INL/EXT-16-38665
Revision 0

Idaho National Laboratory's FY15 Greenhouse Gas Report

Kimberly Frerichs

March 2016

The INL is a U.S. Department of Energy National Laboratory
operated by Battelle Energy Alliance

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Idaho National Laboratory
Idaho Falls, Idaho 83415

http://www.inl.gov

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EXECUTIVE SUMMARY

A greenhouse gas (GHG) inventory is a systematic approach to account for the production and release of certain gases generated by an institution from various emission sources. The gases of interest are those that climate science has identified as related to anthropogenic global climate change. This document presents an inventory of GHGs generated during Fiscal Year (FY) 2015 by Idaho National Laboratory (INL), a Department of Energy (DOE)-sponsored entity, located in southeastern Idaho.

In recent years, concern has grown about the environmental impact of GHGs. This, together with a desire to decrease harmful environmental impacts, would be enough to encourage the calculation of an inventory of the total GHGs generated at INL. Additionally, INL has a desire to see how its emissions compare with similar institutions, including other DOE national laboratories. Executive Order 13693 requires that federal agencies and institutions document reductions in GHG emissions.

INL's GHG inventory was calculated according to methodologies identified in federal GHG guidance documents using operational control boundaries. It measures emissions generated in three scopes: (1) INL emissions produced directly by stationary or mobile combustion and by fugitive emissions, (2) the share of emissions generated by entities from which INL purchased electrical power, and (3) indirect or shared emissions generated by outsourced activities that benefit INL (occur outside INL's organizational boundaries, but are a consequence of INL's activities).

This inventory found that INL generated 58,330 metric tons (MT) of CO_2-equivalent (CO_2e) emissions during FY15. The following conclusions were made from looking at the results of the individual contributors to INL's FY15 GHG inventory:

- Electricity (including the associated transmission and distribution losses) is the largest contributor to INL's GHG inventory, with over 50% of the CO_2e emissions
- Other sources with high emissions were employee commuting, mobile combustion (fleet fuels), stationary combustion (facility fuels), business air travel, and waste disposal (including fugitive emissions from the onsite landfill and contracted disposal)
- Sources with low emissions were wastewater treatment (onsite and contracted), business ground travel (in personal and rental vehicles), and fugitive emissions from refrigerants.

This report details the methods behind quantifying INL's GHG inventory and discusses lessons learned on better practices by which information important to tracking GHGs can be tracked and recorded. It is important to note that because this report differentiates between those portions of INL that are managed and operated by Battelle Energy Alliance (BEA) and those managed by other contractors, it includes only the Laboratory activities overseen by BEA. It is assumed that other contractors will provide similar reporting for those activities they manage, where appropriate.

ACKNOWLEDGMENTS

The author would like to extend recognition to the following individuals for their thoughtful review of this document and/or calculations:

- Ernest Fossum, Sustainable INL Energy Manager
- Chris Ischay, Sustainable INL Program Manager
- Heather Rohrbaugh, INL Editor.

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ACRONYMS

ATR	Advanced Test Reactor
BEA	Battelle Energy Alliance
BMPC	Bechtel Marine Propulsion Corporation
CAS	Chemical Abstract Service
CEDR	Consolidated Energy Data Report
CFA	Central Facilities Area
CH_4	methane
CITRC	Critical Infrastructure Test Range Complex
CNG	Compressed Natural Gas
CO_2	carbon dioxide
CO_2e	CO_2 equivalents
DOE	Department of Energy
DOE-HQ	Department of Energy Headquarters
DOE-ID	Department of Energy Idaho Operations Office
eGRID	Emissions & Generation Resource Integrated Database
EO	executive order
EPA	Environmental Protection Agency
FY	fiscal year
GHG	greenhouse gas
GWP	Global Warming Potential
HFC	hydrofluorocarbon
HHV	higher heating value
HVAC	heating, ventilating, and air conditioning
INEEL	Idaho National Engineering and Environmental Laboratory (a forerunner of INL)
INL	Idaho National Laboratory
INWMIS	INEEL Nonradiological Waste Management Information System
LandGEM	Landfill Gas Emissions Model
LNG	Liquefied Natural Gas
LPG	Liquefied Propane Gas
MFC	Materials and Fuels Complex
MRR	Mandatory Reporting of Greenhouse Gases Rule
MSW	municipal solid waste
MT	metric tonnes

N_2O	nitrous oxide
NF_3	nitrogen trifluoride
NWPP	Northwest Power Pool
PFC	perfluorocarbon
REC	Renewable Energy Certificate
SF_6	sulfur hexafluoride
SMC	Specific Manufacturing Capability
T&D	Transmission and Distribution
TIMS	Transportation Issues Management System
TSD	Technical Support Document
WECC	Western Electricity Coordinating Council

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1. INTRODUCTION

Idaho National Laboratory (INL) has been in operation since 1949. Battelle Energy Alliance (BEA) currently operates INL for the Department of Energy (DOE). In addition to specializing in nuclear energy, INL supports the overall DOE missions in energy research, science, and national defense as indicated in their stated mission to "Discover, demonstrate and secure innovative nuclear energy solutions, other clean energy options and critical infrastructure."

The INL Site covers approximately 890 square miles of high-elevation desert in southeastern Idaho and is home to multiple facilities operated by several contractors in addition to BEA. BEA is currently the largest contractor and is responsible for day-to-day management and operation of the Laboratory. Through FY 2015, other major contractors operating at the INL Site included:

- CH2M-WG Idaho, LLC manages the Idaho Cleanup Project, which includes the Idaho Nuclear Technology Center facility and the performance of cleanup work across the INL Site
- Idaho Treatment Group operates the Advanced Mixed Waste Treatment Project
- Bechtel Marine Propulsion Corporation (BMPC) operates the Naval Reactor Facilities
- DOE Idaho Operations Office (DOE-ID).

This report will look exclusively at the greenhouse gas (GHG) emissions that INL (BEA) owns; it is assumed that other contractors will provide similar reporting for the activities they control. All attempts have been made to look only at INL's emissions unless otherwise indicated. In this report "INL" is used to indicate the BEA operations and employees to which this report applies, while "INL Site" will apply to the entire geographical area and all contractors.

INL's employees work at multiple locations throughout the INL Site, as indicated in Figure 1. The metropolitan area closest to the Site is Idaho Falls, which is also the location of the Research and Education Campus or "town" facilities. The major campuses within the INL Site where INL employees work include the Advanced Test Reactor (ATR) Complex (45 miles west of Idaho Falls), Materials and Fuels Complex (MFC, 28 miles west of Idaho Falls), and the Specific Manufacturing Capability (SMC, 60 miles northwest of Idaho Falls). The INL Site's large geographical area and long history make for some unique characteristics, including:

- Long Commutes. Approximately half of INL's employees work at Site desert locations, approximately 30 to 50 miles west of Idaho Falls, and ride INL buses or utilize their own personal vehicles to commute to work.
- Large Transportation Fleet. INL operates a large vehicle fleet that includes light-duty passenger vehicles, commercial buses, and off-road equipment. This fleet is being modernized through a transition to General Services Administration vehicles. INL's commercial buses are used for transporting employees from all INL Site contractors on their commute to and from the Site facilities.
- Antiquated Facilities. The INL Site includes hundreds of buildings, some of which are DOE-owned, some leased; however, many of these buildings are aged. INL is in the process of modernizing its buildings to support the INL mission, attract and retain its work-force, and satisfy Executive Order (EO) requirements.

Figure 1. Location map of the INL Site and major facilities.

On a historical note, INL is home to the peaceful atom—the world's first usable amount of electricity produced from nuclear energy was generated at INL's forerunner, the National Reactor Test Station, in 1951. With such a long history and a commitment to revitalizing nuclear energy, a low-carbon source of energy, it is only appropriate that INL would be interested in lowering its own GHG emissions.

The first step to quantifying any GHG savings is to establish a baseline. Fiscal Year (FY) 2008 was chosen as the baseline year since this calculation effort will also support EO 13514, "Federal Leadership in Environmental, Energy, and Economic Performance," requirements to report on and reduce GHG emissions based on an FY08 baseline. This report documents the effort to calculate the GHG emissions for FY15 and compares them to the FY08 baseline results. (For more information on INL's FY08 GHG Baseline results, see INL/EXT-10-19264, "Idaho National Laboratory's Greenhouse Gas FY08 Baseline.")

In March 2015, a new Executive Order was signed and new goals established. Therefore, this will be the final report for which goals against EO 13514 are reported. In FY 2016, this report, baseline, and goals will be updated to reflect the new GHG reductions goals as outlined in EO 13693, "Planning for Federal Sustainability in the Next Decade."

This report documents the methodology and calculations to determine the INL GHG inventory, and provides perspective on the results of INL's GHG inventory (also referred to as the carbon footprint). Methodology is still being fine-tuned for calculating GHGs, particularly at the federal level where the intent is to standardize the emissions categories considered and the associated calculations to standardize reporting. These GHG inventory calculations follow the most current methodology available: the EO 13514, "Federal Greenhouse Gas Accounting and Reporting Guidance, Revision 1" (referred to herein as the Guidance) [2012], and its accompanying "Federal Greenhouse Gas Accounting and Reporting Guidance: Technical Support Document" (referred to herein as the TSD) [2012]. In addition to standardizing the methodology, these documents attempt to best utilize the data that federal facilities are already required to report, such as fuel (for energy and fleet) and electricity usage. The Guidance and TSD uses a combination of existing guidance and regulations as their basis, including:

- The World Resource Institute's and Land Management Institute's Public Sector GHG Accounting and Reporting Standard (Public Sector Standard)
- Environmental Protection Agency's (EPA) Climate Leaders Guidance
- EPA's "Final Rule: Mandatory Reporting of Greenhouse Gases" (MRR, 40 CFR 98), as references for their methodologies and emission factors.

2. WHY LOOK AT GREENHOUSE GASES?

INL has many reasons to calculate the organization's GHG emissions, including environmental and political pressures external to INL as well as internal requirements within the Laboratory.

When considering the results of this analysis, it will be important to consider the limits of the analysis. While a GHG inventory is currently the popular method for assessing an organization's environmental impacts, it is focused on just one impact to the earth: climate change. It is important to keep the full lifecycle effects of various sources of environmental impact in mind—including air pollution, habitat degradation, and resource extraction—when making a decision or drawing any overall conclusions.

2.1 Environmental Motivations

Environmental impacts come in a variety of forms. Many emitted pollutants have been the subject of historical environmental regulation (e.g., air pollutants by the Clean Air Act of 1963 or water pollutants by the Federal Water Pollution Control Amendments of 1972). Climate change (sometimes called global warming) is a primary focus of current scientific inquiry, and policymaking reflects the current understanding of the impact of GHGs in causing anthropogenic climate change. Policies currently being considered include the introduction of carbon taxes or carbon-emissions trading—a market-based system of incentives aimed at achieving reductions in emissions of GHGs. Such a system might bear similarity to the trading system in place in the United States that regulates SO_2 emissions under the Clean Air Act of 1990.

2.2 Political Motivations

This effort of identifying and calculating GHG emissions supports EO 13693, "Planning for Federal Sustainability in the Next Decade," signed in March 2015. The EO requires that federal agencies "lead by example" in measuring, reporting, and reducing GHG emissions. It requires that agencies of the federal government report existing emissions and steps taken to eliminate pollutants in a way that is transparent.

This report represents the effort to catalog INL's contribution to the INL Site carbon footprint. To be in compliance with the EO, some emission metrics must be separated from information that INL already tracks and reports for the entire Site (e.g., fuels and electricity), and several metrics, such as employee commuting and travel, are tracked now to comply with the EO.

2.3 INL Objectives

INL chooses to support efforts to monitor and reduce GHG emissions for several reasons. These include an existing Battelle Corporate initiative that seeks to monitor and reduce the corporate contribution to GHG emissions. As a research institution committed to making contributions in the areas of energy research and national security, INL has mission-based interests in the clean, sustainable production of energy. Its historical interest in nuclear reactor testing represents a longstanding commitment to low-carbon power generation.

INL is committed to sustainability. A GHG inventory is an accepted method of identifying environmental impacts, and assessing major contributions to GHG emissions and the best methods to reduce them.

2.3.1 Sustainable INL

The Sustainable INL Program is part of a movement among federal agencies to evaluate current processes and establish goals for achieving sustainability. The Sustainable INL mission is to "ensure the nation's energy security with safe, competitive, and sustainable energy systems without compromising the ability of future generations to meet their own needs." Its intent is to continue innovation and research while simultaneously improving energy efficiency, becoming responsible environmental stewards, and

conserving natural resources. Focus areas within the program include those covered in EO 13693: greenhouse gas emission reduction, energy efficiency, sustainable buildings, community involvement, data center efficiency, renewable energy, water conservation, fleet efficiency, sustainable acquisition, recycling (Pollution Prevention), electronics stewardship, and climate change adaptation. Sustainable INL relies on management and employee participation to achieve its goals. For questions specific to Sustainable INL, visit www.inl.gov/about-inl/inl-safety/sustainability/, or contact Chris Ischay (Program Manager, 208-526-4382, Christopher.Ischay@inl.gov), Ernest Fossum (Energy Manager, 208-526-2513, Ernest.Fossum@inl.gov), or Maryl Fisher (Senior Energy Analyst, 208-526-8340, Maryl.Fisher@inl.gov).

3. CALCULATION APPROACH

3.1 Selected GHG Protocol

As mentioned in Section 1, these calculations follow the Guidance and the TSD unless otherwise indicated.

