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Methodology for GHG Emission Reductions through Truck Stop Electrification

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A leading carbon offset program founded in 1996 as the first private voluntary GHG registry in the world, ACR operates in the voluntary and regulated carbon markets. ACR has unparalleled experience in the development of environmentally rigorous, science-based offset methodologies as well as operational experience in the oversight of offset project verification, registration, offset issuance and retirement reporting through its online registry system.

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1. BACKGROUND AND APPLICABILITY

1.1 Background on Truck Stop Electrification

Approximately 680,000 long-haul trucks[1] stop for extended periods (e.g. overnight) at truck stops and other locations during layover (rest) periods that are mandated by the U.S. Department of Transportation[2]. During this time, drivers will idle their engines to maintain a comfortable temperature in their cab compartments and to provide power to devices such as televisions, refrigerators, laptops, and microwaves. Extended engine idling results in the consumption of large amounts of diesel fuel and the release of greenhouse gases (GHGs), as well as other hazardous air pollutants. According to the U.S. Environmental Protection Agency (USEPA), freight trucks contribute approximately 21 percent of all GHG emissions in the transportation sector.[3] Currently only a small percentage of drivers utilize anti-idling technologies to prevent extended idling. The intent of this methodology is to create immediate incentives and sources of revenues to fund this critical technology transition.

There are a number of different technologies that can reduce idling. These include the following[4]:

- On-board equipment
- Automatic engine stop-start controls
- Auxiliary power units (APU) and similar devices
- Diesel-fired cab and block heaters
- Air-conditioners powered with battery or thermal storage[5]
- Electrified parking spaces at truck stops

Electrified parking spaces at truck stops include single-system electrification systems that require no on-board equipment and dual-system (shore power) options that allow drivers to plug in on-board equipment.

Installation of truck stop electrification (TSE) technologies is an idling reduction solution for locations where extended idling occurs. These technologies allow a driver to shut down the main propulsion engine of the diesel truck, eliminating all of the emissions associated with diesel engine idling. The type of TSE system eligible under this methodology draws power from the electric grid in order to provide heating, air conditioning, and electric power for in-cab devices. Even after deducting the emissions from electricity generation (project emissions), TSE systems can deliver substantial reductions when

[1] Figure based on US Census Bureau. 2002 Economic Census: Vehicle Inventory and Use Survey-- Geographic Area Series--United States: 2002; EC02TV-US; U.S. Census Bureau: Washington, DC, December 2004.

[2] Federal Highway Administration Hours of Service ("HOS") regulations state that drivers may not drive beyond the 14th consecutive hour after coming on duty, following 10 consecutive hours off duty. See http://www.fmcsa.dot.gov/rules-regulations/topics/hos/index.htm.

[3] Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2008, USEPA, April, 2010.

[4] See http://www.transportation.anl.gov/pdfs/EE/605.PDF and http://www.transportation.anl.gov/pdfs/TA/536.pdf

[5] See Gaines, L. 2009. Sleep Cheap: How to Minimize Overnight Costs with Idling-Reduction Equipment. Presentation to the SAE Commercial Vehicle Engineering Congress and Exhibition, Rosemont, IL.

compared to the carbon dioxide (CO_2) produced from an idling engine. In addition, TSE systems improve in-cab air-quality, providing ancillary health benefits for occupants.[6]

General industry acceptance is that a Class 8 diesel truck burns around 1 gallon of fuel for each hour of idling. Further studies have shown that while this is the case on average, actual fuel consumption rates vary greatly depending upon engine model, size, and the throttle level (RPM) set during idling. For this reason, a temperature-sensitive model has been developed that accounts for the differing levels of engine RPM required to maintain a comfortable cab temperature. The model used in this methodology is based on daily high or low temperatures at the TSE location and is used to determine emission levels that occur in the absence of the TSE project.

To date, expansion of TSE locations has been limited. At the time of publication of this methodology, a total of 56 TSE stations in 17 states are listed by the US Department of Energy.[7] This equates to only 2,240 TSE equipped spaces out of the nearly 500,000 available spaces in the U.S. (see Section 3.2 and Table 2 for additional details of truck parking estimates). One of the major roadblocks to current TSE technology expansion is the upfront capital costs required to install the infrastructure-based technology. It is expected that the ability to generate and claim tradable carbon credits would strongly impact TSE financing options, and TSE could play a small but measureable role in mitigating GHG impacts from truck freight movement.

1.2 Methodology Objectives

This methodology addresses boundary definition, baseline determination, additionality, quantification of baseline and project GHG emissions, leakage, uncertainty, data collection and monitoring requirements, quality assurance/quality control, ownership of emission reductions, and permanence for a TSE offset project. A TSE Project refers to a carbon offset project registered on a voluntary GHG program, and may include a single TSE facility or many individual TSE facilities grouped into one project. See definitions in 1.4 and project boundary in 2.1.

The methodology provides the necessary guidance for a TSE Project Proponent to submit to ACR a GHG Project Plan that provides a complete description of the TSE project and a true and accurate representation of its net GHG emission reductions. This documentation shall be sufficient for ACR to certify the GHG Project Plan, for successful third-party validation and verification of the project, and ultimately for project registration and issuance Emission Reduction Tons (ERTs).

1.3 Applicability Conditions

In order to use this methodology a TSE project must meet all of the following conditions:

- The methodology is applicable to installation and use of single-system electrification technologies, and excludes dual-system electrification and on board anti-idling equipment such as cab or bunk heaters, coolant heaters, and auxiliary power units.

[6] See: "In-Cab Air Quality of Trucks Air Conditioned and Kept in Electrified Truck Stop" by Doh-Won Lee, Josias Zietsman, Mohamadreza Farzaneh, and Wen-Whai Li,Hector A. Olvera, John M. E. Storey, and Laura Kranendonk: http://tse.tamu.edu/pdfs/InCab_TRR.PDF.
[7] www.afdc.energy.gov/afdc/progs/tse_listings.php

- The TSE system must use grid-connected electrical power, and must operate with the truck's main propulsion (diesel) engine fully shut off. This methodology does not account for project emissions from the truck, only those from generation of electricity powering the TSE system.
- The methodology is not applicable to projects using electrified parking spaces for vehicles other than long-haul diesel engine trucks.
- The methodology is currently only applicable in the United States due to its use of U.S.-specific references and emission factors (e.g. for electric power emissions). Future versions may expand applicability outside the U.S.
- The project must result in a reduction of direct emissions through identifiable actions by the Project Proponent (provision of TSE services that result in a clear and measurable reduction in diesel engine idling hours).
- Emission reductions must be surplus to any reductions effectively required by existing enforced regulations, and additional to business-as-usual as demonstrated through application of a common practice-based performance standard (see Section 3).
- Both baseline (diesel engine idling) and project (electricity consumption) emissions must be quantified using accepted, transparent, and replicable measurement and calculation tools and techniques (see Section 4). Raw data must be available to verify measurements and calculations. The project proponent should also provide calibration records, and other quality control/assurance information, to support the level of certainty and significance of the data.
- Ownership of GHG emission reductions must be clearly demonstrable by contract or written agreement. TSE facility owners, TSE users and any other parties involved in the project must be identified (see Section 6).
- Measurement uncertainty, permanence, and leakage must be addressed and where necessary quantified and deducted from net GHG emission reductions.
- Community and environmental impacts must be net positive as defined in the *ACR Standard*, with the option of further certifications of environmental, social and sustainable development benefits.

1.4 Definitions and Acronyms

All definitions in the latest version of the *ACR Standard* apply and are not repeated here. This methodology uses the following additional terms:

AILEF	Anti-Idling Law Enforcement Factor Index
ASOS	Automated Surface Observing Systems maintained by the Federal Aviation Administration
eGRID	USEPA's Emissions & Generation Resource Integrated Database
EGC	Electricity Generating Company (used in eGRID)
EMFAC	California Air Resources Board's Motor Vehicle Emissions Inventory (EMFAC) model

ERT	Emission Reduction Tonne (ACR unit of exchange, equal to a verified GHG reduction of one metric tonne CO_2 equivalent)
kWh	kilowatt hours
MADIS	Meteorological Assimilation Data Ingest System managed by the National Oceanic and Atmospheric Administration
NERC	North American Electric Reliability Corporation
PCA	Power Control Area, a level of aggregation in eGRID
PWS	Personal Weather Stations
RPM	Revolutions per minute
SIP	State Implementation Plan
SSRs	Greenhouse gas sources, sinks and reservoirs
TSE	Truck Stop Electrification
TSE system	One or more units that allow drivers to link into an electrical connection to provide power to the truck.
TSE facilities	The entire truck stop equipped with TSE systems, which will have many single parking places or spots for individual trucks.
TSE project	The TSE carbon project registered on a voluntary GHG program. A TSE project may include a single TSE facility or many individual TSE facilities grouped into one project.
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency

1.5 Periodic Reviews and Revisions

ACR may require revisions to this methodology to ensure that monitoring, reporting, and verification systems adequately reflect changes in the project's activities. This methodology may also be periodically updated to reflect regulatory changes, common practice adoption rates, emission factor revisions, or expanded applicability criteria including new models of eligible TSE technologies. Before beginning a project, the Project Proponent should ensure that they are using the latest approved version of this methodology.

Once a GHG Project Plan is certified, it remains valid for the duration of the project Crediting Period regardless of methodology updates.

An Annual Attestation by the Project Proponent is required. Validation is required once per Crediting Period, and verification is required prior to any new issuance of ERTs, as described in the *ACR Standard*. ACR will review Annual Attestations and periodic verification statements and notify the Project Proponent of any required adjustments or corrections to these documents. Once a GHG Project Plan has been certified by ACR, the project may be listed. Once ACR has accepted a verification statement, ACR will register verified emission reductions as ERTs.

2. PROJECT BOUNDARIES

ACR defines the GHG offset project boundary to include a project's physical boundary, temporal boundary, and GHG assessment boundary (i.e. GHG sources, sinks and pools accounted for in the baseline and project scenarios).

2.1 Physical Boundary

The project boundaries will be confined to all TSE systems installed by a single Project Proponent in a continuous time frame or in contiguous phases. A single TSE project may include multiple TSE facilities, each with multiple TSE systems (parking spaces), provided the included facilities are clearly described in the GHG Project Plan.

