendix Table B-18.

(6) The U.S. EPA Certificate of Conformity (such as that shown in Appendix Figure F-3) identifies the applicable locomotive models and model years for which the remanufacture kit may be used, as well as the engine family used to verify the emission rate associated with the remanufacture kit. Emission reductions and

cost effectiveness calculations shall use the factors from the Tier to which the kit is certified.

(7) The eligible costs for a Carl Moyer Program remanufacture kit or repower project include only those items the Certificate of Conformity identifies as 1) being part of the rebuild kit and 2) those the certificate indicates must be contained in the base engine. Each of these specific items on the Certificate of Conformity must be individually itemized in the project invoice. Typical eligible costs of the remanufacture kit may also include the following items: camshafts, injectors, power assemblies (including piston rings, cylinder lines and cylinder head pistons), engine CPU, engine software, aftercoolers, heat exchangers (including radiators and oil cooler), cooling circuits, cooling fans, microprocessor, fuel injectors, oil separator element, governor, water, cooling, and scavenging pumps and pump installation kits, top deck cover seals, rocker arm sets, valve bridges, rod bearing sets, top deck cover seals, blower thrust valves, lower liner inserts, and locomotive control system software. Other items may be eligible for funding on a case-by-case basis.

(8) Project life:

A. Remanufacture kit projects have a maximum project life of six years. A longer project may receive case-by-case approval if applicants provide justifying documentation. If fuel injectors are required to be replaced by the U.S. EPA Emissions Warranty for the project kit before the end of the project life, the applicant must commit to replace the injectors as required with equivalent low-emission injectors. The Carl Moyer Program project cost may include funds for the replacement injectors. The project annual reports must include documentation that all required maintenance identified in the U.S. EPA Emissions Warranty is completed on schedule. Maintenance other than replacement of low-emission fuel injectors is not eligible for Carl Moyer program funding.
B. The maximum project life for a locomotive refurbishment project is 10 years if the new engine does not meet current federal new locomotive standards and 20 years if it meets or is cleaner than required by these standards.

(e) **Retrofit**

Retrofits involve hardware modifications to the engine or exhaust system to reduce emissions, and include selective catalytic reduction, diesel oxidation catalysts or diesel particulate filters. Other retrofit projects may be eligible for funding on a case-by-case basis.

(1) A retrofit device must be ARB- verified to reduce emissions from the project engine in order to be eligible for funding. While no devices have been verified as of January 1, 2010, ARB is evaluating several retrofit devices for potential verification.

(2) Up to 100 percent of the total cost of a locomotive retrofit project is eligible for Carl Moyer Program funding.

(f) **Head End Power Unit (HEP)**

HEP replacement is eligible on a case by case basis. (Criteria under development, based on off road repower)