3.2 Defined Inventory Boundaries

This GHG inventory considers all INL-owned operations, including buildings and employees. As mentioned in the Introduction, several other contractors operate on the INL Site including CH2M-WG Idaho, LLC, Idaho Treatment Group, and BMPC. Facilities managed by these other contractors were not included in this inventory. Some non-INL employees (including DOE-ID) are located in several INL buildings that were included in these calculations, but since INL pays for the operations (e.g., boiler fuels, electricity, solid waste removal) and thus has operational control, these were counted in the INL inventory. Operations directly associated with the employees of other contractors (such as employee travel and employee commuting) were not included in INL's inventory GHG calculations.

The following metrics are offered to give a sense of scale for INL's and FY15 contributions to the overall INL Site's GHG inventory:

- INL employees (including interns and temporary employees) amounted to 3,787 of the combined 5,500 (approximate) employees at the INL Site during FY15 (excluding Naval Reactors Facility)
- The total square footage of buildings owned by INL or occupied by INL personnel and used for INL operations represented 58.3% of the total 5.81 million square feet that made up the INL Site in FY15 (61.6% of 536 buildings)[a]
- The percentage of electrical power consumed by INL operations and personnel is 66.9% of the total 208,325 MWh.

3.3 Defined Scope

GHG inventories or footprints consider emissions from three emissions scopes (Scope 1, 2, and 3) as indicated in Figure 2, and described below:

- Scope 1: Direct or INL-owned emissions that are produced onsite, such as stationary combustion (from fuel combustion), mobile combustion (from fleet vehicles), and fugitive emissions (from refrigerants, onsite landfills, and onsite wastewater treatment). These include emissions that may benefit another entity or contractor, but for which INL controls or owns the associated process.
- Scope 2: Indirect or shared emissions produced by INL's electricity, heat, and steam purchases. (Note that INL did not purchase heat or steam during FY15.)
- Scope 3: Indirect or shared emissions generated by outsourced activities that benefit INL (occur outside INL's organizational boundaries, but are a consequence of INL's activities). This can include a large number of activities, but for purposes of this inventory, INL focused on transmission and distribution losses, employee commuting, employee travel, contracted waste disposal, and contracted wastewater treatment since these categories were identified in the TSD for required reporting. Other activities that could be included in Scope 3 include the embodied emissions of purchased materials.

a. These are based on the numbers provided in the FIMS snapshot at the end of FY15 (typically in November of the next fiscal year), which is considered representative for the entire year. INL's portion is based on the buildings that belong to the DOE Nuclear Energy program, while the remaining buildings at the INL Site belong to the Environmental Management program. The total number of buildings only includes those considered energy-consuming, to be consistent with information submitted in the annual Consolidated Energy Data Report (CEDR).

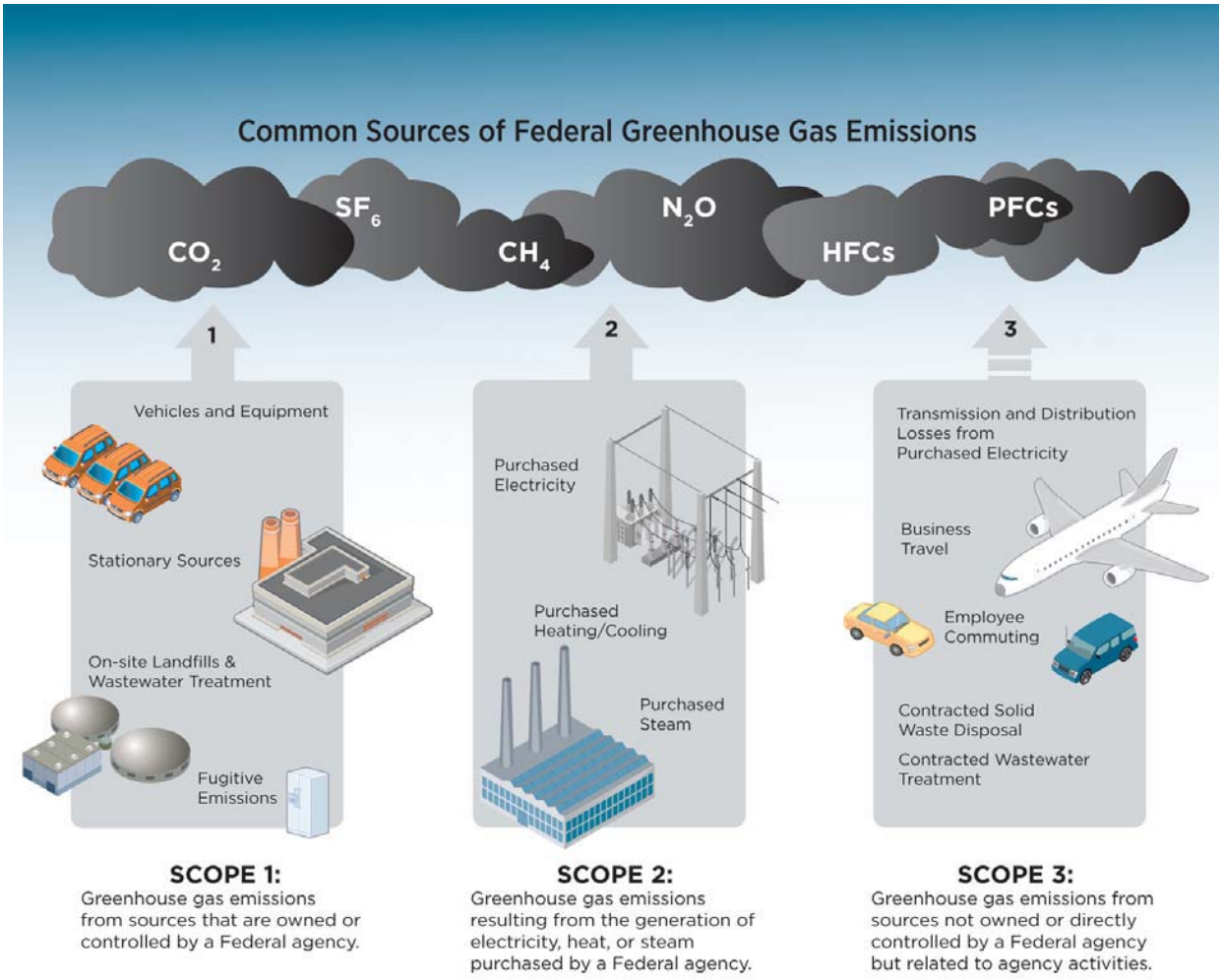

Figure 2. GHG emissions from Scope 1, 2, and 3.

This inventory considered the following six gases: carbon dioxide (CO_2), sulfur hexafluoride (SF_6), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs), as required by the Guidance. Nitrogen trifluoride (NF_3) and other GHGs with high global warming potential (GWP) are identified for optional reporting.

The GWP of the gases considered was used to convert all GHG emissions to units of carbon dioxide equivalent (CO_2e)—a means of describing the cumulative effect of all GHGs weighted by their 100-year warming potential. The GWP indicates each gas's heat-trapping impact relative to CO_2, which has a GWP of 1.0 and functions as a warming index. The GWP values used for the FY15 calculations are based on the EPA MRR and are shown in Appendix A, "Global Warming Potentials."

Table 1 summarizes the GHG emissions categories that were identified in the Guidance and TSD, whether they were calculated for INL's FY15 report, and their reporting status in the Guidance and TSD (identified as required or recommended for reporting). Some Scope 3 GHG sources will not require reporting until FY16 or later since the calculation method for determining their emissions is still being developed.

Table 1. GHG emissions categories identified in Guidance and TSD.

Scope	Emissions Category	Calculated for FY15	Reporting Status in Guidance and TSD
1 (Direct)	Stationary Combustion (Boilers, Generators, etc.)	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Mobile Combustion (Fleet Vehicles)[a]	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Fugitive Emissions: Refrigerants	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Fugitive Emissions: Onsite Landfill	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Fugitive Emissions: Onsite Wastewater Treatment	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Industrial Process Emissions (Manufacturing or Processing Chemicals or Materials)	No, INL does not perform any of the activities listed in the TSD	Required reporting in FY08 Baseline and FY15 Inventory.
2 (Indirect)	Purchased Electricity	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Purchased Steam, Hot Water, or Chilled Water	No, INL does not purchase	Required reporting in FY08 Baseline and FY15 Inventory.
	Combined Heating and Power	No, INL does not utilize	Required reporting in FY08 Baseline and FY15 Inventory.
	Purchased Steam from Waste to Energy	No, INL does not purchase	Required reporting in FY08 Baseline and FY15 Inventory.
	Transmission & Distribution (T&D) Losses (within INL's operational controls)	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Purchased Green Power (Renewable Energy Certificates [RECs])	Yes, INL purchased RECs	Required reporting in FY08 Baseline and FY15 Inventory.
3 (Indirect)	T&D Losses (outside INL's operational controls)	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Employee Commuting	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Business Air Travel	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Business Ground Travel: Rental Vehicle	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Business Ground Travel: Personal Vehicle	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Contracted Municipal Solid Waste (MSW) Disposal	Yes	Required reporting in FY08 Baseline and FY15 Inventory.

Table 1. (continued).

Scope	Emissions Category	Calculated for FY15	Reporting Status in Guidance and TSD
3 (Indirect) (cont'd)	Contracted Wastewater Treatment	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Vendor and Contractor Emissions (Indirect emissions in the supply chain)	No, will wait for additional guidance.	Do not require reporting at this time, but future inventories will include these emissions. It is expected that this category will be a large contributor to INL's GHG inventory.
	Fuel Production	No	Do not require reporting at this time, but future inventories are expected to include these emissions.
	Land Management (changes that sequester or release GHGs)	No	Do not require reporting at this time.
	Biomass Combustion, Enteric Fermentation, Composting, and Manure Management	No, INL does not perform.	Do not require reporting at this time.
Biogenic[b]	Mobile Combustion	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Stationary Combustion	No, INL did not utilize biofuels for this category.	Required reporting in FY08 Baseline and FY15 Inventory.
	Fugitive Emissions: Onsite Landfill	Yes	Required reporting in FY08 Baseline and FY15 Inventory.
	Contracted MSW Disposal	Yes	Required reporting in FY08 Baseline and FY15 Inventory.

a. This includes CH_4 and N_2O from biofuel blends. Per the TSD, biogenic CO_2 emissions generated from combustion of biofuels are counted separately since this carbon would have been released through the plant's natural decomposition.
b. Note that biogenic emissions will not count against GHG reduction targets.

As shown in Table 1, the TSD differentiates between anthropogenic and biogenic emissions for reporting purposes. Anthropogenic emissions are those that are human caused, while biogenic emissions are considered to be those that would have been released due to naturally occurring processes (without human involvement). For example, when considering the combustion of biofuels versus fossil fuels, the carbon from biofuels is absorbed from the atmosphere during plant growth and recycled during the natural decomposition process; therefore, the combustion of biofuels is considered biogenic, while the carbon from fossil fuels has been locked in the earth for millennia and will yield a net increase in atmospheric carbon relative to what would have occurred naturally. Although the TSD requires reporting of biogenic emissions, they will not count against an agency's GHG reduction targets; therefore, INL will focus on their anthropogenic emissions.

3.4 Identified Greenhouse Gas Emissions Categories

After identifying which GHG emission categories in Table 1 would need to be calculated for INL, the next step is to identify where to find the INL-specific organizational data for performing the calculations. Table 2 summarizes the INL-specific data sources for each emissions category.

Table 2. INL's GHG emissions categories for Scopes 1, 2, and 3.

Scope	Emissions Category	INL Data Source
1 (Direct)	Stationary Combustion (Boilers, Generators, etc.)	Fuel consumption reports (INL's Quarterly Energy Reports and Fuel Sheets)
	Mobile Consumption (Fleet Vehicles)	Fuel consumption database (Transportation Issues Management System [TIMS]) and Fuel Sheets
	Fugitive Emissions: Refrigerants	Refrigerant purchases, use, and disposal (Comply Plus Database)
	Fugitive Emissions: Onsite Landfill	INL Landfill records (INEEL Nonradiological Waste Management Information System [INWMIS])
	Fugitive Emissions: Onsite Wastewater Treatment	INL's Environmental Support & Services and Human Resources staff
2 (Indirect)	Purchased Electricity	INL's Quarterly Energy Reports
	Purchased RECs	RECs Purchase Documentation
3 (Indirect)	T&D Losses	INL's Quarterly Energy Reports
	Employee Commuting	FY15 Employee Commute Survey Results
	Business Air Travel	INL Travel Office
	Business Ground Travel: Rental Vehicle	INL Travel Office
	Business Ground Travel: Personal Vehicle	INL Travel Office
	Contracted MSW Disposal	City of Idaho Falls Sanitation invoice records
	Contracted Wastewater Treatment	City of Idaho Falls
Biogenic	Mobile Combustion	Fuel consumption databases (TIMS)
	Fugitive Emissions: Onsite Landfill	INL landfill records (INWMIS)
	Contracted MSW Disposal	City of Idaho Falls Sanitation invoice records

The identification of sources of information for the different emissions allows for the:

- Collecting of necessary data from sources identified in Table 2.
- Gathering of necessary emissions factors (the TSD was consulted as a primary document, and then the EPA's Climate Leaders guidance was referenced if the applicable emissions factors were not available in the TSD).

