

Appendix 2

Non-Road Equipment

This appendix outlines the criteria for project eligibility and gives the methods for calculating the reductions in NO_x emissions for a non-road equipment project. The emissions standards and emissions factors applicable to this program are included in a technical supplement, which will be made available in conjunction with these guidelines at the TERP website, <www.terpgrants.org>. Examples of the calculations will also be available in the supplement, along with other materials prepared by the TCEQ. Potential grant applicants may also contact the TCEQ for hard copies of the supplement and for answers to questions about the applicable emissions standards and factors.

In accordance with Texas Health and Safety Code 386.104(j) and TERP program rules, 30 TAC 114.622(g), the executive director has the authority to waive certain eligibility requirements, based on a finding of good cause. Situations where good cause may be determined and a waiver granted are explained in the discussion of eligibility requirements in this appendix.

The executive director may identify other eligibility criteria for which a waiver may be considered, based on a finding of good cause and subject to the statutory and regulatory requirements. Waiver options will be explained in the grant-application materials.

The granting of a waiver to the eligibility requirements is at the discretion of the executive director or the executive director's designee. In determining good cause and deciding whether to grant a waiver, the executive director shall ensure that the emissions reductions that will be attributable to the project will still be valid and, where applicable, meet the conditions for assignment for credit to the State Implementation Plan.

Eligible Activities and Costs

The activities and eligible costs under each project category are explained in this section. The TCEQ may further limit the types of eligible activities, and may more narrowly define eligibility requirements, during a particular funding period, as needed to best achieve the goals of the TERP. Administrative costs, in-house labor costs, and travel costs are not eligible expenses.

Purchase or Lease of Non-Road Equipment

This category is for the purchase or lease of new non-road equipment. The cost may also include the purchase and installation of a global positioning system, subject to approval by the TCEQ. For this category, the TCEQ does not consider whether the applicant is replacing an existing piece of equipment, and the baseline for comparison of emissions is the current federal NO_x emissions standard for a non-road engine of that horsepower. The baseline non-road equipment used for determining the difference in cost must be **new**.

To be eligible for funding, the engine on the new piece of equipment must be certified to emit at least 25% less NO_x than required (in other words, no more than 75% of the NO_x allowable) under the current federal standard for a non-road engine of that horsepower. “Certification” means approval by the EPA or the California Air Resources Board (CARB), or acceptance on other grounds by the TCEQ.

A *lease* is defined as the use and control of a new piece of non-road equipment in accordance with a lease contract for a period of five or more years. The TCEQ will reimburse the incremental costs of the lease—costs above those that would otherwise have been incurred for the lease of a baseline vehicle.

The TCEQ will reimburse the incremental cost of the purchase of non-road equipment subject to cost-effectiveness limits established by the TCEQ. The incremental cost is the difference between the documented dealer price of a baseline piece of equipment, or other appropriate baseline cost established by the TCEQ, and the actual cost of the cleaner equipment.

Replacement of Non-Road Equipment

This category is for the replacement of non-road equipment with a new or newer piece of non-road equipment. For this category, the applicant must be replacing a piece of equipment with a minimum of five years of remaining useful life. However, the TCEQ may establish longer activity-life requirements for any grant period. The baseline for comparison of emissions is the difference between the emissions of the equipment being replaced and the emissions of the equipment being purchased.

For a replacement project, the TCEQ will evaluate whether the equipment being replaced would have otherwise been used in the eligible counties for the period within which the emissions reductions will be claimed. Standards that apply include **all** of the following:

1. The owner must have continuously owned the equipment for at least the two years immediately preceding the grant application date.
2. Unless otherwise approved by the TCEQ, the equipment must have been continuously located and used in Texas over the preceding two years.

3. The equipment must be in good operating condition and capable of performing its primary function.

The TCEQ may waive the two-year ownership requirement, case by case, where the ownership of the company has changed, the assets of the company have been purchased by another company, or the company has changed its name or incorporation status. The use of the equipment being replaced must not have changed.