Key data to calculate baseline and project emissions will be centrally managed and stored by the Project Proponent. The project boundary will be the physical area encompassing the TSE systems deployed by the Project Proponent within a timeframe specified in the GHG Project Plan.

2.2 Temporal Boundary

Per the *ACR Standard,* the project Start Date is the date on which the project began to reduce GHG emissions against its baseline. For TSE projects, the Start Date corresponds to each TSE facility's first operating hour.

Projects completing validation within one year of approval of this methodology may select a project start date up to three calendar years prior to the year in which validation is completed.[8]

Completed projects are eligible to earn ERTs as long as they comply with ACR guidelines on additionality and start date.

Per the *ACR Standard,* the project Crediting Period is the length of time for which a GHG Project Plan is valid, and during which a project can generate offsets against its baseline scenario. TSE projects using this methodology will have a Crediting Period of ten (10) years. Crediting Periods may be renewed by re-submitting the GHG Project Plan in compliance with current ACR standards and criteria; re-evaluating the project baseline; demonstrating additionality; using ACR-approved baseline methods, emission factors, tools and methodologies in effect at the time of Crediting Period renewal; and undergoing validation and verification, as required.

2.3 GHG Assessment Boundary

The GHG assessment boundary encompasses all primary effects and significant secondary effects associated with the project. The GHG assessment boundary is used to identify the GHG emission sources, sinks and reservoirs (SSRs) that must be examined to quantify a project's GHG reductions, as well as SSRs that may be excluded from accounting either because they are insignificant or because exclusion is conservative (i.e. will lead to an underestimate of net GHG reductions).

For TSE projects, the two primary GHG effects to be evaluated are (1) the reduction of GHG emissions from idling of diesel engines and (2) indirect emissions from the off-site production of electricity

[8] And may include GHG reductions for the entirety of that calendar year.

consumed by TSE systems. Emissions from manufacture and installation of TSE facilities are excluded as insignificant relative to the project's net GHG reductions over the project lifetime.

Baseline emissions from diesel engine idling are quantified using emission factors derived from the California Air Resources Board's EMFAC model, as described in section 4.2. Project emissions from electricity consumption by TSE systems are quantified using USEPA Emissions & Generation Resource Integrated Database (eGRID) emission factors, as described in section 4.3.

Life-Cycle Emissions from Avoided Diesel Use. This methodology classifies as baseline emissions only the direct emissions from diesel combustion by truck engines. It does not attempt to estimate the full life-cycle emissions from diesel, including upstream emissions from production, refining and transport, and credit these to the TSE project. In doing so it would be difficult or impossible to ensure no double-counting, since the TSE project proponent does not have title to the upstream emissions, and therefore could not prevent the upstream sources responsible for diesel production, refining and transport from claiming those emission reductions from reduced diesel. Considering the difficulties in both quantification and title, and considering that not including the upstream emissions in the quantification of baseline emissions is conservative – will result in lower-than-actual baseline emissions, and thus lower-than-actual emission reductions credited to the TSE project activity – upstream emissions are excluded, consistent with the ISO 14064-2 principle of conservativeness.[9]

The GHG assessment boundary for TSE projects is shown in Table 1.

[9] International Organization for Standardization ISO) 14064-2:2006(E) - Greenhouse gases. Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.

Table 1. GHG sources included in and excluded from the GHG assessment boundary.

	Gas	Included / Excluded	Justification
Baseline	CO_2	Included	CO_2 (carbon dioxide) is the major GHG emitted from diesel fuel combustion.
	CH_4	Excluded	While there are minor CH_4 (methane) emissions from diesel fuel combustion, no credit will be claimed for this reduction in order to ensure that the project emission reduction claims are conservative.
	N_2O	Excluded	While there are minor N_2O (nitrous oxide) emissions from diesel fuel combustion, no credit will be claimed for this reduction in order to ensure that the project emission reduction claims are conservative.
Project	CO_2	Included	CO_2 is the major GHG emitted from electricity generation.
	CH_4	Excluded	CH_4 represents a *de minimis* proportion of the emissions from electric power generation, in CO_2 equivalent terms, based on eGRID data.
	N_2O	Excluded	N_2O represents a *de minimis* proportion of the emissions from electric power generation, in CO_2 equivalent terms, based on eGRID data.

3. BASELINE SCENARIO AND ADDITIONALITY

3.1 Baseline Description

Per the *ACR Standard*, the GHG project baseline is a counterfactual scenario that forecasts the likely stream of emissions or removals to occur if the Project Proponent does not implement the project, i.e., the "business as usual" case.

In this methodology the baseline is defined by existing actual or historical emissions, i.e. the continued engine idling of long-haul trucks during extended periods of rest at rates typical of prevailing practice in the industry. The overwhelming majority of trucks are not equipped with a climate control system that can be operated without using the main propulsion engine.

The typical long-haul driver travels about 306 days a year.[10] When away from home, the long-haul driver rests in the truck. During most of these resting hours the engine is idled to provide the amenities necessary for a comfortable resting environment. Factors that influence the rate of idling include seasonal climate variation, industry structure, driver habits, company policy, etc. During periods of temperature extremes (summer and winter) drivers will idle their engines throughout the entire resting period to provide a comfortable in-cab temperature. During more moderate weather, drivers may elect to turn off the engine periodically for fuel savings.

3.2 Additionality Assessment

Emission reductions from the TSE project must be additional, or deemed not to occur in the business-as-usual scenario. Assessment of the additionality of a project shall be made based on passing two tests:

1. Regulatory Surplus Test, and
2. Practice-based Performance Standard

These two tests require the Project Proponent to demonstrate that the TSE project activity is surplus to regulations, i.e. the emission reductions achieved by idling reduction are not effectively required by any applicable and enforced regulation; and that the TSE project activity reduces emissions below the level established, through the practice-based performance standard as defined below, to represent common practice for the long-haul trucking industry in the United States.[11]

3.2.1 Regulatory Surplus Test

In order to pass the regulatory surplus test, the GHG emission reductions achieved by the project must not be effectively mandated by existing and enforced laws, regulations, statutes, legal rulings, or other regulatory frameworks in effect as of the project Start Date.

[10] Based on a proprietary study by IdleAir Technologies Corporation, a survey of fleets with a total of more than 300,000 trucks indicated long-haul drivers were away from home on average 306 days per year and idling 11 hours per day during extended resting periods.

[11] Completed projects are acceptable as long as they comply with the *ACR Standard* requirements on additionality and start date.

The Project Proponent must demonstrate in the GHG Project Plan that there is no existing enforced regulation (federal, state or local) that mandates the project or effectively requires the GHG emission reductions associated with anti-idling technologies. The Project Proponent should consult the latest version of the *Idling Regulations Compendium* maintained by the American Transportation Research Institute as a reference for anti-idling regulations.[12]

Some states and municipalities have anti-idling regulations but provide exemptions to long-haul trucks for required rest periods, sleeper cabs, health and safety reasons, etc. In other jurisdictions regulations are "on the books" but routinely not enforced. Therefore there are four potential regulatory scenarios under this methodology:

- The jurisdiction (state, county, municipality etc.) where the TSE facility is located has an enforced anti-idling regulation → TSE systems are not eligible for crediting; these systems and associated GHG emissions must be excluded from the project.
- The jurisdiction where the TSE facility is located has an anti-idling regulation, but the trucks using TSE systems are exempted from the regulation → TSE systems are eligible for crediting, and application of the Anti-Idling Law Enforcement Factor (AILEF) in 3.2.2 is not required.
- The jurisdiction where the TSE facility is located has an anti-idling regulation, and no exemptions apply, but the Project Proponent believes there is systematic non-enforcement of the regulation → TSE systems may be eligible for crediting, but application of the AILEF is required.
- The jurisdiction where the TSE facility is located has no anti-idling regulation → TSE systems are eligible for crediting. Application of the AILEF is not required.

3.2.2 Demonstrating Non-Enforcement: AILEF Index

This methodology recognizes that prohibiting offset projects in all states that have anti-idling regulations "on the books," even if routinely non-enforced, will prevent the mechanism of carbon offset revenues from functioning to provide incentives for truck drivers and trucking companies to reduce idling. Prohibiting projects in such states would have the perverse result that the GHG reductions are achieved neither through voluntary actions nor regulations.

In jurisdictions where anti-idling regulations exist but are systematically not enforced, the methodology allows Project Proponents to work with an independent third-party nongovernmental organization (NGO) to develop and regularly update an *Anti-Idling Law Enforcement Factor (AILEF)* index reflecting the level of anti-idling enforcement in a particular state or region and discounting baseline emissions by this index. Discounting baseline emissions will reduce net emission reductions credited to projects.

The AILEF index will take into account all local and state data available on enforcement of anti-idling rules. Project Proponents will also work with an appropriate, independent NGO that will collect data, and/or verify data collected by the Project Proponent, to demonstrate non-enforcement. Project Proponents will specify before project commencement in the GHG Project Plan what data will be

[12] *Idling Regulations Compendium*. This compendium is continually updated by ATRI; the latest update must be used. May be viewed at http://www.atri-online.org/

collected and vetted by the NGO. The NGO will issue a letter at each verification saying what the enforcement level was during the period to be verified. Data will be based on public records such as truck miles, estimated rest time, citations issued and fines levied. The AILEF would be calculated as a percentage (e.g. 20% enforced) and that percentage will be used to discount baseline emissions for all TSE projects in the area where the AILEF applies (e.g. municipality or state). When enforcement is over 50% according to the AILEF, no more credits would be issued for the project. The AILEF must be updated annually.

To provide an example, Project Proponents and the third-party NGO could gather evidence, such as: total truck miles driven, number of trucks traveling through a state, hours of truck drivers resting and other overall measures of usage. That data can be compared with analysis on the numbers of citations issues and other evidence, including:

- Interviews with law-enforcement and other relevant public agencies to identify fines levied to vehicle operators violating anti-idling regulations.
- Interviews and/or studies and data from law-enforcement, transportation authorities and other public agencies, non-governmental organizations, universities, research institutes and other groups that have data on idling practices in states with anti-idling regulations.
- Interviews with fleet operators of trucks with records of all enforcement fines levied on their drivers.

This data will be used to compile an assessment, approved by the third-party NGO, on the level of non-enforcement and appropriate AILEF index. If the data suggests that tickets are issued for 5% of total trucks committing infractions, then AILEF would be 5% and baseline emissions would be discounted by 5%.