- Calculating inventory of INL's GHG emissions categories. For each emissions category, the GHG emissions were calculated in metric tons of CO2e based on INL-specific data, emission factors, and applicable GWPs. (A sample calculation is shown in Appendix B, "Sample Calculation.") The majority of these calculations were performed following the TSD, with Excel spreadsheets prepared specifically for establishing INL's GHG inventory. Exceptions to this process are noted in the sections below and include the emissions from the onsite landfill, which were calculated using an EPA model (per the TSD).

4. DISCUSSION AND RESULTS

4.1 Summary

Table 3 and Figure 3 through Figure 5 summarize the GHG emissions from INL during FY15. Details on the emission factors and calculation methods used, as well as a discussion of the individual results, follow in the sections below.

Table 3. INL's GHG emissions during FY15.

Scope	Emissions Category	FY15 GHG Emissions (MT CO_2e)
1 (Direct)	Stationary Combustion	5,505.20
	Mobile Combustion	6,862.68
	Fugitive Emissions: Refrigerants	763.83
	Fugitive Emissions: Onsite Landfill	6,381.00
	Fugitive Emissions: Onsite Wastewater Treatment	148.09
	SCOPE 1 TOTAL	**19,660.80**
2 (Indirect)	Purchased Electricity	42,281.06
	Transmission & Distribution Losses (Owned)	652.43
	Purchased RECs	(23,320.76)
	SCOPE 2 TOTAL	**19,612.73**
3 (Indirect)	Transmission & Distribution Losses (Shared)	2,786.32
	Employee Commuting	10,247.52
	Business Air Travel	4,558.81
	Business Ground Travel: Rental Vehicle	272.02
	Business Ground Travel: Personal Vehicle	182.64
	Contracted MSW Disposal	998.78
	Contracted Wastewater Treatment	10.69
	SCOPE 3 TOTAL	**19,056.77**
TOTAL ANTHROPOGENIC EMISSIONS[a]		**58,330.31**
Biogenic	Mobile Combustion	1,706.99
	Fugitive Emissions: Onsite Landfill	778.10
	Contracted MSW Disposal	109.87
TOTAL BIOGENIC EMISSIONS		**2,594.96**
TOTAL EMISSIONS (ANTHROPOGENIC + BIOGENIC)		**60,925.27**

a. INL will report these numbers as their overall emissions. Furthermore, INL will try to reduce this number in future years.

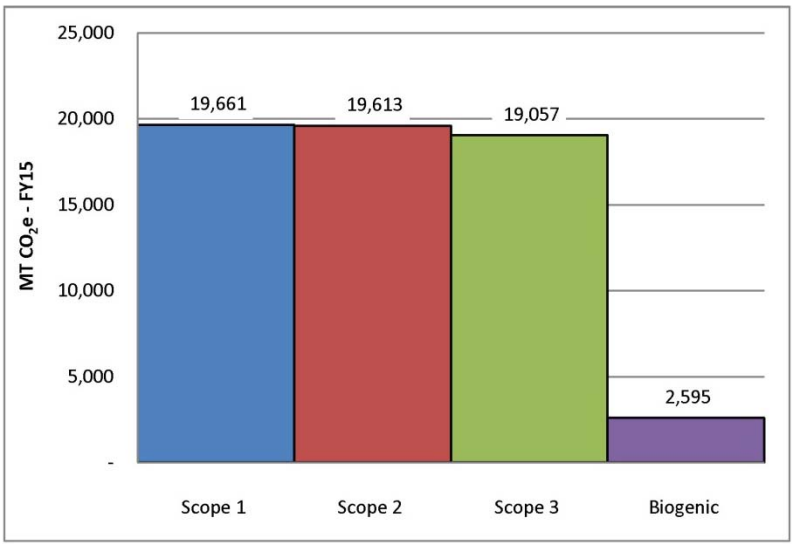

Figure 3. INL's FY15 GHG emissions, by scope.

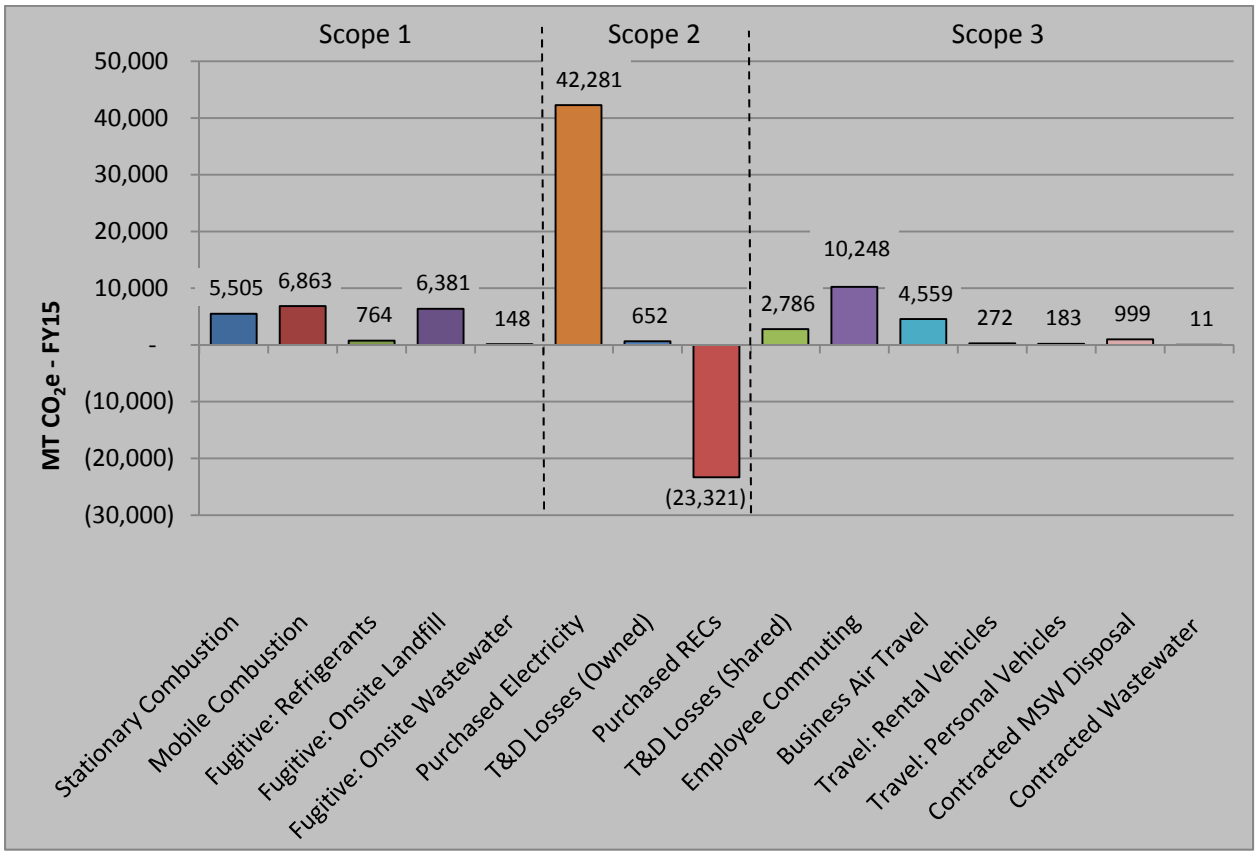

Figure 4. INL's FY15 GHG emissions, by scope and emissions category, excluding biogenic emissions.

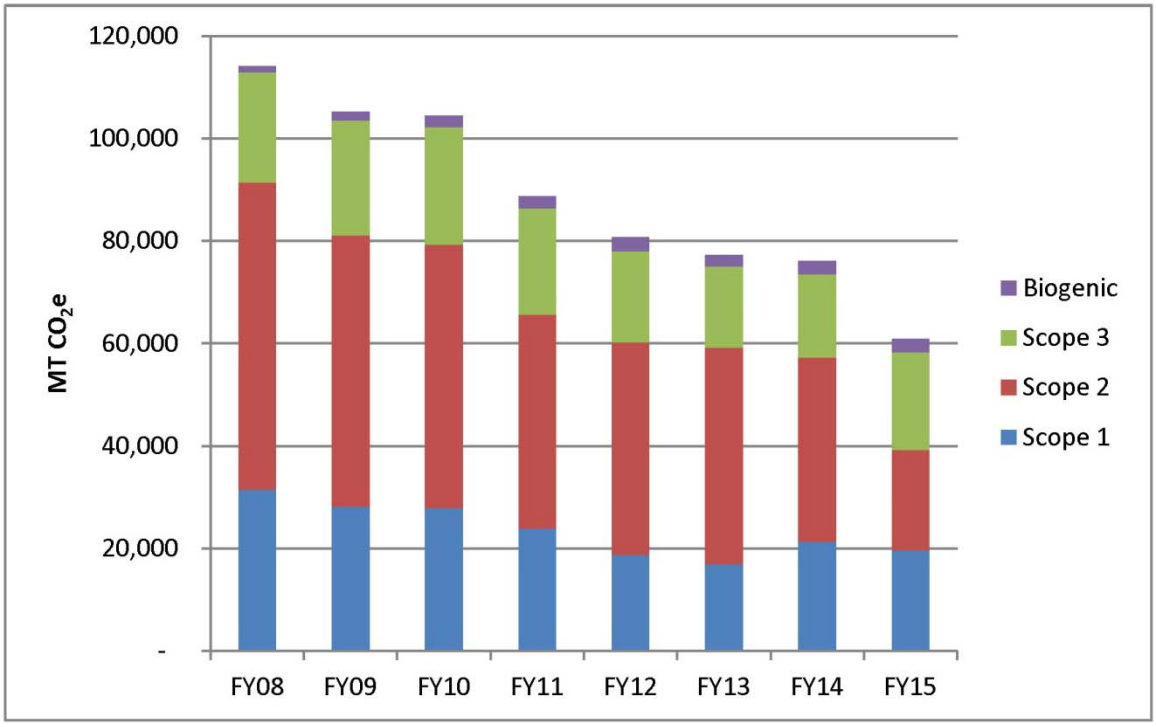

Figure 5. Comparison of INL's FY08 through FY15 GHG emissions, by scope and emissions category, including biogenic emissions.[b]

4.2 Scope One – Direct Emissions

INL's FY15 Scope 1 emissions are summarized in Figure 6, with a comparison to the FY08 baseline shown in Figure 7. A discussion of each of the Scope 1 emissions categories follows and includes the calculation methods, the significance of the results, lessons learned from the data collection and calculation process, and a comparison to the FY08 baseline results. A comprehensive table, as well as the FY08 baseline emissions and the subsequent FY data, is included in Appendix C, "Scope 1 Comprehensive Tables."

b. Scope 2 numbers for FY11 and FY12 were revised in FY13 as a result of a revision to Scope 2 total calculations.

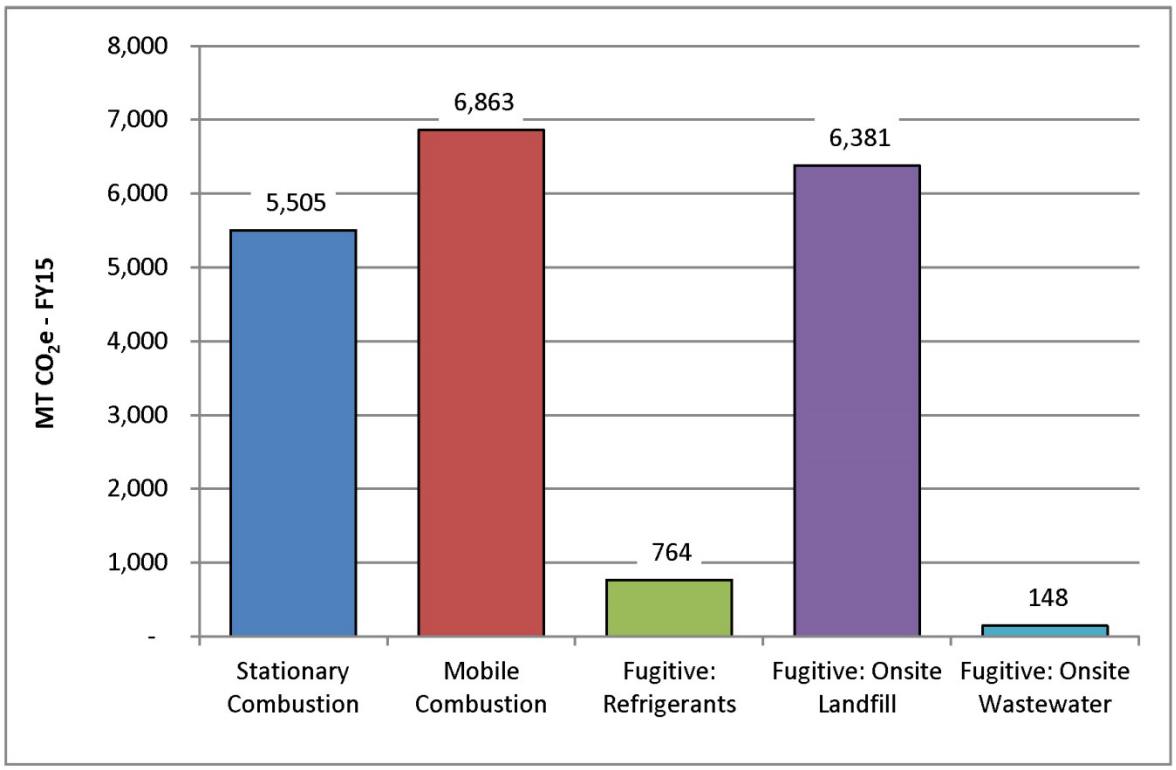

Figure 6. INL's FY15 GHG emission results for Scope 1.