The TCEQ may waive the requirement for two years of continuous use for short lapses in operation attributable to economic conditions, seasonal work, or other circumstances, based on a finding of good cause. The historical usage described by the applicant on the grant-application forms must reflect the lapses in use of the equipment in those activities.

In order for a replacement activity to result in creditable emissions reductions, the applicant must intend to continue to use the equipment being replaced for the same type of use and amount of use over the same period as the activity life, absent the award of a grant. The TCEQ may require additional assurances, certifications, and documentation to verify that the applicant would continue to use the equipment being replaced if the grant is not awarded.

For replacement projects, the emissions reductions are based on replacement of the future use of the original vehicle or equipment with the use of the reduced-emission vehicle or equipment. The estimated future use of the original vehicle or equipment is determined from the recent historical use. Except when a default usage amount is used for the emissions-reduction calculations, the activity level used for those calculations and the corresponding usage commitment for a replacement project may not exceed the average annual use of the vehicle or equipment being replaced for the two years preceding the application.

The engine on the replacement equipment must be certified to emit at least 25% less NO_x (that is, no more than 75% as much NO_x) compared with the engine being replaced. "Certification" means approval by the EPA or the CARB, or acceptance on other grounds by the TCEQ.

The replacement equipment must be of the same type and should be intended for use in the same application or vocation (for example, excavator, compactor, grader) as the equipment being replaced. The TCEQ may accept, case by case, equipment of a different type to account for the latest technology used for a specific vocation. In addition, the TCEQ may accept, case by case, the replacement of a multi-engine piece of equipment with a single-engine piece of equipment, or vice versa, as long as the new equipment will have the same use as the equipment being replaced and the emissions reductions can be adequately determined.

The year of manufacture of the engine installed on the replacement equipment may not be more than three years prior to the current calendar year, unless an alternative age limit is established by the TCEQ for a particular grant round. The TCEQ may also waive the age-limit requirements, case by case, where the equipment has a unique or

specialized use and where a model with a recently manufactured engine is not available.

The grant recipient may be eligible for reimbursement of up to 80% of the eligible costs for the purchase or lease of the replacement equipment, subject to cost-effectiveness limits established by the TCEQ. The TCEQ may further limit the incentive amount to a lower percentage of eligible costs as needed to best achieve the goals of the TERP. The cost may also include the purchase and installation of a global positioning system, subject to approval by the TCEQ.

Costs may include the invoice price, including taxes and delivery charges included in the price of the replacement equipment, or the cash basis for the lease charges. Delivery charges from a third party, not included in the invoice price from the vehicle or equipment vendor, may be included, subject to approval by the TCEQ.

The total incentive amount also must not exceed 80% of the cost of the replacement equipment minus the scrappage value received for the old equipment. The TCEQ may establish a default scrappage value.

Repower of Non-Road Equipment

This category is for the replacement of an existing engine on a non-road piece of equipment with a new, rebuilt, or remanufactured engine, or one or more electric motors, drives, or fuel cells. The upgrade of an engine with an emissions upgrade kit certified by the EPA or CARB may also be considered under the repower category. The engine must be certified to emit at least 25% less NO_x (that is, no more than 75 as much NO_x) as compared with the engine being replaced. "Certification" means approval by the EPA or the CARB, or acceptance on other grounds by the TCEQ. Eligible rebuilt or remanufactured engines must use only components from the original engine manufacturer and be purchased from the OEM or its authorized dealers and distributors. However, the TCEQ may accept engines from suppliers not connected with the OEM, subject to a case-by-case determination.

The grant recipient may be eligible for reimbursement of up to 80% of the incremental cost of the repower, subject to cost-effectiveness limits established by the TCEQ. The TCEQ may further limit the incentive amount to a lower percentage of the eligible costs as needed to best achieve the goals of the TERP.