The AILEF deduction is applied in Equation (4) in section 4.2.4.

3.2.3 Practice-Based Performance Standard

Project proponents shall also demonstrate that TSE installations are not common practice. Such practice-based performance standards evaluate the penetration rates of a particular technology or practice within a relevant industry, sector or region. If penetration rates of a particular technology are especially low (e.g. 5% or less), it can generally be concluded the project activity is not common practice and, having been shown to be surplus to enforced regulations, is deemed additional.[13] The analysis below demonstrates that as of the time of methodology adoption, the market penetration of TSE technology is considerably below 5%, in fact less than 1%.

[13] For reference, EPA's Climate Leaders Program stated that "offset projects are required to achieve a level of performance with respect to emission reductions and/or removals that is significantly better than business-as-usual. EPA determines a performance threshold for additionality specific to each project type, by examining data sets of similar, recently undertaken or planned practices, activities or facilities in the same geographic region. This level of performance is presented in the form of an emissions rate, a technology standard, or a practice standard, as selected by EPA based on the characteristics of the data examined. The performance standard approach minimizes the risk of accepting a project that is not additional or rejecting a project that is additional. A performance standard approach also reduces the complexity, cost, and subjectivity of constructing individual project-specific reviews."

Since technology adoption rates change over time, the practice-based performance standard must be updated at appropriate intervals by re-examining data on penetration rates, so that a GHG program does not continue crediting a project activity that has become essentially business-as-usual.

This practice-based performance standard compares the number of heavy-duty truck parking spaces with TSE technology installed to the estimated total number of truck parking spaces, to derive a common practice (business-as-usual) market penetration rate of TSE technologies.

According to the USDOE TSE Site Locator[14], 56 truck stop locations, with 2,240 individual spaces, are equipped with TSE technology at the time of methodology adoption.

A 2002 *Study of Adequacy of Commercial Truck Parking Facilities*, completed by the Federal Highway Administration,[15] estimates a total of 3,382 commercial truck stop and travel plaza facilities along interstates, with an estimated total of 284,601 parking spaces, in addition to 1,771 public rest area facilities along interstates, with an estimated total of 31,249 parking spaces.

The same study estimates an annual growth rate of 5.1% for truck parking spaces at public rest areas and 6.5% for parking spaces at commercial facilities. Applying these projected growth rates through 2010 would yield an estimate of 471,013 parking spaces at commercial facilities and 46,522 parking spaces at public facilities by 2010. However these growth rates are likely to be overestimated, considering downturns in the economy since the study was published in 2002. It should be noted that state-level data is difficult to obtain, and the only national data is from 2002 – thus precise, up-to-date figures are not readily available.

Simply dividing the number of heavy-duty truck parking spaces currently equipped with TSE technology (2,240) by the estimated total number of parking spaces in 2002 (315,850) yields a penetration rate estimate for TSE technologies of 0.7%. Accounting for growth since 2002 in the number of total heavy-duty truck parking spaces, even if the actual growth rates have been less than the 5.1% and 6.5% projected by the Federal Highway Administration, would only decrease the estimated percentage penetration rate of TSE-equipped spaces.

Data for calculation of the performance standard is shown in Table 2.

Table 2. Estimates of TSE-equipped versus total heavy-duty truck parking spaces (nationwide)

	Locations	Spaces
TSE-equipped, based on USDOE TSE Site Locator	56	2,240
Total commercial facilities as of 2002, based on FHA *Study of Adequacy of Commercial Truck Parking Facilities*	3,382	284,601

[14] See Department of Energy, Alternative Fuels and Advanced Vehicle Data Center. At time of publishing this methodology, the AFDC has its website at http://www.afdc.energy.gov/afdc/vehicles/idle_reduction_stations.html.

[15] *Study of Adequacy of Commercial Truck Parking Facilities*. Published by the Federal Highway Administration. At the time of this methodology's publishing, the report can be accessed at http://www.fhwa.dot.gov/publications/research/safety/01158/index.cfm.

Total public facilities as of 2002, based on FHA study	1,771	31,249
Total commercial + public as of 2002	5,153	315,850
Conservative estimate of TSE penetration (today's TSE-equipped spaces divided by 2002 totals)		0.7%
Total estimated commercial facilities in 2010, based on 6.5% annual growth rate		471,013
Total estimated public facilities in 2010, based on 5.1% annual growth rate		46,522
Total commercial + public, 2010 estimate		517,535
Estimate of TSE penetration (today's TSE-equipped spaces divided by 2002 totals projected forward to 2010 at FHA-estimated annual growth rates)		0.4%

This analysis shows that as of methodology adoption, the market penetration rate of TSE technologies is between 0.4% and 0.7%. We can conservatively estimate that the penetration rate is *at most* 0.7%, which is based on dividing today's number of TSE-equipped parking spaces by the 2002 number of total parking spaces. Any growth in the number of total parking spaces -- even if at less than the 5.1% and 6.5% annual rates, for public and commercial respectively, projected by the Federal Highway Administration in 2002 -- would cause the calculated percentage penetration rate for TSE technologies to be lower than 0.7%.

This indicates that the installation of TSE technologies at travel centers is not common practice. Therefore TSE projects meeting the applicability conditions of this methodology are deemed "beyond business-as-usual" and thus additional, provided they pass the Regulatory Surplus test. Project Proponents must show that the project is surplus to enforced regulations, including application of the AILEF index if required, but need not document project-specific financial, institutional, or technological implementation barriers.

Projects that are certified under this version of the methodology need not reassess additionality during the Crediting Period. However, since additional TSE installations will increase the market penetration rate, the practice-based performance standard must be reassessed periodically after significant changes to the market, or at a minimum every 10 years, to re-evaluate the penetration rate of TSE installations at travel centers. If the penetration rate of TSE systems reaches 5% of total parking spaces in the country, then new projects started after that 5% level is reached will be considered to not have met the Performance Standard.

ACR reserves the right to review the common practice assessment as necessary to ensure additionality of future projects. All new GHG Project Plans, and all applications for Crediting Period renewal on existing projects, shall apply the regulatory surplus and practice-based performance standard tests in the latest approved revision of this methodology in effect at the time of GHG Project Plan submission or application for Crediting Period renewal.

4. Quantification of Baseline and Project Emissions

Please see Appendix A for a worked example of the baseline, project, and net GHG reductions calculations in this chapter.

4.1 Activity Data

The quantification of baseline and project emissions using emission factors depends on reliable and complete measurement of activity data – in this case the usage of TSE systems by participating long-haul truckers. The Project Proponent must describe in the GHG Project Plan a system for accurately monitoring, recording, and storing data on customer usage of the TSE systems included in the project boundary, thereby validating hours of usage by location for emission reduction calculations.

An acceptable system is one that monitors electric power usage at the truck stop facility. TSE usage will be measured by a mechanism separate from electricity metering. The truck will drive up to the TSE unit, open a module to swipe a credit or member card. Then the billing will start hourly. When the driver disconnects, another time stamp will occur, which is logged into a database. This is how TSE usage monitoring will occur. Kilowatt-hours will be calculated through traditional utility meters with the power company sending bills at the end of the month with kWh usage. If Smart Meters are available, the TSE facility will be able to have time-of-day usage data as well.

If on-site power meter records are not available, for example in the early stages of project implementation, utility receipts may be used. In these instances, electric power consumption from the utility receipt should be pro-rated into the appropriate calendar periods to match the time frame of the accumulated TSE usage hours.

Activity data will be spot-checked by the verifier.

4.2 Baseline Emissions

4.2.1 Emission Factors

A 2002 EPA study concludes that during an hour of idling, a heavy-duty diesel engine consumes between 0.4 and 1.65 gallons of diesel fuel and releases anywhere between 4,000 and 16,000 grams of CO_2. The EPA study, along with other studies, shows that fuel consumption and resulting emissions are most directly affected by engine RPM settings. For this reason, this methodology uses a temperature-adjusted emissions model that accounts for the differing levels of engine RPM that would be necessary to maintain a comfortable cab temperature, in the absence of idle reduction technology, based upon daily high or low temperature at the TSE location. This model is applied to the actual hours of TSE system usage at a site to derive baseline CO_2 emissions.

The baseline emission factors used in this methodology are derived from an October 2002 EPA publication as well as more recent data from the California Air Resources Board's Motor Vehicle

Emissions Inventory (EMFAC) model.[16] In the 2002, two-year study, 42 tests were conducted on nine Class-8 trucks of various model years. The study concludes that:

- During an hour of idling, a heavy-duty diesel engine consumes between 0.4 and 1.65 gallons of diesel fuel, depending strongly on the throttle setting (RPM);
- It is general practice to idle a diesel engine up to and, in some cases, higher than 1,000 RPM when accessory loads are present, such as to provide heating or air conditioning to the cab;
- Truckers can reasonably be expected to operate their heaters on days when the temperature is below 50 degrees Fahrenheit and operate the air conditioning on days when the temperature is above 70 degrees Fahrenheit;
- Based on the arithmetic mean for all tests, irrespective of engine RPM, 8,224 grams of CO_2 are released in each hour of diesel engine idling;
- The average rate of CO_2 released from idling trucks (grams/hour) tested at a low RPM (600-800) and tested at a high RPM (1,000-1,200) are 5,805 grams/hr and 11,815 grams/hr, respectively.

The key results of the study are summarized in Table 3.

Table 3. High, Low, and Average CO_2 Emissions and Fuel Consumption Rates for Class 8 Trucks (Han Lim 2002)

	CO_2 (g/hr)	Gal/hr
High Value	16,578	1.65
Low Value	3,915	0.39
Average Value	8,224	0.82
Standard Deviation	3,571	0.40
Coefficient of Variation	0.43	0.43
Low RPM Average (600-800 RPM)	5,805	0.58
High RPM average (1,000-1,200 RPM)	11,815	1.18

[16] U.S. EPA (Han Lim). October 2002. *Study of Exhaust Emissions from Idling Heavy-Duty Diesel Trucks and Commercially Available Idle-Reducing Devices*. This study generated preliminary emissions values of 144 grams/hr NOx, 8,224 grams/hr CO_2, and fuel consumption of 0.82 gal/hr.