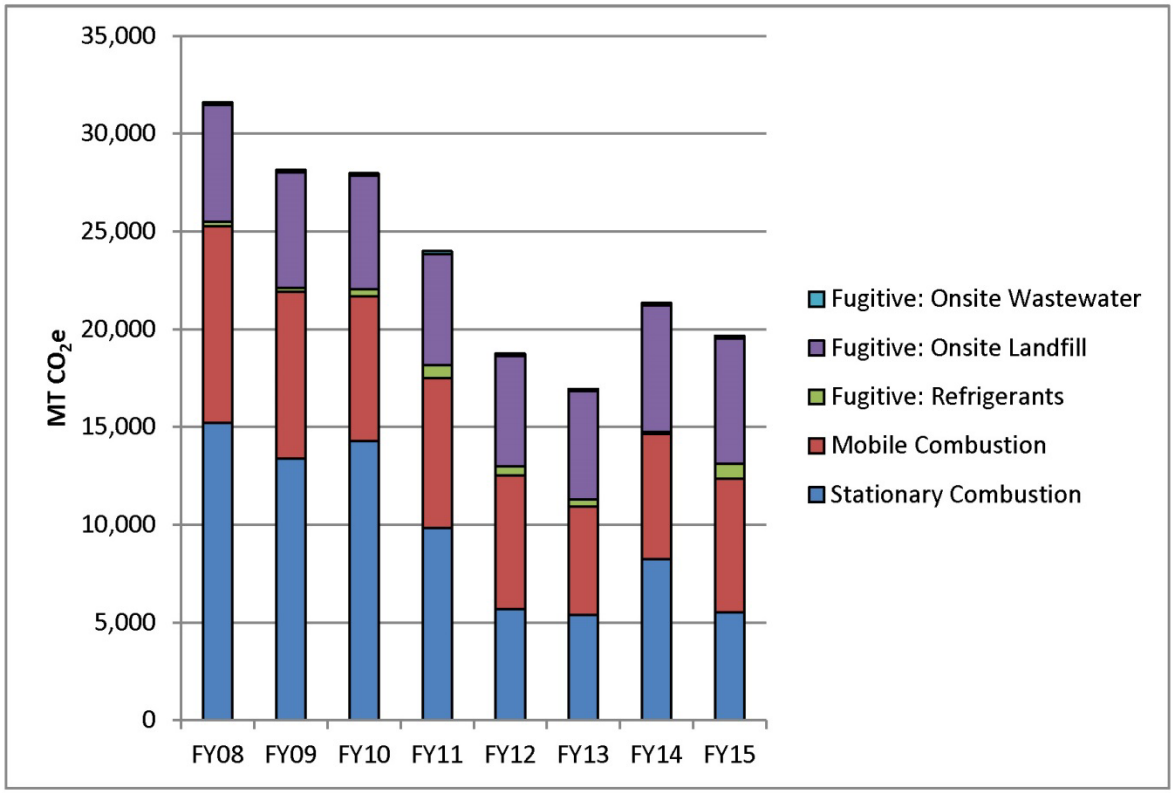

Figure 7. Comparison of INL's FY08 through FY15 Scope 1 GHG emissions.

4.2.1 Stationary Combustion Emissions

4.2.1.1 Calculation Method. To estimate the GHG emissions of INL's stationary combustion from boilers and generators, the default methodology identified in the TSD was adopted. This consisted of obtaining the total amount of fuels used (purchased) onsite by INL. Since these data are also submitted for the CEDR, and are already tracked for the INL Site, the only calculations needed were to isolate the emissions that INL owns from those owned by other INL Site contractors by separating the fuels purchased for INL-operated facilities.

4.2.1.2 Results Discussion. During FY15 INL used the types and amounts of fuel shown in Table 4 for stationary combustion.

Table 4. Amounts of fuel used for stationary combustion at INL during FY15.

Energy Type	Fuel Used		GHG Emissions (MT CO_2e)
	Amount	Units	
Fuel Oil No. 2	189,217	Gallons	1,937.87
Liquefied Natural Gas (LNG)	24,851	Gallons	182.97
Liquefied Propane Gas (LPG)	98,333	Gallons	560.56
Natural Gas (Pipeline)	533,192	Therms	2,823.80
		TOTAL	5,505.20

As shown in Table 4, INL's stationary combustion emissions were calculated to produce 5,505 MT CO_2e in FY15. In FY15, this equates to 28.0% of INL's Scope 1 emissions, and 9.4% of the total anthropogenic emissions considered.

Since these data are already collected and reported annually for the CEDR, they are considered to be of high quality.

4.2.1.3 Lessons Learned. Since the data are already gathered at INL for the CEDR, no changes are needed for reporting in future years. In addition, the data are considered accurate, with all INL-owned sources of stationary combustion included.

4.2.1.4 Comparison to FY08 Baseline. The FY15 results showed a 63.8% decrease over the FY08 baseline. Looking closer at the differences among the four fuel types showed an 81% decrease in diesel, 43% decrease in LNG deliveries (to the Site), 36% decrease in propane deliveries, and a 125.4% increase in natural gas (to town facilities).

MFC discontinued use of diesel-fueled boilers in 2011 and 2012 and ATR Complex switched from diesel-fueled boilers to electric boilers with battery backup in May 2015, resulting in a significant decrease in diesel usage compared to FY08. As for the changes in natural gas at town facilities, several new buildings (UB1–UB4, RESL, ESL, EIL) came online in between FY09 and FY15, which likely accounts for the increased use in FY15.

4.2.2 Mobile Combustion Emissions

INL operates a large vehicle fleet that includes everything from light-duty passenger vehicles to commercial buses to off-road equipment (including bulldozers, backhoes, cranes, road graders, dump trucks, tractors, manlifts, and even a compactor for the onsite landfill).[c] This fleet is being modernized by a variety of methods to lower overall fuel consumption and increase the use of alternative fuels, including the following:

- Used B20 biodiesel blend for year-round use rather than a B10 and B20 winter/summer blend throughout the year (formerly averaged as B15).
- Increased overall bus efficiencies by implementing two additional express routes. These efficiency gains were achieved in conjunction with continued efforts at right sizing the fleet with more flex-fuel vehicles while reducing petroleum-only vehicles.
- Incorporated the Park and Ride concept to reduce bus fuel usage, and developed additional Park and Ride lots for employees at outlying locations.
- Used innovative technology to track and reduce fuel usage such as Global Positioning System, Radio Frequency Identification fuel rings, and data logger technology to monitor engine performance and driver habits.

INL's commercial buses are used for transporting other INL Site contractor employees, as well as BEA employees, on their commute to and from the Site facilities. Since INL owns the bus operations for all Site contractors, these emissions are considered Scope 1 for INL.

During FY15, INL continued to:

- Research feasibility of converting and implementing use of dual-fuel (LNG and diesel) buses to further reduce fossil fuel use and GHG emissions. INL converted two additional buses to dual fuel for a total of seven conversions, allowing these buses to run on biodiesel and LNG. INL also replaced aging buses in the INL fleet with six new motor coaches that run on B20 and have improved fuel mileage by up to 100% (from 3 to 6 mpg).
- Work with Motor Coach Industries to test and compile data on fuel efficient prototype coaches and systems that Motor Coach Industries partners with INL to evaluate.
- Right size the fleet with more fuel efficient vehicles.

4.2.2.1 Calculation Method. To calculate the GHG emissions from INL's mobile combustion sources, a combination of the default and advanced methodology from the TSD were used. INL tracks the majority of its fuel usage in the TIMS, which tracks fuel used by vehicle type for road vehicles (when fuel taxes are paid), as well as a number of other vehicle metrics. A small portion of INL's fuel use is tracked with fuel sheets for off-road equipment (for which no fuel taxes are paid).

Since the amount of each type of fuel consumed by general vehicle type (bus, light-duty truck, light-duty car, equipment, and heavy-duty truck) was known (see Table 5), more specific CH4 and N2O emission factors were used than what is assumed for the TSD default methodology. Since the number of miles traveled by vehicle type is not tracked accurately (some employees bypass inputting this value while refueling), the average mileage by vehicle type was used to calculate this value. For CH4 and N2O emission factors based on the vehicle's emission control technology (approximated by the vehicle model year) conservative assumptions were made as indicated in Appendix D, "Emissions Factors Used."

c. Confirmed in February 11, 2014 e-mail from Tad Pearson and in discussion with Kathy Miles.

4.2.2.2 Results Discussion. During FY15, INL used a combination of fossil fuels and biofuels to power its diverse vehicle fleet as shown in Table 5. Per the TSD, the CO2 emissions from biofuels are to be considered biogenic rather than anthropogenic emissions;[d] therefore, they were calculated and reported separately.

Table 5. Fuel amounts and corresponding GHG emissions for INL's FY15 fleet.

Fuel Type	Vehicle Type	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B20 Biodiesel Blend[d]	Bus	438,355.55	3,583.35	828.63
	Equipment	4,877.18	40.27	9.22
	Heavy Duty	302.04	2.47	0.57
	Light-Duty Truck	136.88	1.12	0.26
Diesel	Bus	17,024.09	173.92	—
	Equipment	67,390.69	694.02	—
	Heavy Duty	56,982.22	582.37	—
	Light Duty Car	—	—	—
	Light-Duty Truck	9,246.66	94.44	—
E10 Ethanol Fuel Blend	Bus	—	—	—
	Equipment	13,567.62	112.23	8.06
	Heavy Duty	3,533.71	29.60	2.03
	Light-Duty Car	589.16	4.84	0.34
	Light-Duty Truck	153,633.47	1,279.65	88.32
E85 Ethanol Fuel Blend	Equipment	1,480.46	2.39	7.23
	Light-Duty Car	5,262.08	9.31	25.71
	Light-Duty Truck	150,741.77	252.69	736.62
	TOTAL	**923,123.58**	**6,862.68**	**1,706.99**

As shown in Table 5, INL's mobile combustion emissions were calculated to produce 6,863 MT CO2e of anthropogenic and 1,707 MT CO2e of biogenic GHG emissions in FY15. In FY15 this equates to 34.9% of INL's Scope 1 emissions, and 11.8% of the total FY15 anthropogenic emissions considered.

Since these data are already collected in TIMS and fuel sheets, they are considered to be of high quality, with all INL-owned sources of mobile combustion included.

d. Although a controversial position, the TSD states that biogenic emissions in the form of CO_2 emissions generated from biofuel combustion are to be counted separately since this carbon would have been released through the plant's natural decomposition. The CH_4 and N_2O emissions from the combustion of biofuel blends are not considered biogenic emissions.

4.2.2.3 Lessons Learned. Since the data for calculating GHG emissions from mobile combustion are already gathered at INL with TIMS, no major changes are needed for reporting in future years. However, there are a few tracking and reporting items that could slightly improve the overall accuracy. As discussed above, the accuracy of the calculations could be improved slightly if the total miles driven were tracked along with the gallons of fuel consumed in each vehicle, and more specific vehicle information, including model year, was reported when determining the applicable CH_4 and N_2O emission factors. (Both mileage and emissions control technology affect the GHG contributions from CH_4 and N_2O, which are a small portion of the GHG compared to the CO_2 contribution.) Furthermore, other INL Site contractors' fuel use is tracked in TIMS and not readily identified as non-INL use that can be separated from INL's numbers. This includes when INL rents heavy equipment to other contractors, but these are a very small portion of the total INL use.[e]

4.2.2.4 Comparison to FY08 Baseline. In FY15, there was a 31.6% decrease in GHG emissions from mobile combustion sources over the FY08 baseline. When considering the differences between the total amounts of fuel consumed between these years, there was an 11.6% decrease in total gallons between FY15 and FY08.

In addition to the changes to the fleet discussed above, the largest contributor to the decrease in GHG emissions is due to the changes in fuel types used since FY08. The largest fuel user at INL is the buses that moved away from LNG (small amount of fuel used in FY08) and diesel (large amount of fuel used in FY08) to biodiesel (B15 and B20 blends). Furthermore, in light-duty vehicles ethanol (E85) replaced gasoline use. These changes yielded a decrease in the associated anthropogenic emissions, and an increase in biogenic emissions.

4.2.3 Fugitive Emissions: Refrigerants

Fugitive emissions from refrigerants and fluorinated gases are those GHG emissions from equipment and vehicles that are not captured or destroyed by an emissions control system (those that do not pass through a stack, chimney, etc.).

4.2.3.1 Calculation Method. DOE Headquarters (DOE-HQ) publicized a data call in October 2010 for each facility's FY10 fugitive emissions from refrigerants and fluorinated gases that focused on the gases listed in Table 6, identified by their Chemical Abstract Service (CAS) number. The 2015 CEDR data call did not include updated guidance, so the list of gases provided in FY10 was used for FY15. Note that the calculation methodologies for the 2015 CEDR differ significantly from the TSD; therefore, the results vary greatly. As INL's inventory system does not allow for returning products to supply, the entire received product was assumed used or released according to the CEDR spreadsheet calculations. The TSD takes several other factors into consideration when calculating emissions, including inventory differences at the beginning and end of the reporting year and how much product was received, used, recovered, or disposed. The TSD methodology was followed for this report for consistency with previous inventories. To evaluate INL's fugitive emissions during FY15, data from the following sources was reviewed:

- Purchase, usage, and disposal data contained in INL's chemical inventory database, Comply Plus
- Use and disposal information contained on Refrigeration Service Records
- Transaction and adjustment detail reports pulled from Comply Plus database for each CAS number.

e. Tad Pearson confirmed these small uses of INL's fuel by other INL Site contractors in a February 11, 2014, e-mail.