The incremental cost for an engine replacement is the cost to purchase and install the replacement engine and associated equipment minus the scrappage value received for the old engine, if applicable. The TCEQ may establish a default scrappage value. The TCEQ may further limit the incentive amount to a lower percentage of the eligible costs as needed to best achieve the goals of the TERP.

For engine conversions and emissions upgrade kits certified by the EPA or CARB, the incremental cost is the cost to purchase and install the conversion system or kit, including the new fuel system, if applicable. Other upgrades or modifications to the

engine or vehicle that are not necessary for the conversion or upgrade of the engine are not eligible.

Expenses for salaries, travel, and overhead, including indirect costs, will not be covered. Costs that may be reimbursed, subject to approval by the TCEQ, include:

- the invoice cost of the new engine or conversion system, including sales tax and delivery charges;
- the invoice cost of additional equipment that must be installed with the new engine or upgrade system;
- associated supplies directly related to the installation of the engine or system;
- costs to remove and dispose of the old engine, if applicable;
- installation costs;
- reengineering costs, if the vehicle or equipment must be modified for the new engine to fit; and
- other costs directly related to the project.

Retrofit or Add-on of Emissions-Reduction Technology

This category is for the retrofit of an existing engine on a non-road piece of equipment, or adding devices onto the equipment.

To be eligible for funding, the retrofit or add-on systems must be verified to emit at least 25% less NO_x (that is, no more than 75% as much NO_x) as compared with the engine prior to the retrofit or add-on. "Verification" means approval by the EPA or the CARB, or acceptance on other grounds by the TCEQ.

The conversion of an existing non-road diesel engine to operate under a dual-fuel configuration that uses natural gas and diesel fuel through an alternative fuel conversion system certified by the EPA or the CARB may also be considered under the retrofit category. Per Texas Health and Safety Code 386.104(f-1), the TCEQ may establish alternative minimum standards for the percentage reduction in NO_x that must be achieved by the conversion of the engine. Under this provision, the TCEQ will establish alternative standards on a grant-round basis after considering the effectiveness of available dual-fuel conversion technology in reducing emissions.

The TCEQ will reimburse the incremental cost of the purchase and installation of the retrofit or add-on technology subject to cost-effectiveness limits established by the TCEQ. If the engine is to be rebuilt to install the emissions-reduction devices, the incremental cost is the difference between the cost of rebuilding the existing engine and the cost of rebuilding the engine to include the retrofit or add-on technology. If the engine does not need to be rebuilt in conjunction with installing the new technology, then the incremental cost will be the full cost of purchasing and installing the technology. The TCEQ may further limit the incentive amount to a lower percentage of the eligible costs as needed to best achieve the goals of the TERP.

Expenses for salaries, travel, and overhead, including indirect costs, will not be covered. Costs that may be reimbursed, subject to approval by the TCEQ, include:

- the invoice cost of the retrofit kit or add-on devices, including sales tax and delivery charges;
- costs of associated supplies directly related to the installation of the devices;
- installation costs;
- reengineering costs, if the vehicle or equipment must be modified for the retrofit or add-on devices to be installed and used; and
- other costs directly related to the project, including the purchase and installation of a global positioning system.

Project Criteria

In addition to the eligibility criteria previously presented, the following list of criteria applies to projects involving non-road equipment activities. The TCEQ may impose additional criteria, and may more narrowly define the criteria established in this guide during a particular funding period, as needed to best achieve the goals of the TERP.

- One or more eligible **activities** of the same project type (i.e., on-road, non-road, locomotive, etc.) that will occur in the same primary area may be included under one project application.
- The applicant must own the equipment being replaced, repowered, or retrofitted.
- Vehicles and equipment used primarily for competition or recreation are not eligible for funding under any of the project categories.
- Non-road equipment activities must reduce emissions of NO_x compared to baseline NO_x emissions. The NO_x emissions of equipment, engines, and retrofit or add-on devices used to achieve the emissions reductions must be certified or verified by the EPA or the CARB, or otherwise accepted by the TCEQ. Where the model year of the equipment and the model year of the existing engine are different—such as equipment that has already had the engine replaced with a newer engine—the model year of the engine must be used to determine the baseline emissions standard for emissions-reduction calculations. The application of the “25% reduction” criterion for each type of activity is explained below.