In addition to this data, the California Air Resources Board recently published updated data from the Motor Vehicle Emissions Inventory (EMFAC) model related to heavy duty diesel trucks (HHDDT). Table 4 gives updated NO_x and CO_2 idle emission rates for HHDDT.

Table 4. NO_x and CO_2 idle emission rates (g/hour) based on CARB EMFAC model

Model Year Group	NOx			CO2		
	Low Idle	High Idle for Summer	High Idle for Winter	Low Idle	High Idle for Summer	High Idle for Winter
Pre-1987	45.7	95.9	82.2	4,271	9,822	7,687
1987-1990	70.2	147	126	4,507	10,365	8,112
1991-1993	78.4	165	141	4,610	10,603	8,298
1994-1997	85.3	179	153	4,713	10,840	8,483
1998-2002	92.1	193	166	4,846	11,145	8,722
2003-2006	95.5	201	172	4,934	11,349	8,882
2007-2009	30.0	63.0	54.0	4,934	11,349	8,882
EPA2007	30.0	63.0	54.0	4,934	11,349	8,882

Source: EMFAC 2011, Technical Documentation, Sept. 2011, California Air Resources Board, p. 122.

Based on these data the high-idle rate is 11,349 gCO_2/hour and the low-idle rate is 4,934 gCO_2/hour. The methodology therefore adopts these numbers as the baseline emissions factors because they are based on more recent information and are more conservative (i.e. will result in slightly lower baseline emissions, and therefore a lower estimate of net GHG reductions credited to the TSE project activity) as compared to the Lim 2002 numbers.

It should be noted that fuel consumption during extended idling depends on RPM, accessory loads (e.g., compressor), and hotel loads (HVAC, in-cab appliances). There are very large differences in fuel consumption among trucks, even under similar loading. This indicates that there will be some evolution in emission factors over time. Additional studies have also been published.[17,18]

4.2.2 Survey of TSE Clients

For conservative crediting, it is important to ensure that the baseline emission rates (gCO_2/hour) from diesel engine idling are not overestimated. This version of the methodology uses recent (EMFAC 2011) baseline emissions rates, which show a slight improvement in diesel engine efficiency compared to the 2002 EPA study. Besides tracking efficiency improvements over time, collecting data on the actual TSE system users can help determine whether their trucks are systematically more or less efficient than the average trucks on which the gCO_2/hour baseline emission rates are based.

The Project Proponent shall collect truck model year information for a representative sample of TSE customers when they register in the Project Proponent's member database. The survey will require ±10% precision at a 90% confidence interval. If the sample size does not reach this level of precision, then the actual uncertainty (i.e. margin of error) will be deducted from the baseline emissions. For

[17] Stodolsky, Gaines, and Vyas. *Analysis of technology Options to Reduce the Fuel Consumption of Idling Trucks.* June 2000.
[18] Lambert, Vojtisek-Lom, and Wilson. *Roadside Emissions Study – Preliminary Results for Stationary and On-Road Testing of Diesel Trucks in Tulare, CA.* Clean Air Technologies, April 2002.

example, if the margin of error is ±3% based on the survey, then $BE_{project}$ in Equation (4) will be discounted by 3%.

Using data from the survey of TSE customers, the Project Proponent shall conduct an annual assessment whether the average age of TSE customers' trucks is less than five (5) years. If the average age is less than 5 years, the baseline emission rates above will be discounted by 5% (in addition to any margin-of-error deduction) based on the conservative assumption that these trucks may be more efficient (lower-emitting) than the average trucks on which the EMFAC emission rates are based. Thus:

- If the survey indicates that average age of trucks using the TSE systems is less than 5 years, the high-idle rate of 11,349 gCO_2/hour will be replaced with 10,782 gCO_2/hour, and the low-idle rate of 4,934 gCO_2/hour will be replaced with 4,687 gCO_2/hour.
- If the survey indicates that average age of trucks using the TSE systems is 5 years or greater, the EMFAC rates of 11,349 gCO_2/hour high-idle and 4,934 gCO_2/hour low-idle will be used for all trucks.

4.2.3 Temperature Adjustment

Because TSE systems are a stationary technology, it is possible to determine the daily temperature at each TSE location. Projects can also use differing emission factors that result from variations in engine RPM. Therefore by correlating engine RPM to average daily temperatures, it is possible to calculate baseline CO_2 emissions from diesel idling to maintain a comfortable cab temperature and operation of accessories. Climate control is the main reason drivers idle their engine, followed by the need to operate electrical accessories.[19]

To portray the temperature experienced during idling periods, average daily low or high temperatures are used. Low temperatures typically correspond with overnight lows, which are the times in which the majority of drivers lay over at truck stops, and also the time that idle reduction equipment experiences the highest usage.

For days when the daily low temperature is below 50 degrees Fahrenheit, or the daily high temperature is above 70 degrees Fahrenheit, this methodology assumes drivers are operating climate control equipment as well as electrical accessories and therefore idle their engines at the higher 1,000-1,200 RPM rate, emitting on average 11,349 g CO_2/hr (per the California Air Resources Board EMFAC data). During days when the daily low and high temperature is between 50 and 70 degrees, the methodology assumes drivers are only operating electrical accessories and therefore idle their engines at the lower 600-800 RPM rate, emitting on average 4,934 g CO_2/hr).

4.2.4 Baseline Emissions Equations

If the daily low temperature during day *X* at TSE location *Y* is below 50 degrees Fahrenheit, or above 70 degrees Fahrenheit, then:

$$BE_{dayX,locY} = (EF_{high} * Hours_{TSE}) / 1,000,000 \qquad \textbf{(1)}$$

[19] Lutsey, Brodrick, Sperling and Oglesby. *Heavy-Duty Truck Idling Characteristics – Results from a Nationwide Truck Survey*. Submitted to TRB 2004.

Where:

$BE_{dayX,locY}$	Baseline emissions during day *X* at TSE location *Y*; metric tons CO_2
EF_{high}	"High-idle" emission factor from California Air Resources Board Motor Vehicle Emissions Inventory (EMFAC) model = 11,349 gCO_2/hour (or 10,782 gCO_2/hour if survey of TSE customers per 4.2.2 indicates average age of trucks is less than 5 years)
$Hours_{TSE}$	Hours TSE systems were used, based on measured activity data, during day *X* at location *Y*
1,000,000	Conversion from grams to metric tons CO_2

If the daily low or high temperature during day *X* at TSE location *Y* is between 50 and 70 degrees Fahrenheit, then:

$$BE_{dayX,locY} = (EF_{low} * Hours_{TSE}) / 1,000,000 \quad \textbf{(2)}$$

Where:

$BE_{dayX,locY}$	Baseline emissions during day *X* at TSE location *Y*; metric tons CO_2
EF_{low}	"Low-idle" emission factor from California Air Resources Board Motor Vehicle Emissions Inventory (EMFAC) model = 4,934 gCO_2/hour (or 4,687 gCO_2/hour if survey of TSE customers per 4.2.2 indicates average age of trucks is less than 5 years)
$Hours_{TSE}$	Hours TSE systems were used, based on measured activity data, during day *X* at location *Y*
1,000,000	Conversion from grams to metric tons CO_2

Then summing across days and across TSE facility locations included in the project:

$$BE_{locY} = \sum_{day=1}^{365} BE_{dayXlocY} \quad \textbf{(3)}$$

And

$$BE_{project} = \sum_{Y=1}^{n} BE_{locY} \times (1 - (AILEF / 100)) \times (1 - ME_{survey}) \quad \textbf{(4)}$$

Where:

BE_{locY}	Baseline emissions at TSE location *Y*, summed over the year; metric tons CO_2
$BE_{dayX,locY}$	Baseline emissions during day *X* at TSE location *Y*; metric tons CO_2
$BE_{project}$	Baseline emissions across all TSE locations included in project, summed over the year; metric tons CO_2
Y	1, 2, 3 ... *n* locations included in the TSE project
AILEF	Anti-Idling Law Enforcement Factor Index (percentage), as described in 3.2.2. Set AILEF = 0 if there is no anti-idling regulation, or the trucks using TSE systems are exempted from the anti-idling regulation. If the AILEF exceeds 50%, no emission reductions will be credited to the TSE Project
ME_{survey}	Margin of error of the survey of TSE customers, per 4.2.2, if the target of +/- 10% precision at a 90% confidence interval is not met. If this target is met, set ME_{survey} = 0.

4.3 Project Emissions

4.3.1 Emission Factors

The TSE systems eligible under this methodology allow the truck driver to shut down the main propulsion engine completely. Thus in the project scenario there is no need to measure emissions from the truck's diesel engine. Only emissions from electricity generation, used to power the TSE system, are quantified and deducted from baseline emissions to derive the calculation of net GHG emission reductions.

The CO_2 emissions from power generation are estimated using data from the USEPA's Emissions & Generation Resource Integrated Database (eGRID). eGRID is a comprehensive source of data on the environmental characteristics of electric power generated in the United States, including emissions of nitrogen oxides, sulfur dioxide, carbon dioxide, methane, and nitrous oxide, net generation, resource mix, and other attributes.[20] As of adoption of this methodology, the latest release is eGRID2012 version 1.0, containing data through 2009. The latest published version of eGRID shall always be used.

eGRID2012 provides data organized by power control area (PCA), North American Electric Reliability Corporation (NERC) region, eGRID subregion, U.S. state, and other levels of aggregation. The PCA, eGRID subregion, and NERC region data are based on electricity generation, transmission and distribution areas so effectively represent the emissions associated with the mix of GHG-emitting and non-emitting resources used to serve electricity loads in those areas.

The Project Proponent shall use emission factors from the latest version of eGRID available. The Proponent should download, from the eGRID website, the data files spreadsheet. For eGRID2012 Version 1.0, this is called "eGRID2012 year 2009 data files.xls". Note the "Contents" tab shows the various levels of aggregation included in the other spreadsheet tabs.

[20] See http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html.

To calculate CO_2 emissions from the electric power consumed by TSE systems included within the project boundary, the Project Proponent will multiply total kWh consumed for that TSE location and reporting period by one of the following eGRID emission factors, drawn from the data spreadsheet.

Note: The data aggregation levels are to be used in the order of preference below; i.e. if the PCA can be identified the emission factor from this tab must be used. Only if it is not possible to use the preferred level of aggregation is it permitted to move to the next level.