Queries were run in Comply Plus for the different outcomes during FY15 using the CAS numbers. Additionally, INL obtained electronic and hard copies of the refrigerant service records from different facilities. These records were reviewed to determine if there was a difference between the amount of refrigerant recovered from a system and its total full capacity. If fewer refrigerants were recovered than the system's full charge amount, the difference was determined to have been released (used). If there was no difference, then there was no release. Additionally, if the refrigerant service record indicated the equipment would be disposed, any difference in the amount recovered and the full charge was considered a released (used) amount. If refrigerants were disposed, the quantity indicated on the refrigerant service record was included as disposed on the spreadsheet. Transaction detail reports were run in Comply Plus for each CAS number for the specific date range to ensure no duplicate entries from the refrigerant service record and the information maintained in Comply Plus. Any duplicate data was removed from the total amount reported. Adjustment queries were also run in Comply Plus to account for "manual" changes to inventory data that is not included in the transaction detail reports. These "manual" changes typically occur during chemical inventories performed by chemical coordinators. Negative values calculated are results of "found" inventory that was previously reported as used.

This methodology aligns with the default methodology presented in the TSD. INL relied on information contained in the Comply Plus inventory database and on hard-copy maintenance records for heating, ventilating, and air conditioning (HVAC) systems and vehicles. The amounts of fluorinated gases emitted were calculated as detailed in examples in the TSD (depending on the original units of the gas included in the database or on the maintenance record).

4.2.3.2 Results Discussion. Using the method described above, the fugitive refrigerant emissions in Table 6 were considered for their contribution to INL's GHG emissions during FY15. A majority of the gases in the table evaluated were not considered to have any releases during FY15, but they are listed in the table to show that they have been evaluated. Also shown in the table is the GWP of each gas, which indicates each gas heat-trapping impact relative to CO_2.

Table 6. Fugitive refrigerants evaluated for GHG emissions during FY15 at INL.

		BEA 2015 CEDR		FY15 TSD	
Common Name	GWPa	Mass Emitted (lbs)	GHG Emissions (MT CO2e)	Mass Emitted (lbs)	GHG Emissions (MT CO2e)
CO2	1	161.18	0.12	−114.95	−0.05
CH4	25	37,960.65	430.47	34,699.70	393.49
N2O	298	0.058	0.01	0.00	0.00
HFC-23	14,800	27.6	185.28	0.00	0.00
HFC-32	675	135.08	41.36	21.90	6.71
HFC-41	92	0.00	0.00	0.00	0.00
HFC-125	3,500	141.20	224.17	22.50	35.72
HFC-134	1,100	0.00	0.00	0.00	0.00
HFC-134a	1,430	1,684.18	1,092.42	55.22	35.82
HFC-143	353	0.00	0.00	0.00	0.00
HFC-143a	4,470	31.20	63.26	0.00	0.00
HFC-152	53	0.00	0.00	0.00	0.00
HFC-152a	124	6.05	0.34	0.00	0.00
HFC-161	12	0.00	0.00	0.00	0.00
HFC-227ca	NL	0.00	0.00	0.00	0.00

Table 6. (continued).

Common Name	GWPa	BEA 2015 CEDR		FY15 TSD	
		Mass Emitted (lbs)	GHG Emissions (MT CO2e)	Mass Emitted (lbs)	GHG Emissions (MT CO2e)
HFC-227ea	3,220	0.00	0.00	0.00	0.00
HFC-236ca	NL	0.00	0.00	0.00	0.00
HFC-236cb	1,340	0.00	0.00	0.00	0.00
HFC-236ea	1,370	0.00	0.00	0.00	0.00
HFC-236fa	9,810	0.00	0.00	0.00	0.00
HFC-245ca	693	0.00	0.00	0.00	0.00
HFC-245fa	1,030	4.91	2.29	0.00	0.00
HFC-365mfc	794	34.34	12.37	0.00	0.00
HFC-c-447-ef	NL	NE	NE	NE	NE
HFC-43-10mee	1,640	40.79	30.34	0.00	0.00
PFC-14	7,390	0.00	0.00	0.00	0.00
PFC-116	12,200	32.40	179.30	0.00	0.00
PFC-218	8,830	0.00	0.00	-0.05	-0.18
PFC-318 or PFCc318	10,300	0.00	0.00	0.00	0.00
PFC-3-1-10	8,860	0.00	0.00	0.00	0.00
PFC-4-1-12	9,160	0.00	0.00	0.00	0.00
PFC-5-1-14	9,300	0.00	0.00	0.00	0.00
PFC-9-1-18	7,500	0.00	0.00	0.00	0.00
c-C3F6	17,340	0.00	0.00	0.00	0.00
SF6 – Sulfur Hexafluoride	22,800	276.25	2,856.97	28.26	292.32
NF3	17,200	0.00	0.00	0.00	0.00
TOTAL		40,535.88	5,118.70	34,712.58	763.83

a. Numerous GWPs were updated in November 2013, for reporting consideration in 2014. Updated GWPs (noted in red).
NL = Not listed. GWP not listed for compound.
NE = Not evaluated. Refrigerant was not included in CEDR data call.

As shown in Table 6, INL's fugitive emissions from refrigerants were calculated to produce 763.83 MT CO_2e in FY15. In FY15 this equates to 3.9% of INL's Scope 1 emissions, and 1.3% of the total anthropogenic emissions considered.

4.2.3.3 Lessons Learned. The accuracy of the data used to calculate GHG emissions from refrigerants is hard to verify as some of the maintenance records are completed by hand and stored in hard copy. It is difficult to be assured that all of the maintenance records have been reviewed, including fluorinated gas charges. There is some overlap in data contained on the maintenance records and Comply Plus. Comply Plus was used to verify the amounts of refrigerants emitted and the volumes reported on the maintenance records.

It may be helpful to have electronic data gathering at point of entry (i.e., maintenance personnel enter the data directly into an electronic system that updates to Comply Plus automatically, removing one potential source of error in data entry). Also, this would eliminate the requirement to obtain hard copies of the maintenance records and remove one source of information to review during the calculations.

4.2.3.4 Comparison to FY08 Baseline. INL's increase in FY15 over FY08 baseline is likely due to natural variations in fugitive purchasing cycles, improved data collection abilities, and using the simplified mass balance approach for calculating release emissions.

Overall, although the variation between years is large, it is important to keep in mind the escalation of scale—overall fugitive emissions are a small contributor to the total INL GHG footprint. And although slight changes make for large changes within this emissions category, they are insignificant when compared to the total footprint.

It should be noted that INL's reporting is based on the DOE-HQ data calls for FY08 and FY15. The FY08 baseline data call requested information on fewer items than the FY15 data call.

4.2.4 Fugitive Emissions: Onsite Landfill

INL utilized a combination of both an onsite and offsite (contracted) landfill for non-hazardous solid waste disposal during FY15. These Scope 1 calculations look at the emissions associated with solid waste disposal in the onsite landfill at the Central Facilities Area (CFA), while the Scope 3 calculations look at the emissions associated with contracted MSW disposal from town facilities that go to an offsite landfill.

INL operates the landfill at CFA, which accepts waste from all INL Site contractors. The CFA landfill currently includes one open designated area for compactable non-municipal solid waste that has been receiving waste since 1984. Three other designated waste areas have been opened and closed since 1947 and are no longer receiving waste. The CFA landfill has no landfill gas collection or destruction, is not subject to Title V GHG reporting, and has no formalized operating permit.[f] A daily soil cover is applied to produce an estimated overall soil-to-trash ratio of one-to-one. Of the 198 acres currently designated as landfill space at CFA, 150 acres have been designated for compactable non-municipal solid waste, although only a portion of this area is currently being utilized.[g]

4.2.4.1 Calculation Method. To determine the Scope 1 emissions associated with INL's onsite landfill, the historical quantities of solid waste were pulled from the INWMIS database. INWMIS tracks the amounts (by both weight and volume) and types of waste collected from each Site facility for delivery to the CFA landfill. INWMIS tracks multiple types of waste, including a number of types of construction and demolition waste. For this calculation, only two categories of waste in INWMIS were considered: Category 1 and 2 for "regular trash" and "cafeteria waste," respectively.

EPA's Landfill Gas Emissions Model (LandGEM) was used to calculate the GHG emissions associated with the CFA landfill, as identified in the TSD methodology. LandGEM utilizes the mass of solid waste disposed of from the year the landfill was opened until the year it was closed. The historical data shown in Table 7 were input to LandGEM to get the estimated annual amounts of CO_2 (biogenic) and CH_4 (anthropogenic) produced. These calculations only considered the open portion of the CFA landfill (open since 1984) and ignored the three areas that have been closed. Since INWMIS only includes data starting in 1992, the solid waste amounts for 1984 through 1991 were estimated based on an average trend from the available data (average of the previous 5 years). The solid waste disposed of in the CFA landfill is documented in Table 7.

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f. INL's CFA landfill does not receive household waste, but it does receive a portion of waste that is MSW-like. It is operated according to a State of Idaho-approved non-municipal solid waste operating plan, which prohibits disposal of many substances including hazardous waste and sludge.

g. CFA landfill information is based on correspondence with Kathy Hernandez, e-mail dated January 29, 2013.

Table 7. Amount of solid waste produced annually since 1984 for disposal in INL's onsite CFA landfill.

Fiscal Year	Amount of Solid Waste (tons)
1984	15,196.35
1985	15,196.35
1986	15,196.35
1987	15,196.35
1988	15,196.35
1989	15,196.35
1990	15,196.35
1991	15,196.35
1992	40,540.28
1993	8,308.58
1994	13,707.36
1995	9,178.26
1996	4,247.27
1997	1,436.32
1998	3,479.26
1999	1,135.21
2000	1,091.80
2001	972.30
2002	1,099.19
2003	1,299.64
2004	1,639.89
2005	1,070.45
2006	1,754.07
2007	1,145.95
2008	826.64
2009	647.06
2010	805.48
2011	708.65
2012	663.54
2013	567.14
2014	610.95
2015	618.91
TOTAL	219,124.82

4.2.4.2 Results Discussion. INL's disposal of non-hazardous solid waste in the onsite landfill at CFA is estimated to conservatively contribute 6,381.0 MT CO_2e of anthropogenic emissions to the GHG inventory during FY15. An additional 778.1 MT CO_2e of biogenic emissions were contributed to the GHG inventory during FY15. In FY15, the anthropogenic emissions equate to 32.5% of INL's Scope 1 emissions, and 10.9% of the total anthropogenic emissions considered.

4.2.4.3 Lessons Learned. Since INL currently tracks the quantities and types of materials sent to the onsite landfill at CFA, the data used are considered accurate, and no changes are needed for streamlining the calculation in future years. However, additional searching may identify the amounts deposited in the landfill prior to 1992; this information had to be estimated for this calculation.

4.2.4.4 Comparison to FY08 Baseline. In FY15, there was a 7.0% increase in GHG emissions from the landfill over the FY08 GHG baseline. When considering the change in the amount (weight) of waste disposed per Site employee against the FY08 baseline, FY15 showed a 25.4% decrease. It should be noted that the GWP for CH_4 increased 16% from 21 to 25, resulting in a larger increase in emissions regardless of an increase in waste being disposed (there is a 25.1% decrease in the amount of waste sent to the landfill over the FY08 GHG baseline).

In addition to EO 13693 setting GHG goals that led to INL quantifying their annual GHG emissions, the EO covers a number of other environmental areas including waste diversion. INL is currently working to divert their solid waste to meet a goal of 50% diversion by weight each year; this increased diversion rate is expected to result in a decrease in the overall amount of solid waste deposited in the landfill; however, it is not guaranteed since the diversion goal only considers the waste produced within a single year rather than compared to previous years.

It should be noted that the onsite landfill GHG calculations (the LandGEM) rely predominately on historical waste disposal amounts rather than current information. There is a significant lag time before the current actions will have a notable effect on the associated GHG emissions, particularly diversion efforts (e.g., recycling).

4.2.5 Fugitive Emissions: Onsite Wastewater Treatment

At its Site facilities, INL operates its own wastewater treatment, which consists of a combination of lagoons and septic systems. Evaporative lagoons are located at the major facilities, while septic tanks are located at the smaller or remote locations, including Experimental Breeder Reactor I, SMC fire station, the Gun Range, the main INL guard gate, and the Critical Infrastructure Test Range Complex (CITRC) (formerly known as the Special Power Excursion Test Reactor Tests II, III, and IV). It should be noted that the evaporative lagoons are facultative, with an aerobic upper layer and an anaerobic lower layer. The methodology behind the TSD considers facultative lagoons to be anaerobic.

INL also operates a number of lagoons (including evaporative ponds) for industrial waste. Since this industrial waste does not contain significant amounts of organics, the lagoons were not considered in these calculations.

4.2.5.1 Calculation Method. INL's data on onsite lagoons used for wastewater treatment are identified by facility in Table 8 for FY15. INL's Human Resources department provided the employee counts at each facility as an average for the year based on the numbers at the end of each quarter. The number of visitors to each facility was estimated based on 10% of the number of employees, a conservative estimate to account for subcontractors and visitors.

Table 8. FY15 population data by facility for onsite wastewater treatment calculations.

Facility Name	Wastewater Type	Number of Employees	Number of Visitors	Total Population Considered
EBR-I	Septic Tank	1	0.06	0.64
CITRC	Septic Tank	0.75	0.075	0.825
Gun Range	Septic Tank	5.33	0.53	5.87
Main INL Guard Gate	Septic Tank	2	0.2	2.2
			TOTAL SEPTIC POPULATION	9.5
ATR	Lagoon	474	47.36	520.94
CFA	Lagoon	455	45.5	500.5
MFC	Lagoon	874	87.42	961.58
SMC	Lagoon	154	15.38	169.22
			TOTAL LAGOON POPULATION	2,152.24

The population data from Table 8 were used with the calculation method in the TSD, and the default national averages (from the TSD) for the specific treatment process.