Purchases and leases are allowed based on what year the purchase or lease is completed. At a minimum, the equipment and engine being purchased or leased must be certified to emit at least 25% less NO_x (in other words, no more than 75% as much NO_x) as compared with the current federal NO_x emissions standard for that engine.

Replacements. The replacement equipment and engine must have been certified to emit at least 25% less NO_x than the engine being replaced.

Repowers. The replacement engine must be certified to emit at least 25% less NO_x than the engine being replaced.

Retrofits and add-ons. Emissions standards for retrofit and add-on activities are based on the engine being retrofitted. The retrofit or add-on technology must be verified to emit at least 25% less NO_x than the federal standard for the engine being retrofitted. The TCEQ may establish an alternate standard for the conversion of a non-road diesel engine to operate under a dual-fuel configuration that uses natural gas and diesel fuel through an alternative fuel conversion system.

Combined technologies. Where two technologies (for example, repower plus retrofit) are combined on the same equipment, engine, or both, the TCEQ may consider the combined reductions from the two technologies in meeting the 25% requirement. This decision will be solely at the discretion of the TCEQ, and will be based on its determination that the combination of the two technologies will permanently reduce emissions by at least 25%.

- The cost-effectiveness of a project, other than a demonstration project, must not exceed any limits set by the TCEQ on the cost per ton of NO_x emissions reduced in the eligible counties for which the project is proposed.
- In the areas of the state where Texas Low Emission Diesel (TxLED) is required, the baseline and reduced emissions-rate calculations for diesel-engine usage after September 2005 must be adjusted using a correction factor, in addition to any other calculation adjustments. See Figure A2.1 for more information about the TxLED correction factor.
- An activity is not eligible if it is required by any state or federal law, rule, regulation, memorandum of agreement, or other legally binding document. However, this restriction does not apply to an otherwise qualified activity—regardless of the State Implementation Plan’s assumption that the change in equipment, vehicles, or operations will occur—if, on the date the grant is awarded, the change is not yet required by any state or federal law, rule, regulation, memorandum of agreement, or other legally binding document. This restriction also does not apply to a purchase of vehicles or equipment required only by local law or regulation, or by controlling-board policy of a public or private entity. Projects used to demonstrate a technology that may be used to comply with an emissions-reduction requirement may be funded, as long as the reductions directly attributable to the project are not used to comply with those requirements.
- An activity involving a new emissions-reduction measure that would otherwise generate marketable credits under state or federal emissions-reduction credit averaging, banking, or trading programs is not eligible for funding under this program unless:

- the activity includes the transfer of the reductions that would otherwise be marketable credits to the State Implementation Plan or the owner or operator, as provided under Texas Health and Safety Code 386.056; and
- the reductions are permanently retired.
- The incremental cost of the proposed activity must be reduced by the value of any existing financial incentive that directly reduces the cost of the proposed activity, including tax credits or deductions, other grants, or any other public financial assistance.
- For repower activities, eligible rebuilt or remanufactured engines must use only components from the original engine manufacturer and be purchased from the OEM or its authorized dealers and distributors. However, the TCEQ may accept engines from suppliers not connected with the OEM, subject to a case-by-case determination.
- For all activities, the activity life must be a minimum of five years. The TCEQ may establish longer activity-life requirements for each grant period. Except for non-road equipment used for natural gas recovery, not less than 75% of the annual usage of the equipment must take place in one or more of the eligible counties throughout the life of the project. Leases that do not include a binding commitment to purchase must be for the length of the activity life. Annual usage is to be measured by either hours of operation or fuel consumption.