1. In eGRID2012 version 10, the **PCAL09** tab has data for 119 Power Control Areas across the United States. This methodology considers those PCA emission factors to be the most precise representation of emissions caused by TSE systems and thus requires the PCA emission rate to be used as long as the PCA can be identified. In the **PCAL09** tab, look up the appropriate PCA in the left-hand column and scroll across to the column giving the **PCA annual CO_2 total output emission rate** in lb/MWh.
2. *Only if the PCA is not known*, use the eGRID subregion data in the **SRL09** tab. This includes emission factors for 26 eGRID subregions covering the United States (see "eGRID2012_eGRID subregion representational map," reproduced in Annex B). Look up the appropriate eGRID subregion in the left-hand column and scroll across to the column giving the **eGRID subregion annual CO_2 total output emission rate** in lb/MWh.
3. *Only if the PCA is not known* ***and*** *it is not feasible to place the TSE facility definitively in an eGRID subregion* (e.g. because it is located near a boundary between two subregions), use the data aggregated by U.S. state in the **ST09** tab. This will be the least precise because electricity generation, transmission and distribution regions do not follow state boundaries. Look up the state where the TSE facility is located in the left-hand column and scroll across to the column giving the **State annual CO_2 total output emission rate** in lb/MWh.

4.3.2 Project Emissions Equations

Calculate project emissions using the following equation:

$$PE_{dayX,locY} = (kWh / 1{,}000) * (Rate_{eGRID} / 2{,}205) \qquad \textbf{(5)}$$

Where:

$PE_{dayX,locY}$	Project emissions from electricity consumed during day *X* at TSE location *Y*; metric tons CO_2
1,000	Conversion from kWh to MWh
$Rate_{eGRID}$	eGRID emission rate for CO_2, by (in order of preference) PCA, eGRID subregion, or State; lb/MWh
2,205	Conversion from lb/MWh to metric tons/MWh

Then summing across days and across TSE facility locations included in the project:

$$PE_{locY} = \sum_{day=1}^{365} PE_{dayXlocY} \qquad \textbf{(6)}$$

And

$$PE_{project} = \sum_{Y=1}^{n} PE_{locY} \qquad \textbf{(7)}$$

Where:

PE_{locY}	Project emissions at TSE location *Y*, summed over the year; metric tons CO_2
$PE_{dayX,locY}$	Project emissions during day *X* at TSE location *Y*; metric tons CO_2
$PE_{project}$	Project emissions across all TSE locations included in project, for the year; metric tons CO_2
Y	1, 2, 3 ... *n* locations included in the TSE project

4.4 Leakage

Leakage is defined as an increase in emissions outside the project boundary attributable to the implementation of the project. In cases where leakage occurs, it must be accounted for and subtracted from the reported net GHG emission reductions for the verification period.

Potential types of leakage include activity shifting (a shifting of GHG-emitting activities outside the project boundaries due to the project) and market effects (an increase in GHG-emitting activities due to unchanged market demand for a good or service whose supply is decreased due to project activities).

In this case because reduction in idling and use of TSE systems does not increase idling outside the project boundaries, nor affect the quantity of goods and services produced, nor cause any other expected significant increases in emissions outside project boundaries, leakage is assumed to be zero.

4.5 Emission Reductions

Net GHG emission reductions achieved by the TSE project, prior to accounting for uncertainty, are calculated as:

$$ER_{prelim} = (BE_{project} - PE_{project}) * (1 - LK) \qquad \textbf{(8)}$$

Where:

ER_{prelim}	Preliminary calculation of net emission reductions across all TSE locations included in project, for the year, prior to accounting for uncertainty; metric tons CO_2
$BE_{project}$	Baseline emissions across all TSE locations included in project, summed over the

year, as derived in Equation (4); metric tons CO_2

$PE_{project}$ Project emissions across all TSE locations included in project, summed over the year, as derived in Equation (7); metric tons CO_2

LK Leakage discount; here LK = 0 as described in section 4.4

4.6 Uncertainty

4.6.1 Sources of Uncertainty

The emission reduction calculations in this methodology are designed to minimize the possibility of overestimation and over-crediting of GHG emission reductions due to various uncertainties, primarily associated with emission factors and representative sampling populations.

There are several uncertainties related to estimates of GHG emission reductions from TSE projects. Some of these uncertainties are more easily quantified than others. These include:

- *Emission factors.* CO_2 emissions from the idling of diesel engines are estimated using the emission factors in the 2011 EMFAC data cited in section 4.2.1. CO_2 emissions from the generation of electricity consumed by TSE systems are estimated using eGRID emission factors by PCA, eGRID subregion, or aggregated State-level data.
- *Activity data.* The measurement of TSE activity is not a source of uncertainty. The TSE operator is assumed to track precisely the duration of system usage and kWh consumption, and this data will be collected, verified, recorded, and reported as an integral part of the TSE project activity.
- *Induced Demand.* In the early stages of adoption of an innovative technology, encouraging trial and adoption is a critical challenge. Drivers must be induced to adjust longstanding behaviors and attitudes. To encourage driver trial and adoption, some TSE companies have packaged numerous benefits and services along with their HVAC services. This potentially could induce drivers to use the TSE system when they would not have idled their trucks otherwise. However this sort of use would be costly to the driver and/or their employer, and would not return fuel savings to the truck owner. During this phase in the evolution of the idle reduction industry, TSE operators generally do not perceive “gratuitous use” to be a driving factor. The impact of local weather on TSE usage is direct evidence that primary demand (the direct substitution of idling) is far greater than induced demand.
- *Life-Cycle Emissions from TSE system deployment.* TSE facility life-cycle emissions could be potentially reduced if the process of manufacturing and deploying TSE systems was itself carbon intensive. For the purposes of this methodology, since TSE operators generally do not manufacture their systems and lack reliable information about the carbon intensiveness of systems built and installed by contractors, emissions from construction are ignored and assumed to be *de minimis* relative to the overall emission reductions over the full TSE facility life.
- *Environmental influences and operating errors.* The variation in TSE system efficiency due to environmental influences or operating practices may also contribute to overall uncertainty.

Operating malfunctions of the project, if any, shall be recorded and the project activity data shall be adjusted to correct for faulty or missing data. The contribution of this variation to overall uncertainty expected to be small.

- *Survey of Truck Owners*: Project Proponents will survey TSE customers per 4.2.2 to determine the age of their trucks. There is some inherent uncertainty in any statistical sample, and this survey will require a 10% precision and a 90% confidence factor. If the sample size does not reach this level of precision, then the actual uncertainty, specifically the margin of error, will be deducted from $BE_{project}$ in Equation (4).

These potential sources of uncertainty, and the associated QA/QC program elements designed to minimize them, are summarized in Table 5.

Table 5. Uncertainties and Mitigation Procedures

Data Parameter	Uncertainty Level of Data	QA/QC Procedures Risk Mitigation
Number of TSE systems	Very low	TSE operator will have comprehensive records of the number of TSE systems installed, in operation, and used by truckers.
Operating time of TSE systems (hours)	Very low	TSE operator will track precisely the duration of system usage. Usage will be time-stamped, allowing the operator to know during which day usage occurred and apply the correct emission factor based on average daily low or high temperature at the TSE location.
Daily low or high temperatures	Very low	Weather data will be acquired from publicly available sources, originating from weather stations in the closest proximity to project locations. Data sources include historical weather station readings from: 1) Automated Surface Observing Systems (ASOS) stations maintained by the Federal Aviation Administration,[21] Meteorological Assimilation Data Ingest System (MADIS) stations managed by the National Oceanic and Atmospheric Administration,[22] and other Personal Weather Stations that have certified quality controls (PWS Network).
Electricity consumed by TSE systems (kWh)	Very low	TSE operator will track precisely the electricity consumed by TSE users. Electricity meters will be subject to a regular maintenance and testing regime to ensure accuracy. Their readings will be checked by the electricity distribution company. Any faulty or missing activity data shall be adjusted and corrected to ensure that net GHG emission reductions are not overestimated.

[21] See http://www.faa.gov/air_traffic/weather/asos/.
[22] See http://madis.noaa.gov/.

Data Parameter	Uncertainty Level of Data	QA/QC Procedures Risk Mitigation
Emission factors (baseline)	Low/medium	Variation and uncertainty does exist in the 2011 EMFAC emission factors for diesel engine idling. The CO_2 numbers are very similar to those in Han Lim 2002, indicating that CO_2 emission rates per hour of diesel engine idling have changed little in recent years. In the absence of more comprehensive studies, these emission factors are accepted as the best available. CO_2 emissions are most strongly affected by idle RPM, which this methodology addresses by including two different RPM levels to represent typical baseline idling for different daily low or high temperatures.
Emission factors (project)	Low	The eGRID emission factors used to estimate CO_2 emissions from generated electricity are based on extensive electric sector data collected by USEPA and the U.S. Department of Energy - Energy Information Administration.[23] While these emission factors do have some embedded uncertainties, this methodology does not require the Project Proponent to account for uncertainties in the eGRID emission factors. The methodology does require the Project Proponent to use the most specific eGRID emission factor available. If the PCA is known, the eGRID factor for this PCA must be used. Otherwise the emission factor for the eGRID subregion or State where the TSE facility is located (in declining order of preference) may be used. The eGRID factors do not enable consideration of the resource mix generating electricity (i.e. dispatch order) at

[23] See the eGRID 2012 Technical Support Document, included in the eGRID download at http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html, for eGRID data sources and methodology. eGRID is developed from a variety of data collected by the U.S. Environmental Protection Agency (EPA), and the Energy Information Administration (EIA). Federal data sources include EPA, Clean Air Markets (EPA/CAMD) Annual and Ozone Season Emissions data (EPA, 2010); EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008; EIA, EIA-860: Annual Electric Generator Report (EIA, 2008a); EIA, EIA-861: Annual Electric Power Industry Report (EIA, 2008b); EIA, EIA-923 Schedule 3B: Power Plant Operations Report, Prime Mover Fuel Consumption (EIA, 2008c); EIA, EIA-923 Schedule 2: Power Plant Operations Report, Plant Cost and Quality of Fuel Receipts (EIA, 2008d); EIA, Electric Power Monthly, Plants Sold and Transferred (EIA, 2007-2010); and the North American Electric Reliability Corporation (NERC). Data displayed in eGRID are derived from the above data sources; EPA does not collect data directly from electric generators for eGRID. Inconsistencies between data sources, missing data, and ambiguous data occasionally necessitate adjustments to values of individual data elements. When necessary, EPA substitutes data from secondary sources or default values. EPA also updates ownership, corporate affiliation, and grid configuration data.