4.2.5.2 Results Discussion. INL's onsite wastewater treatment is estimated to contribute 148.09 MT CO_2e (147.48 from lagoons and 0.602 from septic systems) emissions to the GHG inventory during FY15. In FY15 this equates to less than 1% of INL's Scope 1 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

4.2.5.3 Lessons Learned. For future inventories it is believed that site-specific data and the factors unique to INL would produce more accurate results than calculations based on national averages. In addition, future calculations for industrial waste treatment should be included, even though these are likely minimal GHG contributors relative to the lagoons.

4.2.5.4 Comparison to FY08 Baseline. In FY15, there was an apparent 14.9% increase over the FY08 GHG baseline; however, in FY14 the GWP for CH_4 increased from 21 to 25. When FY08 baseline numbers were recalculated with the updated GWP, there was an actual 5.1% decrease in emissions from onsite wastewater. Since the wastewater calculations are based on employee counts, the increase in GHG emissions from wastewater generally followed the decrease in employee numbers of 3.2% in FY15 over the FY08 baseline.

4.3 Scope Two – Indirect Emissions

INL's FY15 Scope 2 emissions are summarized in Figure 8, with a comparison to the FY08 baseline shown in Figure 9. A discussion of INL's FY15 Scope 2 emissions categories follows, including the calculation methods, the significance of the results, lessons learned from the data collection and calculation process, and a comparison to the FY08 baseline results. A comprehensive table, as well as the FY08 baseline emissions and the subsequent FY data, is included in Appendix E, "Scope 2 Comprehensive Tables."

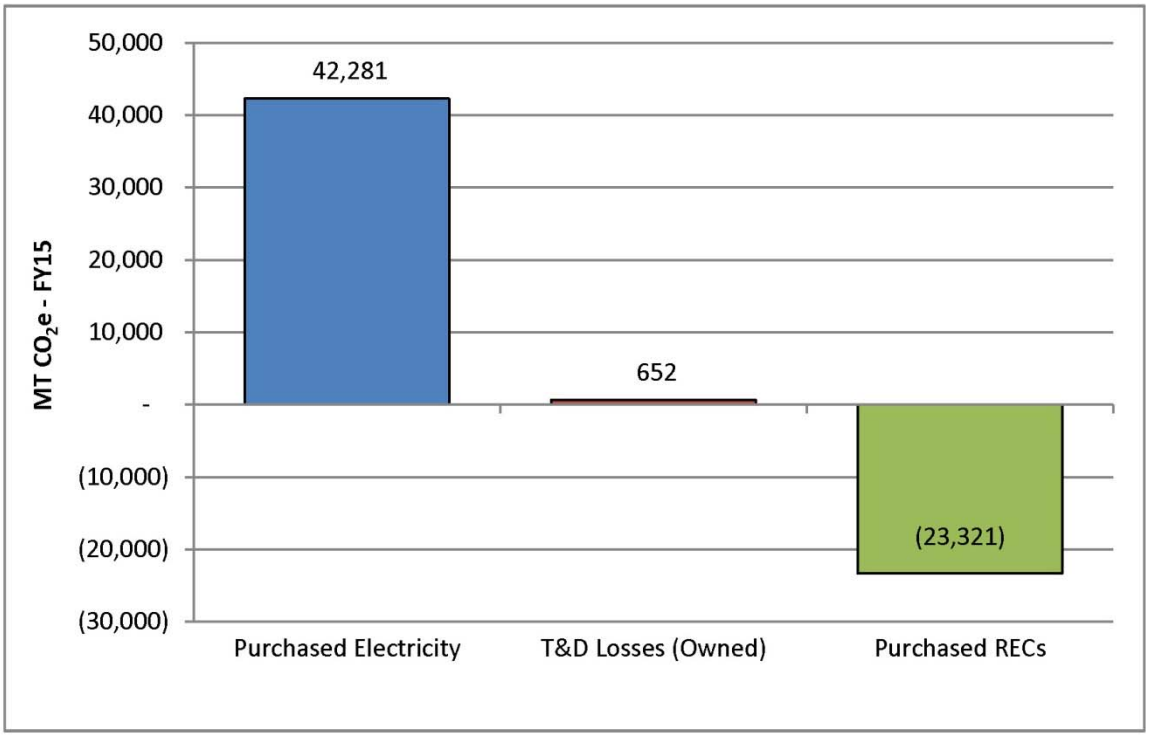

Figure 8. INL's FY15 GHG emission results for Scope 2.

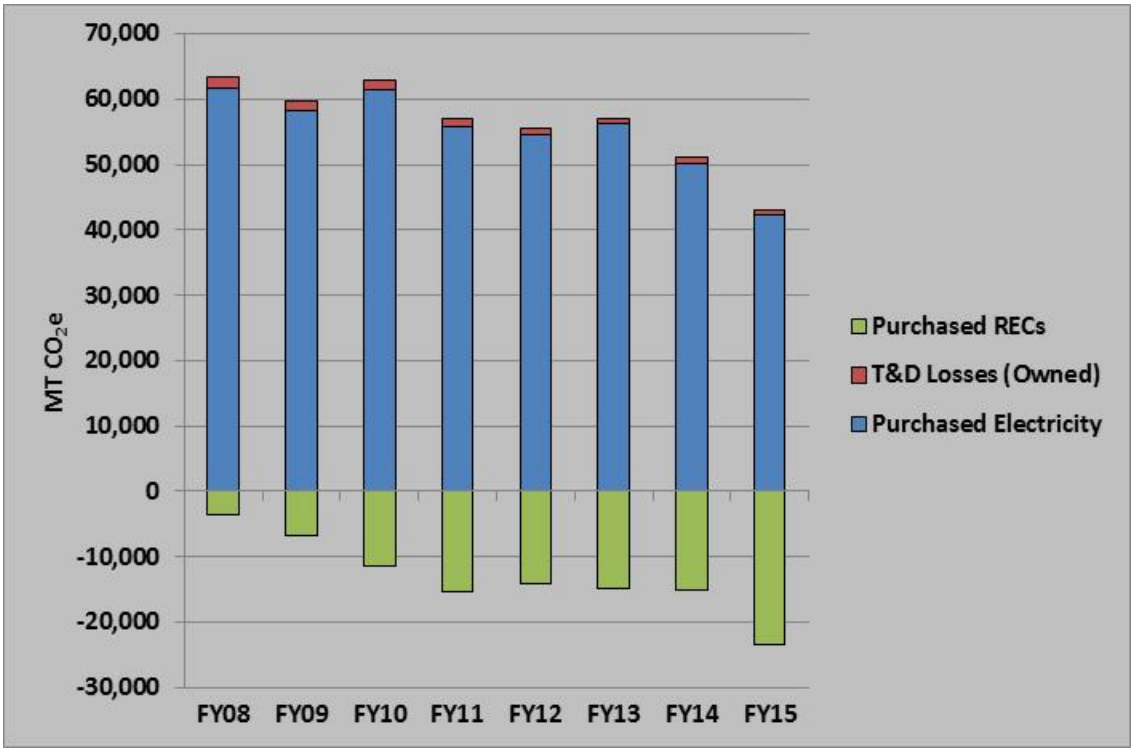

Figure 9. Comparison of INL's FY08 through FY15 Scope 2 GHG emissions.[h]

h. Scope 2 numbers for FY11 and FY12 were revised in FY13 as a result of a revision to Scope 2 total calculations.

4.3.1 Purchased Electricity Emissions

4.3.1.1 Calculation Method. These calculations follow the TSD default methodology of electricity purchases reported for the CEDR. The amounts are determined based on a combination of monthly electrical bills and INL's onsite electricity meters. Since these data are also submitted in the CEDR and they are tracked for the INL Site, the only calculations needed were to isolate the emissions that INL owns (consumed in INL-operated facilities) from the other INL Site contractors.

INL purchases electricity from four different electrical utilities to support the operations of its different facilities: Idaho Falls Power supplies electricity to the town facilities, Idaho Power supplies electricity to the Site facilities as well as some small locations outside of Idaho Falls city limits, and Rocky Mountain Power and Lost River Electrical Company provide electricity to some of the smaller buildings and equipment outside of Idaho Falls city limits, including lighting at some bus lots. The breakdown in electrical purchases by electrical provider is shown in Table 9 for FY15.

INL purchased 139,299.90 MWh during FY15, with 40,485.00 MWh provided to non-Site locations, and 98,918.40 MWh going to INL facilities at the INL Site. Per the TSD, the emission factors for purchased electricity are determined using the EPA's Emissions and Generation Resource Integrated Database (eGRID) and the location of INL's facilities. eGRID uses subregional emission factors based on plant-specific data in that region, as reported to the EPA, the Energy Information Administration, and the Federal Energy Regulatory Commission. (For more information on eGRID, refer to https://www.epa.gov/energy/egrid.) All INL facilities are located in the Western Electricity Coordinating Council (WECC) Northwest eGRID subregion, the Northwest Power Pool (NWPP).

Table 9. INL's FY15 electrical purchases by location and provider.

Location	Owner of T&D System	Electrical Provider	FY15 Electricity Purchase (MWh)
INL Site	INL	Idaho Power (includes owned T&D losses)	98,814.90
SUBTOTAL (Site)			98,814.90
Assorted Locations (excludes INL Site)	Electrical Provider	Idaho Power	98.65
Town Facilities	Electrical Provider	Idaho Falls Power	40,166.94
Assorted Locations Outside INL Site and Idaho Falls City Limits	Electrical Provider	Lost River Electric Company	3.30
Assorted Locations Outside INL Site and Idaho Falls City Limits	Electrical Provider	Rocky Mountain Power	216.11
		SUBTOTAL (Non-Site)	40,485.00
		TOTAL INL Purchases	139,299.90

4.3.1.2 Results Discussion. For FY15, the purchased electricity and owned T&D losses amount to 42,933.50 MT CO_2e, which is all of INL's Scope 2 emissions (before accounting for the credit from the RECs) and 73.6% of the net total anthropogenic emissions considered.

4.3.1.3 Lessons Learned. Since these data are already collected and reported annually for the CEDR, they are considered to be of high quality.

4.3.1.4 Comparison to FY08 Baseline. In FY15, INL purchased 9.4% less electricity than the FY08 baseline, which yielded a 31.5% decrease in associated GHG emissions.

Efforts to reduce the overall INL carbon footprint will focus on reducing electricity demand and increasing REC purchases since this source is such a significant contributor.

4.3.2 Transmission and Distribution Loss Emissions, Owned

4.3.2.1 Calculation Method. The TSD calls for differentiating between T&D losses within INL's operational controls and those outside INL's operational controls as Scope 2 and 3, respectively, based on whether the organization owns the associated transmission lines. To facilitate this differentiation, electricity purchases in Table 9 are identified according to who owns the T&D system: INL or the electrical provider. Since INL owns the electrical grid at the Site, and the T&D losses are considered within INL's operational controls, the electricity purchase for the Site from Idaho Power (shown in Table 10) includes the associated T&D losses. (The Scope 3 T&D losses [outside INL's operational controls] are based on the total INL electrical purchase.)

The amount of INL's owned T&D losses was calculated based on an average T&D loss factor of 2.175% in FY15. This percentage was determined based on the difference between the total amount of electricity purchased for the INL Site (based on the Idaho Power meter at the Scoville, Idaho substation) and the total metered amounts at individual Site facilities (this difference accounts for the losses within the INL Site).

4.3.2.2 Results Discussion. The owned T&D losses of 2,149.52 MWh for FY15 equates to 652.43 MT CO_2e of emissions. It should be noted that this T&D loss is already accounted for in the purchased electricity emissions, and simply reduces the GHG emissions from purchased electricity report above; the goal of these calculations was to isolate this amount for reporting purposes according to the TSD.

4.3.2.3 Lessons Learned. Since this calculation is based on a percentage of the GHG emissions presented for INL's Scope 2 electricity purchases, the data used are considered accurate, and no changes are needed for streamlining the calculation in future years.

4.3.2.4 Comparison to FY08 Baseline. Since T&D losses are based on a percentage of the INL electricity purchase, a comparison to the FY08 baseline yields the same results as Section 4.3.1.4.

4.3.3 Renewable Energy Certificates Emissions

4.3.3.1 Calculation Method. In addition to the electricity purchased directly for its facilities, INL purchased the following amount of RECs to offset a portion of its carbon emissions:

- 32,400 MWh in FY15 from multiple wind power projects in Idaho, Washington, Oregon, and Wyoming. (See Appendix F, "Receipt for RECs Purchased in FY15," for the receipt, which includes details on INL's RECs purchase.)

INL did not actually purchase renewable energy, but rather purchased the RECs or certified environmental benefits of the renewable energy generated in another region to support the growth and expansion of the renewable energy industry as a whole. INL is credited for the GHG emissions that this renewable energy did not emit.

The emission factors for the RECs purchased in FY15 are based on the wind power facility locations in Idaho, Washington, Oregon, and Wyoming, and the NWPP of the WECC eGRID subregion (the subregion was determined using the facility's ZIP Codes and EPA's Power Profiler Web site [https://www.epa.gov/energy/egrid]). (Note that the TSD calls for using the eGRID non-baseload emission rates for calculating the GHG emissions associated with RECs, as opposed to the baseload emission rates used for emissions from purchased electricity.)