Figure A2.1 Correction Factor for TxLED

The TCEQ adopted rules (30 TAC 114.312–19) requiring that diesel fuel sold or supplied for use in compression-ignition engines in certain counties in Texas must meet low-emission-diesel standards.

The counties affected by the TxLED requirements currently include all those eligible for TERP incentive funding, as listed in Table 3.1, except for El Paso County.

The requirements set a maximum for content of aromatic hydrocarbons of 10% by volume. The requirements also set a minimum cetane number for TxLED of 48.

The TxLED requirements are intended to result in reductions in NO_x emissions from diesel engines. Currently, reduction factors of **5.7%** (0.057) for on-road use and **7.0%** (0.07) for non-road use have been accepted as estimates for use of TxLED. However, these estimates are subject to change, based on the standards accepted by the EPA for use in the Texas State Implementation Plan. The TCEQ will identify the appropriate reduction factors to use in the technical supplement prepared to support these guidelines.

For activities in the applicable counties, a correction factor will need to be applied when calculating the baseline or reduced emissions for diesel engines.

On-road:

$$\text{TxLED correction factor} = 1 - 0.057 = \mathbf{0.943}$$

Non-road:

$$\text{TxLED correction factor} = 1 - 0.070 = \mathbf{0.93}$$

- Non-road equipment used for natural gas recovery must be operated in the eligible counties for a sufficient amount of use over the activity life to meet the requirements of a commitment to reduce emissions and cost effectiveness. To qualify for this provision, the primary purpose and use of the equipment must be natural gas recovery, as determined by the TCEQ. For example, a generator used on a natural gas drill rig may qualify, but a tracked dozer used to build a road to a drill site would not.
- For most non-road equipment, annual usage is to be measured using hours of operation. For equipment without an hour meter installed and no viable mechanism for measuring the hours of operation, fuel consumption may be used as the usage factor, if accepted by the TCEQ.
- Applicants should refer to the technical supplement to these guidelines for the maximum acceptable activity life established by the TCEQ for each type of activity.
- Applicants must agree to monitor the use of grant-funded vehicles, equipment, infrastructure, and fuel, and to report to the TCEQ for the life of each grant-funded activity.
- Applicants must also agree to notify the TCEQ of any changes during the life of the following activities: termination of use; change in use, sale, transfer, or accidental or intentional destruction of grant-funded vehicles or equipment; or change in use of the qualifying fuel.
- Administrative costs and other internal costs of the grant recipient—including but not limited to personnel expenses, internal salaries, indirect costs, and travel—are not eligible. This restriction also applies to situations where the grant recipient acts as a transporter for delivery of the grant-funded vehicle or equipment before or after its acceptance.
- Consultant fees for the preparation of a grant application, either directly or as an addition to the cost basis of the grant-funded vehicle, equipment, or engine, are not eligible.
- Fees for a third-party consultant hired by the grant recipient to manage and administer the grant-funded activities, including coordination of the work and submission of reports and paperwork to the TCEQ for the grant recipient, are not eligible. This restriction is not intended to limit the ability of the vehicle or equipment supplier or installer to include reasonable and necessary costs for managing the work to be performed in the price of the vehicle, equipment, or installation. The costs for professional services, including engineering and technical work, required for completion of the activity may be included, subject to the restrictions pertaining to that type of project. Per the Uniform Grant Management Standards, the “cost plus a percentage of cost” method of contracting for professional services must not be used.
- The TCEQ may impose additional criteria for certain projects and funding periods, consistent with these guidelines.

NO_x Emissions Factors

The baseline NO_x emissions factors for this program will normally be the federal standards applicable to the type of engine and model year. However, if the baseline engine was certified by the EPA or the CARB to a Family Emissions Limit, the TCEQ may use the FEL for the baseline NO_x emissions factor.