Data Parameter	Uncertainty Level of Data	QA/QC Procedures Risk Mitigation
		the time of day when TSE facilities are used. This would require tracking not just electricity consumption but also the time of day consumed, combined with time of day-specific emission factors accounting for which plants are dispatched at that time.

4.6.2 Uncertainty Deduction

The Project Proponent should address, in the GHG Project Plan, sources and magnitude of uncertainties relevant to both the baseline and with-project scenarios.

The *ACR Standard* requires that total uncertainty be no more than 10% of the mean estimated net emission reductions at 90% confidence. If the Project Proponent cannot meet the targeted ±10% of the mean at 90% confidence, then the reportable amount shall be the mean minus the lower bound of the 90% confidence interval.

Total uncertainty should be estimated by summing estimated baseline and project uncertainty:

$$UNC = \sqrt{\mathrm{UNCERTAINTY_{BSL}}^2 + \mathrm{UNCERTAINTY_P}^2} \tag{9}$$

Where:

UNC	Total uncertainty for the TSE project; %
$\mathrm{UNCERTAINTY}_{BSL}$	Total uncertainty estimated for baseline scenario; %
$\mathrm{UNCERTAINTY}_{P}$	Total uncertainty estimated for project scenario; %

If *UNC* ≤ 10% of ER_{prelim}, then no deduction for uncertainty is required.

If *UNC* > 10% of ER_{prelim}, then the value of $ER_{project}$ shall be adjusted to account for uncertainty:

$$ER_{project} = ER_{prelim} * (1 - UNC) \tag{10}$$

Where:

$ER_{project}$	Net emission reductions across all TSE locations included in project, adjusted for uncertainty; metric tons CO_2
ER_{prelim}	Preliminary calculation of net emission reductions across all TSE locations included in project, for the year, prior to accounting for uncertainty, as calculated in Equation (8); metric tons CO_2

UNC Total uncertainty for the TSE project; %. If *UNC* ≤ 10% of ER_{prelim}, set *UNC* = 0.

4.7 Calculation of ERTs

The Project Proponent shall include in the GHG Project Plan an *ex ante* estimation of Emission Reduction Tonnes (ERTs) over the duration of the approved Crediting Period. Actual ERT issuance will be based on *ex post* verified emission reductions.

$$ERT_t = \left(ER_{project,t_2} - ER_{project,t_1}\right) * \left(1 - BUF\right) \tag{11}$$

Where:

ERT_t Number of Emission Reduction Tonnes at time $t = t_2 - t_1$

$ER_{project,t2}$ Cumulative total net GHG emissions reductions up to time t_2, adjusted for uncertainty per Equation (10)

$ER_{project,t1}$ Cumulative total net GHG emissions reductions up to time t_1, adjusted for uncertainty per Equation (10)

BUF Percentage of project ERTs contributed to the ACR buffer pool; here BUF = 0 since emission reductions from avoidance of diesel idling are irreversible.[24]

Note that the calculation of ERTs accounts for uncertainty, but there are no required deductions for leakage (see Section 4.4) or non-permanence (see Section 6.4).

[24] Emission reductions achieved through the avoidance of fossil fuel combustion cannot be reversed subsequent to crediting. In contrast emission reductions achieved through some project types – e.g. forest carbon and other types of sequestration – can be reversed, for example through fire or harvest, and for that reason ACR requires these types of projects to mitigate reversal risk by depositing ERTs in a buffer pool or using other ACR-approved risk mitigation mechanisms. No buffer deduction is required for TSE projects since there is no reversal risk.

5. DATA COLLECTION AND MONITORING

It is critical for the accuracy and transparency of calculating, monitoring and verifying GHG reductions that:

- Measurements of operating hours and electricity consumption be undertaken with reliable equipment that is regularly calibrated;
- Average daily low and high temperatures be accurately recorded using data from the closest weather station (ASOS, MADIS, etc.);
- Multiple data cross-checks and internal validation be performed; and
- Measurement and calibration equipment and processes and changes thereto be clearly described as part of the CO_2 emissions reporting process.

5.1 Monitoring Plan Guidelines

A monitoring plan is a working document that describes procedures for collecting activity data, baseline and project emissions data, and for ensuring and controlling the quality of the collected data. The TSE project monitoring plan will be updated whenever the methodologies used to measure project activity or baseline emissions are changed.

Some of the key GHG accounting principles that should drive the design of data collection and monitoring include:[25]

- *Relevance*: levels of accuracy and uncertainty associated with monitoring methods should reflect the intended use of the data and the objectives of the offset project. Some intended uses may require greater accuracy than others.
- *Accuracy*: measurements, estimates, and calculations should be unbiased, and uncertainties reduced as far as practical. Calculations and measurements should be conducted in a manner that minimizes uncertainty.
- *Conservativeness*: where there are uncertainties in monitored data, values used to quantify GHG reductions should err on the side of underestimating rather than overestimating reductions.

5.2 Data Measurements

Implementation of the quantification methodology described in section 4 requires measurement of the following activity data:

- Operating hours of the TSE systems (equal to hours of diesel idling avoided)
- Electricity consumption of the TSE systems and any office buildings

[25] Based on World Resources Institute/World Business Council for Sustainable Development (WRI/WBCSD), *GHG Protocol for Project Accounting*, November 2005 and International Organization for Standardization ISO) 14064-2:2006(E) - Greenhouse gases. Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.

- Average daily low and high temperatures (for the temperature-adjusted baseline emissions model), based on data from approved sources (ASOS, MADIS or certified PWS)

Records of all data shall be recorded and archived electronically in a database maintained by the Project Proponent. Data aggregations of hourly, daily, and annual data totals should be available by querying the database. All database reports and calculations to support the CO_2 emission reduction estimates must be archived to facilitate *ex post* verification.

Table 6 lists the key data and parameters to be monitored and recorded for the purposes of capturing activity data, calculating emission reductions, conducting internal cross-checking, and providing data for third-party validation and verification. All project data should be stored electronically and centrally in a format that is easily accessible for validation and verification.

Table 6. Parameters for Monitoring and Emission Reduction Calculations

Parameter	Unit	Description	Source of data	Used in equations	Monitoring frequency	Proportion of data monitored
Number of TSE facilities included in project	#	Total TSE facilities included in the GHG project boundary	Project Proponent records	-	Once per Crediting Period	100%
Number of TSE spots per facility / per total project	#	Total TSE parking spots included in the GHG project boundary	Project Proponent records	-	Once per Crediting Period	100%
Locations of TSE facilities	Loca-tions	Geographic location (by zip code) of each TSE facility included in the project, necessary to determine average daily low and high temperatures (baseline emissions calculation) and appropriate eGRID emission factor (project emissions calculation)	Project Proponent records	-	Once per Crediting Period	100%

Parameter	Unit	Description	Source of data	Used in equations	Monitoring frequency	Proportion of data monitored
Operating hours for each TSE system spot	Hours	Hours of operation, by day, for each TSE system spot at each included facility, necessary for calculating hours of avoided idling (baseline emissions calculation)	Project Proponent records	1, 2	Continuous	100%
Daily low and high temperatures	^oF	Low and high temperatures for each day	Weather data from ASOS, MADIS, or certified PWS	1, 2	Measured daily,	100%
Electricity consump-tion of the TSE systems and office buildings	kWh	Electricity consumed by TSE systems included in the project boundary, necessary for calculating emissions from generation of electricity consumed by TSE systems (project emissions calculation)	Project Proponent records / electric distribution company bills	5	Continuous	100%

5.3 Quality Assurance/Quality Control (QA/QC) Measures

The Project Proponent should maintain a QA/QC program including measures such as:

- Accurate metering and cross-checks: TSE system usage measured by visit duration hours (from operations data collection), and by the quantity sold (or billable hours, from financial/revenue transactions). These two independent measures of activity should be reviewed and updated, as necessary, as well as used as a cross-check against each other.
- Calibrations on key monitoring instrumentation are made at least annually, and more frequently if any QA/QC issues are indicated.
- Responsible entities: field personnel and corporate data system manager shall be responsible for data capture, to ensure data are properly recorded into the database.
- A designated corporate QA/QC officer shall be responsible for the following:

- Development, implementation, and oversight of QA/QC procedures for measurement, calibration, and data collection of CO_2-related data;
- Assess calculation results to ensure data have been properly processed; and
- Strategies for identifying and managing missing or poor-quality data, and making any necessary adjustments to data based on findings from the QA/QC measures.

- Daily log sheets, calibration and maintenance records, 3rd party analytical results, utility bills/receipts, and other electronic and hard copy data records shall be archived for a minimum of three (3) years to support future auditing and verification activities.
- Emission reduction estimates shall be made so as to overstate project emissions and understate baseline emissions, thereby erring on the side of understating net GHG emission reductions.

5.4 Validation and Verification Interval

Per the *ACR Standard*, validation of the GHG Project Plan will occur once per Crediting Period.

Verification of GHG assertions is at the discretion of the Project Proponent, provided it conforms to ACR requirements. Verification must occur prior to any new issuance of ERTs. ERTs may be created and issued annually, or at the Proponent's request, more or less frequently. At each request for issuance of new ERTs, the Project Proponent must submit a verification statement from an approved verifier based on a desk audit. No less than once every five years, Proponents must submit a verification statement based on a full verification including a field visit and an adequate sample of the TSE facilities included in the TSE project, as determined in the verifier's professional judgment, necessary for the verifier to provide a reasonable level of assurance that the GHG assertion is without material discrepancy.[26]

[26] Reasonable level of assurance, and materiality, are defined in the *ACR Standard* and *ACR Validation/Verification Guideline for GHG Projects*.

6. EMISSIONS OWNERSHIP AND QUALITY

6.1 Real

TSE project emission reductions should represent a recognizable action that directly resulted in reductions of anthropogenic CO_2 emissions, which would have been released to the atmosphere in the absence of the TSE project. Emission reductions must be demonstrated to have actually taken place and to be attributable to TSE use, as monitored using a comprehensive data collection, storage, and management system.