4.3.3.2 Results Discussion. Table 10 summarizes how much INL reduced its Scope 2 GHG emissions in FY15 by purchasing RECs. Specifically, the RECs purchased decreased the overall Scope 2 GHG emissions by 23,320 MT CO_2e in FY15.

Table 10. INL's GHG emissions from electricity and RECs purchased in FY15.

Emissions Category	FY15 GHG Emissions (MT CO_2e)
Purchased Electricity (includes T&D losses within INL's operational controls)	42,933.50
Purchased RECs (displaced GHG emissions)	(23,320.76)
SCOPE 2 TOTAL	19,056.77

4.3.3.3 Lessons Learned. Since these data are based on the RECs receipts, and are already collected and reported annually for the CEDR, they are considered to be of high quality.

4.3.3.4 Comparison to FY08 Baseline. In FY15, significantly more (390.9% more) RECs were purchased than FY08 (by MWh). The associated emissions avoided were calculated according to the NWPP subregional eGRID emission factors, which led to a 574.4% increase over FY08. The 2012 eGRID emission factors for the NWPP subregion decreased by approximately 20% and the non-baseload emission factors for the NWPP subregion (amount credited for RECs) increased by approximately 18%; therefore, significantly increasing the benefits of purchased RECs from previous years.

4.4 Scope Three – Indirect Emissions

INL's FY15 Scope 3 emissions are summarized in Figure 10, with a comparison to the FY08 baseline shown in Figure 11. Each of the Scope 3 emissions categories is discussed here and includes the calculation methods, the significance of the results, lessons learned from the data collection and calculation process, and a comparison to the FY08 baseline results. A comprehensive table, as well as the FY08 baseline emissions and the subsequent FY data, is included in Appendix G, "Scope 3 Comprehensive Tables."

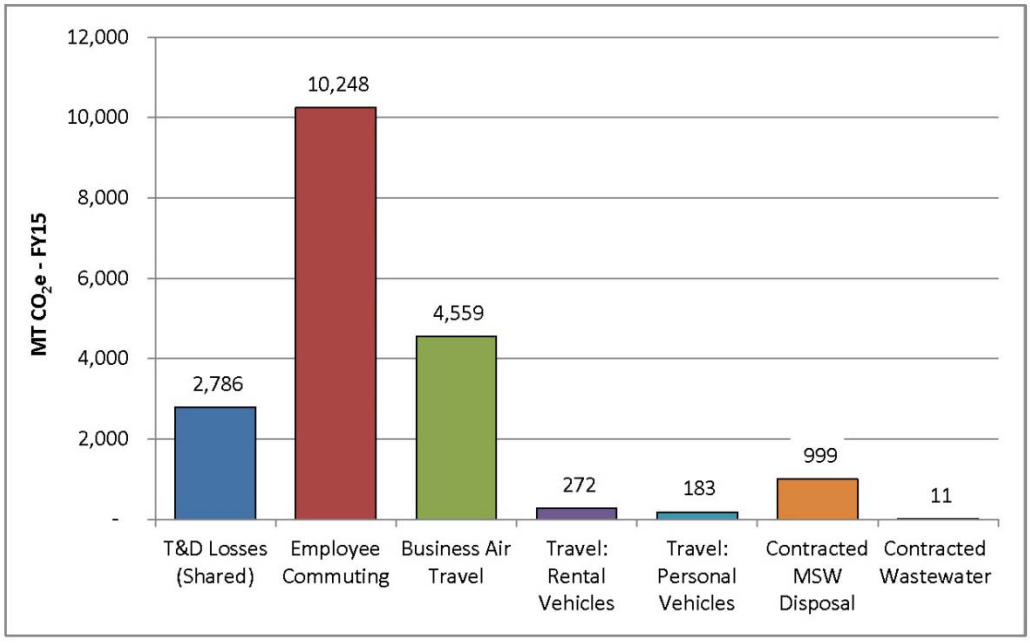

Figure 10. INL's FY15 GHG emission results for Scope 3.

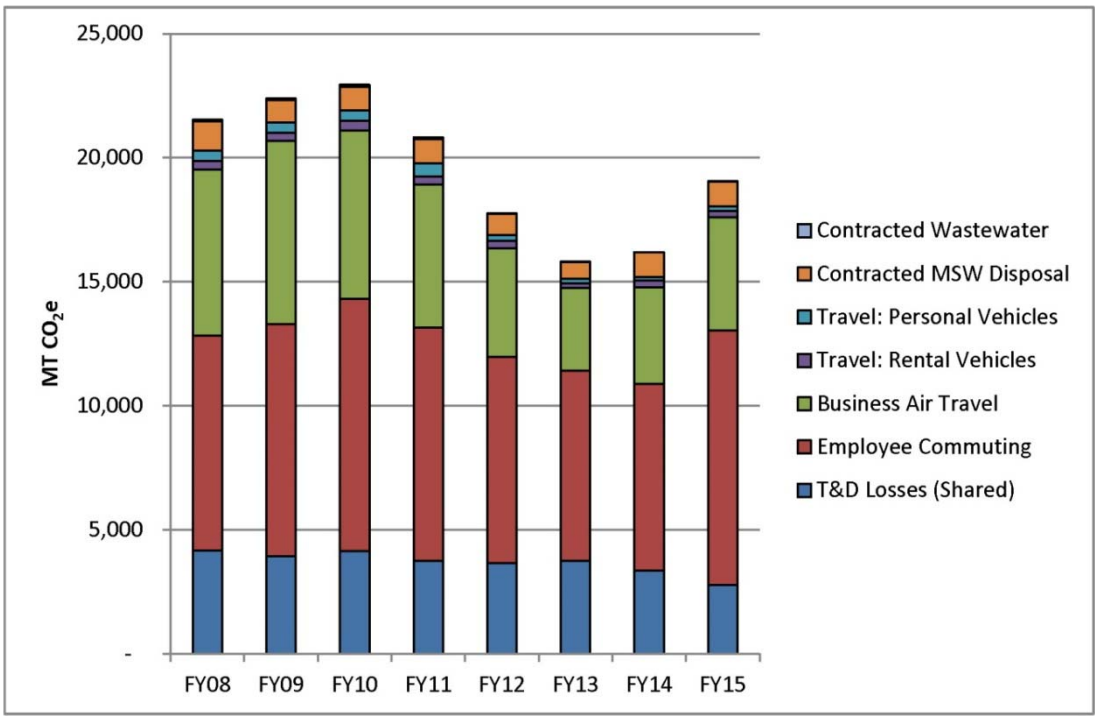

Figure 11. Comparison of INL's FY08 through FY15 Scope 3 GHG emissions.

4.4.1 Transmission and Distribution Loss Emissions, Shared

4.4.1.1 Calculation Method. The TSD provides only a default calculation methodology for determining the GHG emissions from T&D losses outside INL's operational control. This method assumes the national average T&D loss factor of 6.59% for purchased electricity, and utilizes the same eGRID subregion emission factors used for Scope 2 purchased electricity (https://www.epa.gov/energy/egrid). As stated in Section 5.3.1.1, the TSD differentiates between T&D losses inside and outside of INL's operational controls. While the owned T&D losses reported in Scope 2 are based only on the electricity purchased at the Site where INL owns the T&D lines, the Scope 3 shared T&D losses are based on INL's total annual electrical purchases.

4.4.1.2 Results Discussion. A T&D loss of 6.59% equates to 9,179.86 MWh for INL's FY15 electricity purchases, and 2,786.32 MT CO_2e of emissions. In FY15 this equates to 14.6% of INL's Scope 3 emissions, and 4.8% of the total anthropogenic emissions considered.

4.4.1.3 Lessons Learned. Since this calculation is based on a percentage of the GHG emissions presented for INL's Scope 2 electricity purchases, the data used are considered accurate, and no changes are needed for streamlining the calculation in future years.

4.4.1.4 Comparison to FY08 Baseline. Since T&D losses are based on a percentage of the INL electricity purchase, a comparison to the FY08 baseline yields the same results as Section 4.3.1.4.

4.4.2 Employee Commuting Emissions

4.4.2.1 Calculation Method. The TSD identified an employee survey as the best source for calculating the GHG emissions from employee commuting. Employee commuting behaviors for FY08 and FY09 were calculated by utilizing available historical data that was gathered and combined with appropriate assumptions for FY08 and FY09 calculation. However, for the FY15 calculation of employee commuting emissions, a survey was utilized. These processes are described below.

The FY15 employee commute survey was distributed to 3,810 employees. The distribution list included all BEA employees, including management at the director level and above and subcontractors with INL e-mail addresses (since they were assumed to be dedicated INL employees with offices within INL office). The survey response was approximately 53% (2,008 employees completed the survey) and considered to be representative of the INL population. The results were distributed across the total INL FY15 population, which included subcontractors. The survey results are summarized in several Excel spreadsheets.

4.4.2.2 Results Discussion. As shown in Table 11, INL employees commuted an estimated 18.5 million vehicle-miles during FY15. The associated GHG emissions were estimated to be 10,247.52 MT CO2e. In FY15, the GHG emissions equates to 53.8% of INL's Scope 3 emissions, and 17.6% of the total anthropogenic emissions.

Table 11. Number and type of commute miles traveled by INL employees during FY15.

Type of Miles	Number of Miles	GHG Emissions (MT CO_2e)
Passenger Car Miles, Gasoline	10,668,699.81	5,343.24
Passenger SUV or Truck Miles, Gasoline	5,966,269.03	3,811.81
Motorcycle Miles	97,138.84	23.45
Passenger Car Miles, Diesel	331,921.20	181.66
Passenger SUV or Truck Miles, Diesel	863,313.19	753.99
Passenger Car Miles, Alternative Fuel	621,265.39	133.36
TOTAL VEHICLE MILES	18,548,607.46	10,247.52
Walk, Run, or Bike Miles	80,688.11	0
TOTAL COMMUTE MILES	18,629,295.57	10,247.52

4.4.2.3 Lessons Learned. With a commute survey response of 53%, it may be more beneficial to send the survey out earlier in the year. This was the first year in which a portion of the year (beginning January 1, 2015) bus passes were free to BEA employees.

4.4.2.4 Comparison to FY08 Baseline. In FY15, there was an 18.4% increase in GHG emissions from employees commuting over the FY08 baseline. Although there was an 8.4% decrease in the total number of commute miles, the number of commute miles per employee decreased by 5.4%, indicating there are fewer employees, but they are commuting further (there are only 0.4% more Site employees than town employees for FY15 compared to FY08).

The commute survey utilized in FY15, to gather the commute data, could be considered more accurate than the method used in FY08, which called for a great number of assumptions.

4.4.3 Business Air Travel Emissions

INL employees took 7,104 business trips during FY15, as indicated by submitted and approved travel request forms. Employees submit the forms to the INL Travel Office to make necessary reservations for both domestic and international travel on behalf of the Laboratory. Travel request forms are also submitted to secure insurance coverage for employees that do not need travel arrangements, so there are times when a form is submitted and no travel arrangements are necessary (this could lead to no Scope 3 GHG emissions calculated, for example, in the case where an employee uses an INL fleet vehicle or is carpooling in another employee's personal vehicle to an offsite location).

Each trip can include commercial airline and/or ground travel (in both personal and rental cars). Ground travel by taxi, bus, or rail is less common and is currently only tracked as a dollar value when an employee requests reimbursement. For the FY15 GHG calculations, only employees travelling by commercial airline, personal vehicle, and rental vehicle were included. Travel by taxi, bus, rail, and other commercial means is not currently tracked; furthermore, they are considered de minimis when compared to these other transportation means, especially airline travel. It is also considered likely that INL travelers with large ground transportation needs will rent a car, rather than take public transportation; thus, these emissions are included in INL's FY15 inventory.

INL travel requests are submitted by full-time INL employees as well as by subcontractors, student interns, and prospective employees traveling for interviews, house hunting, and/or relocation. If an employee is performing work for others, their trip may be paid for and arranged by the external entity, and thus these data would not be tracked by the INL Travel Office nor included in the reported airline miles. This would also apply to tracking the associated personal and rental car miles. In these cases, the "other" would own the associated GHG emissions.

4.4.3.1 Calculation Method. The TSD provides one calculation method (the default methodology) for calculating the GHGs of airline travel, which is based on the actual flight miles traveled. This data was provided by the travel vendor as total passenger-miles traveled on short-, medium-, and long-haul flights[i] based on the length of each individual flight leg of an employee's trip (as opposed to the total miles between the starting and destination airports). These passenger-miles were then multiplied by the appropriate emission factors for short-, medium-, and long-haul flights that account for the increased GHG emissions during take-off and landing. (This is different from the FY08 calculation approach when the travel vendor was only able to provide a value for the total passenger-miles traveled, and then it was multiplied by an average emission factor per mile of commercial flight.)

4.4.3.2 Results Discussion. Table 12 shows that the 23,235,748 passenger-miles flown by INL employees during FY15 resulted in an estimated 4,558.81 MT CO_2e, or 0.196 MT CO_2e per 1,000 passenger-miles for the year. In FY15, this equates to 23.9% of INL's Scope 3 emissions, and 7.8% of the total anthropogenic emissions considered.

Table 12. Number of miles flown by INL employees during FY15.

Type of Miles	FY15	
	Number of Passenger-Miles	GHG Emissions (MT CO_2e)
Short Haul	2,200,131	611.24
Medium Haul	3,702,956	605.69
Long Haul	17,332,661	3,341.88
TOTAL	23,235,748	4,558.81

4.4.3.3 Lessons Learned. Since this data is already tracked and reported in the CEDR, it is considered accurate and no changes are needed for future reporting.