The federal NO_x emissions standards for non-road engines are listed in the technical supplement available from the TERP Program. Potential grant applicants should consult with the TCEQ to ensure they use the appropriate baseline standards.

The NO_x emissions factor for the reduced-emission engines will normally be the federal NO_x emissions standard or the FEL to which the reduced-emission engine is certified. If a retrofit or add-on system is verified by the EPA or the CARB to reduce NO_x emissions by a specified percentage, the verified percentage will be applied to the baseline emissions factor to determine the emissions factor for the retrofitted engine.

Emissions Factors for Retrofits with Dual-Fuel Conversion Systems

The TCEQ may consider alternative information to determine the emissions factors and calculate the emissions reductions for retrofit projects involving the conversion of a non-road engine to operate under a dual-fuel configuration that uses natural gas and diesel fuel through an alternative fuel conversion system certified by the EPA or the CARB. In particular, if the TCEQ determines it is necessary and appropriate, the TCEQ may consider certified engine-test information that demonstrates reductions of NO_x emissions and other information to determine the emissions reductions.

To be considered under this alternative approach, the TCEQ may require that manufacturers or dealers apply to the TCEQ for a determination of the appropriate emissions factors and reductions that will be accepted for that system. In general, any testing to verify the emissions should be performed and certified by an independent testing service or facility. The TCEQ is not required to accept a dual-fuel conversion system under this alternative, and it will be the responsibility of the manufacturer to submit sufficient test data and other information to verify the emissions factors.

The TCEQ may determine an appropriate factor for the percentage reduction in NO_x emissions as a result of the dual-fuel engine conversion. The percentage-reduction factor will be applied to the baseline emissions factor determined by the TCEQ for that engine in order to calculate the emissions reductions. Alternatively, the TCEQ may determine a specific NO_x-emission rate for the converted engine based on the certified test results. In that case, the TCEQ may also consider the certified test results of either the original engine or the converted engine operating in diesel-only mode to determine the baseline emission rate.

In considering certified test information and agreeing to an appropriate percentage reduction in emissions or a specific emission rate, the TCEQ will take into account whether the engine can operate solely on diesel fuel in addition to dual-fuel operation. The TCEQ may adjust the percentage-reduction factor or the specific emission rate to account for the difference in emissions using solely diesel fuel and

dual-fuel operation of the engine. In determining appropriate adjustments to the emissions factors, the TCEQ may also take into account the level of confidence that can be given to the test information. In addition, a correction factor may be applied to account for the partial use of TxLED in dual-fuel operation of the engine.

Calculating Reductions in NO_x Emissions

In general, the emissions-reduction benefit represents the difference in the emissions of a baseline engine and a reduced-emissions engine. In situations where the model year of the equipment and the model year of the current engine are different, the model year of the engine must be used to determine the baseline emissions for benefit calculations.

The emissions level is calculated by multiplying an emissions factor, an activity level, and a conversion factor, if necessary. Because conversion factors and activity levels may be expressed in different units for the existing and replacement engines, the emissions levels for the baseline and reduced-emissions engines should be calculated separately, and then differences taken to determine emissions reductions.

Emissions factors are generally expressed in terms of grams per brake horsepower-hour (g/bhp-hr), grams per mile (g/mi), or grams per gallon (g/gal). Conversion factors are generally expressed in units of brake horsepower-hour per mile (bhp-hr/mi) or horsepower-hour per gallon (hp-hr/gal).

For most non-road applications, the activity level should be established by the annual hours of operation. For equipment without an hour meter installed, and no other mechanism to track hours of operation, the activity level should be determined based on annual fuel consumption. Emissions-reduction calculations should be consistent with the type of records maintained over the life of each activity.

Calculation of NO_x-Emissions Reductions Based on Annual Hours of Operation

The calculation of emissions and emissions reductions using annual hours of operation as the usage factor is determined by the steps in Table A2.1.