Emission reductions must have occurred and been verified prior to ERT issuance. ACR will not forward issue nor forward register a projected stream of future offsets.

6.2 Surplus

Emission reductions are surplus if they are not required by law. While several states have enacted anti-idling regulations with the goal of reducing criteria pollutant (NOx, CO, PM, VOC) emissions, no state or federal laws require truck drivers or fleets to reduce GHG emissions.

Substantial problems with compliance and enforcement have occurred in every area that has enacted an anti-idling regulation. Because of these concerns, the majority of state environmental agencies – as well as their respective EPA Regional Offices – are not convinced these regulations create real emission reductions, and have not incorporated these emission reductions in their State Implementation Plans (SIPs). Among the jurisdictions that do not claim these emission reductions within the state SIP are the states of New York, Pennsylvania, Arizona, Nevada, and New Hampshire, as well as the cities of Denver, Colorado; Washington, D.C.; St. Louis, Missouri; and Philadelphia, Pennsylvania.

There are also several jurisdictions that have made provisions for incorporating idling emission reductions within the SIP, but have specifically exempted long-haul trucks with sleepers. These jurisdictions include the states of California, Arizona, and Illinois, and Salt Lake City, Utah. Since California's anti-idling regulation (implemented January 2005) exempts sleeper trucks at travel centers, it does not affect TSE emission reductions. It should be pointed out that this regulation was developed to reduce airborne toxics and was not intended to regulate GHG emissions.

Only the emission reductions from TSE sites located within areas where there are no anti-idling regulations, where the anti-idling regulations include provisions specifically exempting long-haul trucks with sleepers, or where the Project Proponent presents evidence suitable to the validator/verifier that anti-idling regulations are routinely not enforced, are eligible for crediting under this methodology. See section 3.2.2 for a description of how routine non-enforcement may be documented and demonstrated to a validator/verifier.

6.3 Unique

Emission reduction accounting must ensure that there is no double counting, double crediting or double selling. The Project Proponent's accounting system must record each visit, TSE system use, and track this usage by driver, fleet, parking space, facility, city, and state. Any double counting in systems use and emissions reduction calculations can thus readily be identified.

ERTs registered on ACR will be issued unique serial numbers that link the verified emission reduction to a specific project or source, geographic identifier, and vintage year, guarding against the possibility of multiple sales. This also provides the ability to track all transfers, trades, retirements or cancellations of ERTs. Market participants can track individual emission reductions from cradle to grave using the on-line transaction log.

6.4 Permanent

The CO_2 emission reductions from avoided diesel idling are irreversible because the emissions are avoided from trucks not idling, and which would have idled in the absence of the TSE project. Once the TSE system has operated and the truck has not idled, the emission reduction has occurred and cannot reversed subsequent to crediting.

6.5 Verifiable

The data sources used to create the ERTs claimed in any GHG assertion must be readily verifiable by a competent independent third party validation/verification body. Measurement data records and electricity consumption data shall be maintained by the Project Proponent and be readily available for audit. The Project Proponent shall maintain its own QA/QC system and internal cross-checks to identify, diagnose and correct for any apparent data anomalies. The Project Proponent's data system shall record fine-grained data about locations (parking space, facility, city, county, state), visits (e.g., date and time of the start and end of each session), and drivers. This information shall be maintained in a database format that is routinely evaluated for programming errors and data anomalies. Data audits should be readily supported.

6.6 Direct Emission Reductions

The emission reductions from a TSE project will represent direct emissions reduced by the project activity (through the avoidance of diesel engine idling) at clearly identified and controlled sources. None of the emission reductions claimed by the project will be indirect emission reductions.

The Project Proponent shall include in its Annual Attestation that all emission reductions are direct reductions.

6.7 Ownership of GHG Reductions

The emissions from diesel engines are "owned" by the owner/operators of the trucks, unless signed over contractually to another party. These owner/operators must sign over to the Project Proponent all rights to the environmental attributes, including GHG reductions, inherent in their use of the Project Proponent's TSE facilities. The Project Proponent should provide to ACR a sample agreement with participating truckers indicating they have relinquished ownership of the GHG reductions to the Project Proponent.

Other entities with a potential or hypothetical claim on GHG reductions could include:

- *Travel centers hosting the TSE facilities*. Travel centers will generally own the real estate on which TSE systems are deployed, but do not contribute either technology or investment toward the achievement of TSE emission reductions. Travel centers may receive a percentage of the TSE operator's gross receipts as their inducement to allow the TSE operator to install systems. If the travel center operator has signed an agreement conferring rights to GHG emission reductions to the Project Proponent as lessee, the Project Proponent should provide such sample agreement to ACR.
- *Granting agencies*. In certain instances, the TSE operator's ownership of CO_2 emission credits has been, or may in the future be, limited by regulations established by federal or state agencies that provided funding to finance a portion of the TSE system installation costs. Granting federal agencies could potentially have a claim on carbon dioxide reductions that could limit the TSE operator's right to sell ERTs. The focus of these funding agencies (primarily the U.S. EPA and the U.S. Department of Transportation) is on the reduction of criteria pollutant emissions. These funding programs generally make no provisions concerning greenhouse gases, nor do they generally prohibit the TSE operator from selling NOx and VOC reductions.
- *State agencies*. Individual states may have their own criteria that can affect either emission credit ownership, or the extent to which such emission credits may be sold. If state mandates (and/or state funding programs) are directed toward criteria pollutant or particulate matter reductions, but do not address GHG emission reductions, the Project Proponent may argue that GHG emission reduction ownership is unaffected by these mandates.

The Project Proponent shall address in the GHG Project Plan any potential conflicting claims, and if necessary provide supporting evidence that they have title or contractual rights to the claimed emission reductions and that no other entity has a conflicting claim, prior to ACR registration. In addition, Project Proponents shall review available material from the users of TSE systems (both fleets and their owners) to ensure that none are claiming reductions in their own carbon footprint from the use of TSE systems. If such claims are made, the Project Proponent shall request the truck fleets or their owners remove such claims from public materials, whether a website, sustainability report or other publication. In addition Project Proponents shall review available material from state or local government to ensure that public agencies are not claiming reductions from the use of TSE systems within their territories. If such claims are made, the Project Proponent shall request these agencies have such claims removed from public materials, whether a website, sustainability report or other publication.

6.8 Community and Environmental Impacts

Per the *ACR Standard*, community and environmental impacts must be net positive overall. Project Proponents shall document in the GHG Project Plan a mitigation plan for any foreseen negative community or environmental impacts, and shall disclose in their Annual Attestations any negative environmental or community impacts or claims by community members of negative environmental and community impacts.

TSE projects may not have significant community and environmental impacts. If there are any significant impacts from the TSE installation and/or operation, Project Proponents should take into account ACR's Community and Environmental Impacts criteria when applying this methodology to specific projects. These criteria require analysis of any adverse environmental or social impacts on the communities affected by a project. If there are any adverse impacts that may result from the project, Project Proponents should conduct stakeholder meetings with community groups or other appropriate stakeholders to ensure that any concerns associated with the project are addressed.

TSE projects will however cause positive environmental co-benefits in the form of reductions in criteria pollutant emissions (e.g., NOx, PM, CO, and VOC), as well as environmental/community benefits such as noise reduction, job creation, etc. The Project Proponent is encouraged to quantify such benefits in the GHG Project Plan and consider additional optional certifications.

6.9 Warranties

The Project Proponent shall include in the GHG Project Plan the following warranty:

"I hereby warrant that all information provided by [Project Proponent] in this GHG Project Plan is true and factual, and all matters affecting the validity of this GHG Project Plan or consequent emission reduction credit claims have been fully disclosed. This project has not been previously registered with any other emission reduction program or regulatory agency. [Project Proponent] has title to the GHG emission reductions created by this project, and warrants that no security has been granted over those rights, and said rights are valid. Any ERT delivery risks associated with lack of statutory rights, governmental agency recognition, or future emission reduction creation operations commensurate with potential ERT forward option volumes will be mitigated by [Project Proponent] via clearing house, registry, and/or insurance instruments, as appropriate."

6.10 Annual Attestations

The Project Proponent shall submit Annual Attestations, as required in the *ACR Standard*, in a format to be provided by ACR. The Annual Attestations address continued undisputed ownership of emission reductions, any claims of negative environmental or community impacts, and a mitigation plan in the case of such claims.

7. APPENDIX A: WORKED EXAMPLE FOR CALCULATING EMISSION REDUCTIONS

In this worked example of the emission calculations in Chapter 4, we calculate baseline and project emissions, net GHG reductions, and *ex ante* estimated ERTs for a hypothetical TSE facility located in Dallas, Texas. The TSE project is assumed to include only this one TSE facility.

1. *Activity data*

Assume the following monthly average low temperatures, TSE usage hours, and electricity consumption at the Dallas TSE facility:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average low temp (°F)	36	41	49	56	65	73	77	76	69	58	47	39
TSE usage hours at location	20,299	18,723	18,529	20,270	23,089	25,020	29,960	30,772	24,184	22,877	18,739	16,901
Electricity consumption (kWh)	30,449	28,085	27,794	30,405	34,634	37,530	44,940	46,158	36,276	34,316	28,109	25,352

2. *Baseline emissions*

For January, February, March, June, July, August, November, and December, average temperatures are either below 50°F or above 70 °F, so we assume truckers would be idling at the 1,000-1,200 RPM level to power both climate control equipment and electrical accessories. We use Equation (1). For example for January: (NOTE: calculations will be made by day, but for simplicity, we are using monthly temperatures in this example)

$BE_{dayX,locY}$ = (11,349 gCO_2/hour * 20,299 hours) / 1,000,000 = 230.4 metric tons CO_2

For April, May, September, and October, average temperatures are between 50°F and 70 °F, so we assume truckers would be idling at the 600-800 RPM level to power electrical accessories only. We use Equation (2). For example for April:

$BE_{dayX,locY}$ = (4,934 gCO_2/hour *20,270 hours) / 1,000,000 = 100.01 metric tons CO_2

Repeating this calculation for each month yields:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Emission factor (gCO2/hr)	11,349	11,349	11,349	4,934	4,934	11,349	11,349	11,349	4,934	4,934	11,349	11,349
Baseline emissions for month (metric tons CO2)	230.4	212.5	210.3	100.0	113.9	284.0	340.0	349.2	119.3	112.9	212.7	191.8

Summing across months using Equation (3) gives a total of 2,477 metric tons CO_2. Because there is only one TSE facility in this hypothetical project, 2,477 metric tons CO_2 is the total baseline emissions for the year, assuming an AILEF index of zero (i.e. no anti-idling regulation, or zero enforcement of anti-idling regulations).