Appropriate baseline NO_x emissions factors and default load factors are included in the technical supplement to these guidelines. Use the emissions factors associated with engine horsepower and model year. Use the load factor associated with the type of equipment. Potential grant applicants should consult with the TCEQ to ensure they use the appropriate factors.

Table A2.1
Calculating Reductions in NO_x Emissions Based on Annual Hours of Operation

Applying the TxLED Correction Factor

The counties affected by the TxLED requirements currently include all those eligible for TERP incentive funding, as listed in Table 3.1, except for El Paso County.	
TxLED correction factor for non-road: <i>1 - 0.07</i>	0.93

Step 1. Determine the Reduced NO_x Emissions Factor

Option A. Reduced-emissions technology verified to achieve a percentage reduction from the baseline	
Baseline NO _x emissions factor (g/bhp-hr)	
× verified percentage reduction from baseline	
= reduced NO _x emissions factor (g/bhp-hr)	
Option B. Reduced-emissions engine certified to a specific emissions standard (g/bhp-hr)	
Certified NO _x emissions (g/bhp-hr)	

Step 2. Calculate the NO_x-Emissions Reduction

Baseline		Reduced Emissions	
NO _x emissions factor (g/bhp-hr)		NO _x emissions factor (g/bhp-hr)	
× TxLED correction factor (<i>diesel engines only</i>)		× TxLED correction factor (<i>diesel engines only</i>)	
= corrected NO _x emissions factor (g/bhp-hr)		= corrected NO _x emission factor (g/bhp-hr)	
× load factor		× load factor	
× horsepower		× horsepower	
= g/hr		= g/hr	
Baseline g/hr - reduced emissions g/hr =			
× annual hours of operation			
× percent within eligible counties (%)			
= g/year			
		÷ 907,200 grams per ton	
= estimated annual NO _x emissions reduction (tons/yr)			
× activity life (years)			
= estimated activity-life NO _x emissions reduction (tons)			

For retrofit and add-on activities, as well as other activities where the emissions reductions are based on a percentage reduction from the baseline, the verified percentage-reduction factor can be applied to the baseline emissions factor to determine the reduced NO_x emissions factor.

Alternatively, for activities where the emissions of the new or replacement engine are certified at a specific emissions level (g/bhp-hr), such as purchases or repowers, use that emissions level as the emissions factor.

Calculation of NO_x-Emissions Reductions Based on Annual Fuel Use

If the annual fuel consumption is used, the activity level should be based on actual annual fuel receipts or other available documentation to estimate the expected annual fuel use of the equipment. An energy-consumption factor must also be calculated. This factor converts the emissions factor in terms of g/bhp-hr to g/gal of fuel used. There are two ways of calculating the energy-consumption factor:

1. dividing the hp of the engine by the fuel economy in gal/hr, or
2. dividing the density of the fuel by the brake-specific fuel consumption of the baseline engine.

Check with your equipment dealer to confirm the fuel economy or fuel consumption of the equipment for the type of application.

The calculation of reductions in NO_x emissions using annual fuel use is outlined in Table A2.2. Applicants should consult with the TCEQ for the appropriate calculations for projects involving non-diesel engines.

Calculating Cost-Effectiveness

Only the amount of incentive funds requested under the program can be used in calculating cost-effectiveness. The incremental costs for each activity must be reduced by the value of any existing financial incentive that directly reduces the cost of the proposed activity, including tax credits or deductions, other grants, or any other public financial assistance.