3. *Project emissions*

Imagine the power control area (PCA) is not known, but the TSE facility location (Dallas) clearly places the project in eGRID subregion ERCT. Having downloaded the eGRID2012 Version 1.0 files, we go to the **SRL09** tab, look up ERCT at the left, and scroll across to find the **eGRID subregion annual CO_2 total output emission rate** for ERCT is 1,181.73 lb/MWh. This will be the emission factor used for electricity generation. (NOTE: calculations will be made by day, but for simplicity, we are using monthly temperatures in this example)

For January, applying Equation (5) yields:

$PE_{dayX,locY}$ = (30,449 kWh / 1,000) * (1,181.73 lb/MWh / 2,205 lbs per metric ton) = 16.3 metric tons CO_2

Repeating this calculation for each month yields:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Emission factor (lb/MWh)	1,181.73	1,181.73	1,181.73	1,181.73	1,181.73	1,181.73	1,181.73	1,181.73	1,181.73	1,181.73	1,181.73	1,181.73
Baseline emissions for month (metric tons CO2)	16.3	15.1	14.9	16.3	18.6	20.1	24.1	24.7	19.4	18.4	15.1	13.6

Summing across months using Equation (6) gives a total of 216.5 metric tons CO_2. Because there is only one TSE facility in this hypothetical project, 216.5 metric tons CO_2 is the total project emissions for the year.

4. *Emission reductions*

Applying Equation (8), and considering that leakage is assumed to be zero,

$$ER_{prelim} = (BE_{project} - PE_{project}) * (1 - LK)$$

$$= (2{,}477 - 216.5) * (1 - 0)$$

$$= 2{,}260.4 \text{ metric tons } CO_2$$

5. *Uncertainty deduction*

Assume that total uncertainty, when estimated and aggregated across the baseline and project scenarios, is less than 10% of ER_{prelim}. Therefore no deduction for uncertainty is required. Equation (10) is not used and $ER_{project}$ is the same as ER_{prelim}.

6. *Calculation of ERTs*

Assume this is the first year of the project so there are no prior t_1 cumulative emission reductions to subtract. *BUF* is set to zero since the emission reductions are irreversible. Applying Equation (11),

$$ERT_t = \left(ER_{project,t_2} - ER_{project,t_1}\right) * \left(1 - BUF\right)$$

$$= (2{,}260.4 - 0) * (1 - 0)$$

$$= 2{,}260.4$$

2,260 metric tons CO_2 are the ERTs projected *ex ante* to be registered for the first year of the project, once verified by an approved third party verifier.

8. APPENDIX B: EGRID SUBREGIONS AND EMISSION RATES

The following map and table show the eGRID subregions and GHG emission rates, used in section 4.3 to calculate CO_2 emissions from TSE use. Note these eGRID subregion rates may only be used in the case that the Power Control Area is not known. See http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html.

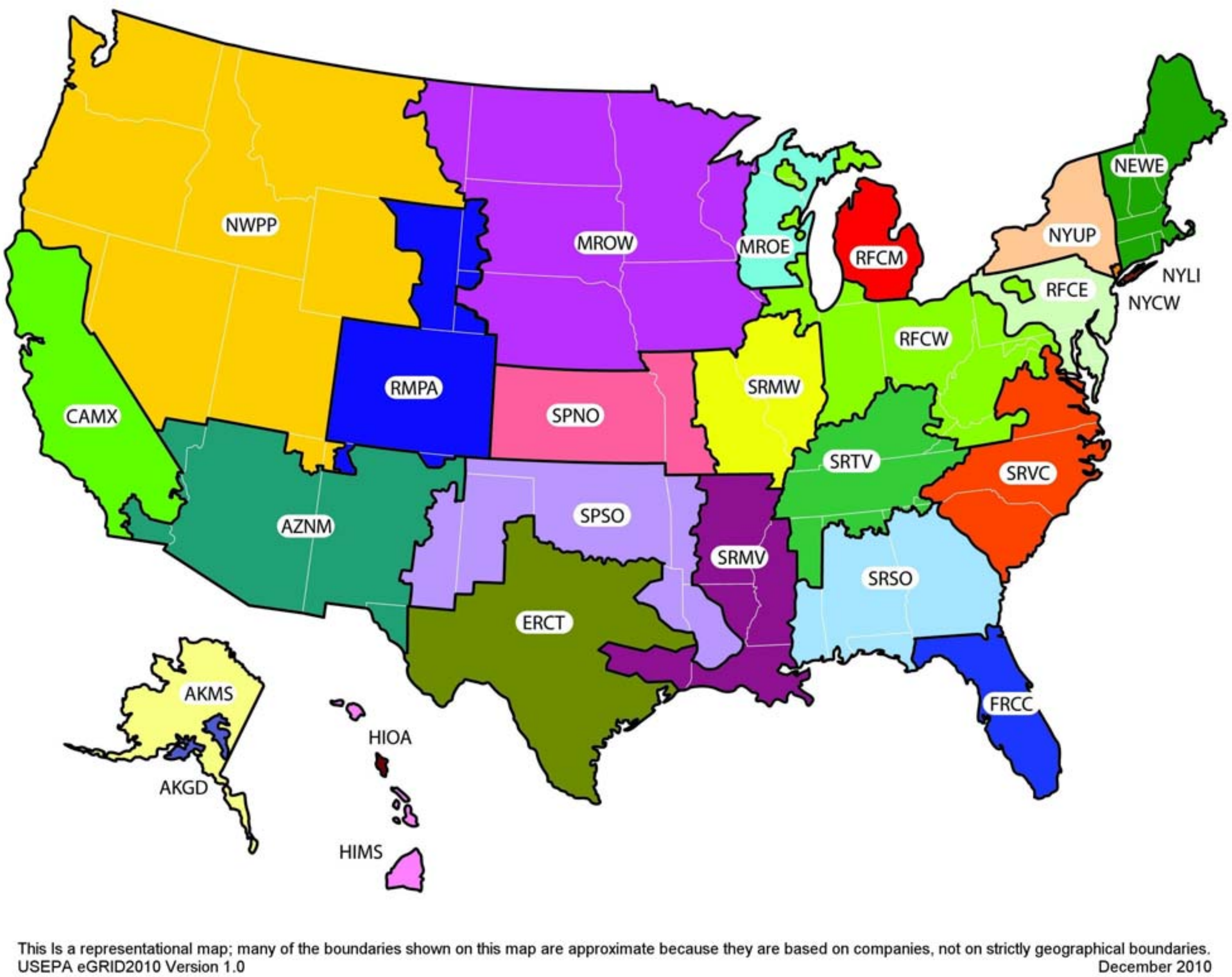

Figure AB-1. eGRID subregions.

Table AB-1. Annual GHG output emission rates for 2009 from eGRID2012 v1.0.

eGRID subregion acronym	eGRID subregion name	Annual total output emission rates: Carbon dioxide (CO_2) (lb/MWh)	Annual total output emission rates: Methane (CH_4) (lb/GWh)	Annual total output emission rates: Nitrous oxide (N_2O) (lb/GWh)	Annual non-baseload output emission rates: Carbon dioxide (CO_2) (lb/MWh)	Annual non-baseload output emission rates: Methane (CH_4) (lb/GWh)	Annual non-baseload output emission rates: Nitrous oxide (N_2O) (lb/GWh)
AKGD	ASCC Alaska Grid	1,280.86	27.74	7.69	1,320.75	33.16	6.34
AKMS	ASCC Miscellaneous	521.26	21.78	4.28	1,469.44	61.53	12.10
AZNM	WECC Southwest	1,191.35	19.13	15.58	1,187.67	22.25	9.12
CAMX	WECC California	658.68	28.94	6.17	993.89	33.52	4.07
ERCT	ERCOT All	1,181.73	16.70	13.10	1,155.44	19.66	7.59
FRCC	FRCC All	1,176.61	39.24	13.53	1,301.40	36.04	11.91
HIMS	HICC Miscellaneous	1,351.66	72.40	13.80	1,615.98	91.06	17.19
HIOA	HICC Oahu	1,593.35	101.74	21.98	1,621.42	107.94	18.73
MROE	MRO East	1,591.65	23.98	27.04	1,868.23	29.40	30.40
MROW	MRO West	1,628.60	28.80	27.79	2,114.93	61.83	37.41
NEWE	NPCC New England	728.41	75.68	13.86	1,157.44	61.72	14.43
NWPP	WECC Northwest	819.21	15.29	12.50	1,404.55	38.56	18.79
NYCW	NPCC NYC/Westchester	610.67	23.75	2.81	1,118.06	22.47	2.31
NYLI	NPCC Long Island	1,347.99	96.86	12.37	1,336.59	30.78	3.51
NYUP	NPCC Upstate NY	497.92	15.94	6.77	1,347.12	41.08	16.87
RFCE	RFC East	947.42	26.84	14.96	1,628.97	32.94	22.46
RFCM	RFC Michigan	1,659.46	31.41	27.89	1,834.66	35.17	29.15
RFCW	RFC West	1,520.59	18.12	25.13	2,001.76	24.56	32.10
RMPA	WECC Rockies	1,824.51	22.25	27.19	1,756.62	23.54	22.51
SPNO	SPP North	1,815.76	21.01	28.89	2,147.53	26.32	31.82
SPSO	SPP South	1,599.02	23.25	21.79	1,513.73	25.22	15.11
SRMV	SERC Mississippi Valley	1,002.41	19.45	10.65	1,201.66	25.72	7.11
SRMW	SERC Midwest	1,749.75	19.57	28.98	2,192.85	25.04	35.89
SRSO	SERC South	1,325.68	22.27	20.78	1,622.00	27.22	23.50
SRTV	SERC Tennessee Valley	1,357.71	17.28	22.09	1,921.12	25.16	30.61
SRVC	SERC Virginia/Carolina	1,035.87	21.51	17.45	1,677.35	38.55	25.56
U.S.		**1,216.18**	**24.03**	**18.08**	**1,555.48**	**30.83**	**19.76**