Table A2.2
Calculating Reductions in NO_x Emissions Based on Annual Fuel Use

Applying the TxLED Correction Factor

The counties affected by the TxLED requirements currently include all those eligible for TERP incentive funding, as listed in Table 3.1, except for El Paso County.	
TxLED correction factor for non-road: <i>1 - 0.07</i>	0.93

Step 1. Determine the Reduced NO_x Emissions Factor

Option A. Reduced-emissions technology verified to achieve a percentage reduction from the baseline	
Baseline NO _x emissions factor (g/bhp-hr)	
× verified percentage reduction from baseline	
= reduced NO _x emissions factor (g/bhp-hr)	
Option B. Reduced-emissions engine certified to a specific emissions standard (g/bhp-hr)	
Certified NO _x emissions (g/bhp-hr)	

Step 2. Calculate the NO_x-Emissions Reduction

Baseline		Reduced Emissions	
NO _x emissions factor (g/bhp-hr)		NO _x emissions factor (g/bhp-hr)	
× TxLED correction factor (<i>diesel engines only</i>)		× TxLED correction factor (<i>diesel engines only</i>)	
= corrected NO _x emissions factor (g/bhp-hr)		= corrected NO _x emissions factor (g/bhp-hr)	
× energy-consumption factor (hp-hr/gal)		× energy-consumption factor (hp-hr/gal)	
× annual fuel consumption (gal/yr)		× annual fuel consumption (gal/yr)	
= g/yr		= g/yr	
Baseline g/yr - reduced emissions g/yr =			
× percent within eligible counties (%)			
= g/yr			
		÷ 907,200 grams per ton	
= estimated annual NO _x -emissions reduction (tons/yr)			
× activity life (years)			
= estimated activity-life NO _x emissions reduction (tons)			

To determine the cost-effectiveness of an activity—with the exception of qualifying fuel activities—the incentive amount for the activity included in the project must be amortized over the activity life designated by the applicant, at a discount rate of 3%.

The following amortization formula yields a *capital-recovery factor* (CRF).

$$\text{capital-recovery factor} = [(1 + i)^n (i)] / [(1 + i)^n - 1]$$

where i = discount rate (3%)
 n = activity life

The discount rate of 3% reflects the opportunity cost of public funds—the level of earning that reasonably could be expected by investing state funds in various financial instruments, such as U.S. Treasury securities.

The incentive amount should be multiplied by the incremental cost or incentive amount requested to determine the annualized cost.

$$\text{incremental cost} \times \text{CRF} = \text{annualized cost}$$

The cost-effectiveness calculations appear in Table A2.3. For use in the calculations, capital-recovery factors for up to 20 years appear in Table A2.4.

For projects that include more than one activity, the total project incentive amount must be used to determine the cost-effectiveness of the project. The applicant may request an incentive amount that is less than the full incremental costs, in order to meet the cost-effectiveness criteria.

To determine the cost-effectiveness: First sum all of the annualized costs for the activities included in the project. Also sum the annual emissions reductions from each activity to determine an annual emissions reduction for the project. Then divide the combined annualized costs for all activities included in the project application by the total annual NO_x emissions reductions for the combined project activities.

$$\text{total annualized cost} / \text{total annual NO}_x \text{ reductions} = \text{project cost-effectiveness}$$

Table A2.3
Calculating Cost-Effectiveness

Step 1. Determine the capital-recovery factor (CRF)	
$\text{CRF} = [(1 + i)^n (i)] / [(1 + i)^n - 1]$ $i = \text{discount rate (.03)}$ $n = \text{activity life}$	
Capital-recovery factor:	
Step 2. Determine the annualized cost	
Incentive amount × CRF = annualized cost	
Annualized cost (\$/year):	
Step 3. Determine cost-effectiveness	
$\text{Annualized cost (\$/year)} / \text{annual NO}_x\text{-emissions reduction (tons/year)}$ $= \text{cost-effectiveness (\$/ton)}$	
Cost-effectiveness (\$/ton):	\$

Table A2.4
Capital-Recovery Factors Using a Discount Rate of 0.03

Activity Life	1	2	3	4	5	6	7	8	9	10
CRF	1.00	.5226	.3535	.2690	.2184	.1846	.1605	.1425	.1284	.1172
Activity Life	11	12	13	14	15	16	17	18	19	20
CRF	.1081	.1005	.0940	.0885	.0838	.0796	.0760	.0727	.0698	.0672