4.4.3.4 Comparison to FY08 Baseline. When comparing the FY15 inventory to the FY08 GHG baseline, there was a 31.8% decrease in airline GHG emissions, 4.8% fewer passenger-miles flown, and an overall 30.1% decrease in the number of trips[j] per employee.

i. Short haul are flight segments <300 miles, medium haul are flight segments 300–699 miles, and long haul are flight segments >700 miles.

j. The number of trips includes all of the trips coordinated by the INL Travel Office, and includes more than airline trips.

INL employees are traveling less; however, they are flying more domestic miles resulting in greater GHG emission reductions. It should be noted that the FY08 passenger-miles were not able to be broken down into flight length, which resulted in using an emissions factor for unknown flight lengths that appears to have been more conservative than using emission factors specific to the flight segment length.

4.4.4 Business Ground Travel: Rental Vehicle Emissions

4.4.4.1 Calculation Method. For calculating the GHG emissions from rental vehicles, the INL Travel Office was able to provide the total number of miles that INL employees traveled during FY15 by each vehicle class. This data was provided by the rental car vendor.

Vehicle classes were divided into two categories: passenger cars and light-duty trucks/vans/SUVs. The emission factors from the TSD were applied accordingly based on these two categories.

This calculation process followed the TSD's advanced methodology since the number of miles traveled in each rental car class was known (the default methodology called for making assumptions on the numbers of vehicle miles per rental car use).

4.4.4.2 Results Discussion. As shown in Table 13, INL's rental car use during FY15 resulted in 272.02 MT CO_2e based on 696,558 vehicle-miles traveled this year. In FY15 this equates to 1.4% of INL's Scope 3 emissions, and less than 1% of the total anthropogenic emissions considered.

Table 13. Number of vehicle-miles traveled in rental cars by INL employees during FY15.

	FY15	
Vehicle Class	Number of Vehicle Miles	GHG Emissions (MT CO_2e)
Passenger Cars	625,821	234.25
Light-Duty Truck/Van/SUV	70,737	37.77
TOTAL	696,558	272.02

4.4.4.3 Lessons Learned. Since the number of miles traveled in rental vehicles is already tracked by the rental car vendors and reported in the CEDR, these data are considered to be of high quality, and no changes are needed for tracking the data in future years.

4.4.4.4 Comparison to FY08 Baseline. In FY15, there was a 22.5% decrease in GHG emissions from rental vehicle business travel over the FY08 baseline, while the number of miles traveled decreased by 13.6%.

4.4.5 Business Ground Travel: Personal Vehicle Emissions

4.4.5.1 Calculation Method. For calculating the GHG emissions from personal vehicles, the INL Travel Office was able to provide the total number of miles that INL employees traveled during FY15 in personal vehicles as submitted in electronic expense reports for reimbursement. The expense report programmer provided this data to the INL Travel Office.

To determine which emission factors to use for calculating the associated GHG emissions during FY15, the distribution between passenger cars and light-duty trucks/vans/SUVs that was found in the FY15 employee commute survey was used (this amounted to 63% of the travel completed in passenger cars and 37% in light-duty trucks/vans/SUVs).

4.4.5.2 Results Discussion. The 421,442 vehicle-miles that INL employees traveled during FY15 resulted in an estimated 182.64 MT CO_2e. In FY15 this equates to 1.0% of INL's Scope 3 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

4.4.5.3 Lessons Learned. The electronic system for expense reports that was introduced during FY10 will continue to allow for more streamlined and accurate reporting of personal car miles than previous years (FY08 and FY09) when a representative sample was used. An additional assumption could be removed in future years if employees were asked to indicate the type of vehicle they used for their personal vehicle miles during the reimbursement process (since the actual distribution between the type of vehicles traveled was not known, an assumption was made based on the commute survey responses).

4.4.5.4 Comparison to FY08 Baseline. In FY15, there was a 55.7% decrease in GHG emissions from personal vehicle business travel over the FY08 baseline, while the number of miles traveled also decreased by 56.3%.

4.4.6 Contracted MSW Disposal Emissions

4.4.6.1 Calculation Method. To determine the Scope 3 emissions associated with INL's contracted offsite waste disposal from town facilities during FY15, the quantity of MSW sent to an offsite landfill was compiled. This information came from the City of Idaho Falls invoice records of the trash-collection history for each town building, including dumpster location, size of dumpster, and pick-up frequency.

Since the City of Idaho Falls does not track actual volumes or weights of solid waste collected from INL facilities, the records of dumpster size and pick-up frequency from monthly invoices were used to calculate an estimated volume (assuming dumpster fill rates of 80%). The FY15 volume of 8,677 cubic yards, was converted to a weight based on an assumed solid waste density of 150 pounds per cubic yard (density value was selected based on EPA range [www.archive.epa.gov/wastes/conserve/tools/recmeas/web/pdf/guide_b.pdf]). This resulted in a weight of 650.82 tons (1,301,643 pounds) for INL's offsite MSW disposal during FY15.

The TSD default methodology identifies the EPA's municipal solid waste mass balance model to calculate the GHG emissions associated with offsite MSW disposal. The estimated weight of INL's MSW disposed offsite was used with the calculation method in the TSD, along with default national averages (from the TSD).

4.4.6.2 Results Discussion. INL's offsite disposal of MSW during FY15 is estimated to contribute 998.78 MT CO_2e to FY15's anthropogenic GHG inventory. In FY15, this equates to 5.2% of INL's Scope 3 emissions, and 1.7% of the total anthropogenic emissions considered.

It was also calculated that 109.87 MT CO_2e of biogenic emissions were released in FY15.

4.4.6.3 Lessons Learned. Since the quantity of INL's MSW sent for offsite disposal is based on estimated volumes and an assumed density, it would be preferable to work with the City of Idaho Falls to get actual weights collected. If actual weights are not available, then actual volumes could be collected, and a sample of INL's MSW could be analyzed to determine an INL-specific density. These approaches will also assist with more accurate tracking of INL's waste disposal and overall diversion rates that are additional requirements under EO 13693.

In addition to the waste volumes estimated from the city, INL has several small buildings located outside of the Idaho Falls city limits that were not included in the amount of MSW collected from INL for offsite disposal. In future years it would be good to include these amounts.

4.4.6.4 Comparison to FY08 Baseline. In FY15, there was a 15.8% decrease in GHGs over the FY08 baseline. When considering the change in waste disposed per employee against the FY08 baseline, FY15 showed a 26.2% decrease. These decreases are likely due to the change in recycling practices at INL site and town facilities, which allows for a greater number of items to be recycled, and reduced workforce numbers.

As discussed previously for the onsite landfill baseline comparison, Section 4.2.4.4, the EO 13693 waste diversion goals are expected to decrease INL's amount of GHGs produced by contracted MSW disposal.

4.4.7 Contracted Wastewater Treatment

4.4.7.1 Calculation Method. Wastewater from INL's town facilities is sent for treatment to the City of Idaho Falls' wastewater treatment plant and is INL's only source of offsite contracted treatment.

Employee counts at INL's town facilities was provided by Human Resources as an average during FY15, based on the total number of employees at the end of each quarter of the year. The reported number of town employees was 1,725 employees for FY15. The number of visitors to the town facilities was estimated based on 10% of the number of employees. This yielded a total population of 1,897, which was used with the calculation method in the TSD along with default national averages (from the TSD) for the specific treatment process.

4.4.7.2 Results Discussion. INL's contracted wastewater treatment during FY15 is estimated to contribute 10.69 MT CO_2e[k] emissions to the GHG inventory. In FY15, this equates to less than 0.1% of INL's Scope 3 emissions, and a nearly negligible amount of the total anthropogenic emissions considered.

4.4.7.3 Lessons Learned. For future inventories it is believed that site-specific data and factors would produce more accurate results than calculations based on national averages.

4.4.7.4 Comparison to FY08 Baseline. In FY15, there was a 12.7% decrease over the FY08 GHG baseline (as recalculated in FY12, see footnote). Since the wastewater calculations are based on employee counts, the decrease in GHG emissions from wastewater generally followed a decrease in INL's total town employee counts of 4.1% and full realization of water reduction activities implemented previously. Several water reduction projects occurred at INL town facilities, including installing low water vegetation around the Willow Creek Building, landscape intensity reduction at INL Research Complex, efficient water fixture installation at Engineering Research Office Building, xeriscaping efforts at Engineering Research Office Building and INL Research Complex, and water meter installation at all four University Boulevard buildings. Water meter installation allowed for actual water usage to be measured rather than estimated.

k. It should be noted that during the FY12 calculations, it was discovered that an incorrect equation was used for FY08 and subsequent years. The TSD directions indicated the reporting portal would automatically calculate emissions from flaring. This was missed in previous years. For FY08 percentage comparisons, the FY08 data was revised for a total emissions from contracted wastewater treatment of 12.25 MT CO_2e, resulting in a 7.9% increase for FY12 for both population change and for GHG emissions. ("Offsite Wastewater (FY08)" tab in "FY12 Wastewater for GHG (Scope 1+3) 9Oct12.xlsx")

5. PUTTING INL'S FOOTPRINT INTO PERSPECTIVE

During FY15, the INL GHG inventory is estimated to have emitted 58,330 MT of anthropogenic CO_2e. This represents 15.4 MT for each employee working at INL that year. Furthermore, the total GHG emissions generated by the Laboratory during FY15 are the equivalent to the CO_2 emissions from any one of the following[l]:

- Consuming approximately 6.6 million gallons of gasoline or more than 135,651 barrels of oil
- Driving 12,280 passenger vehicles for a year
- Supplying electricity to 8,023 homes for a year.

Comparing these equivalency results to the FY08 baseline shows that INL removed an equivalent of 9,863 vehicles from the road in FY15. As an overall reduction goal, INL has met the old EO 13514 total emissions goals for FY20, which is the basis of this report. The FY20 target goal for INL is 87,039 MT of anthropogenic CO_2e. INL has surpassed this overall reduction goal by over 28,500 MT CO_2e. In FY 2016, the new goals, issued through EO 13693 will be incorporated into this report, new baselines will be established, and updated totals will be reported using newly released emission factors.

l. Calculated with the EPA Greenhouse Gas Equivalencies (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator) in March 2016.

6. SUMMARY AND CONCLUSIONS

As mentioned earlier, this will be the final year for which GHG reduction goals are reported against EO 13514. In FY 2016, EO 13693 goals will be incorporated into this report. Executive Order 13514 mandated reductions in the output of GHGs generated by federal agencies. These reductions are targeted at 28% for direct (Scope 1 and 2) emissions and 13% for indirect (Scope 3) emissions, all by 2020 (White House 2010a and b). The EO set 2008 as the baseline year against which reductions will be measured, and this report documents the calculations for INL's FY15 inventory and the associated reductions. The reductions observed in GHG emissions are shown in

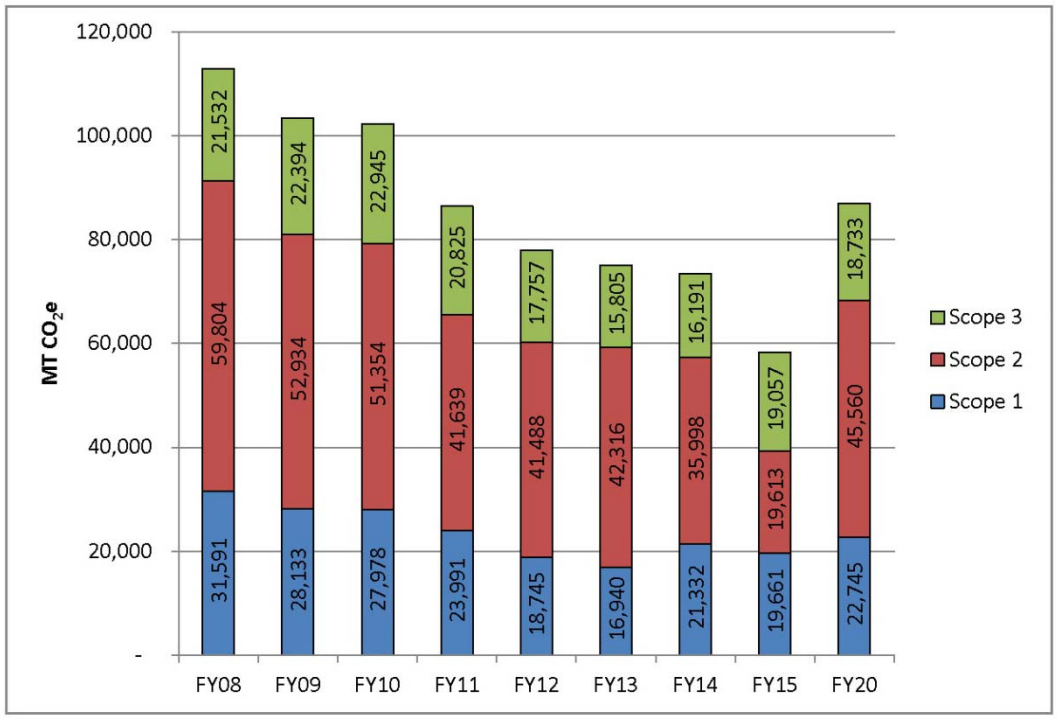

Figure 12 along with the 2020 goal. The specific values in FY15 consist of a 57.0% reduction for Scope 1 and 2, and a 11.5% decrease for Scope 3 was calculated over the respective FY08 baseline values.

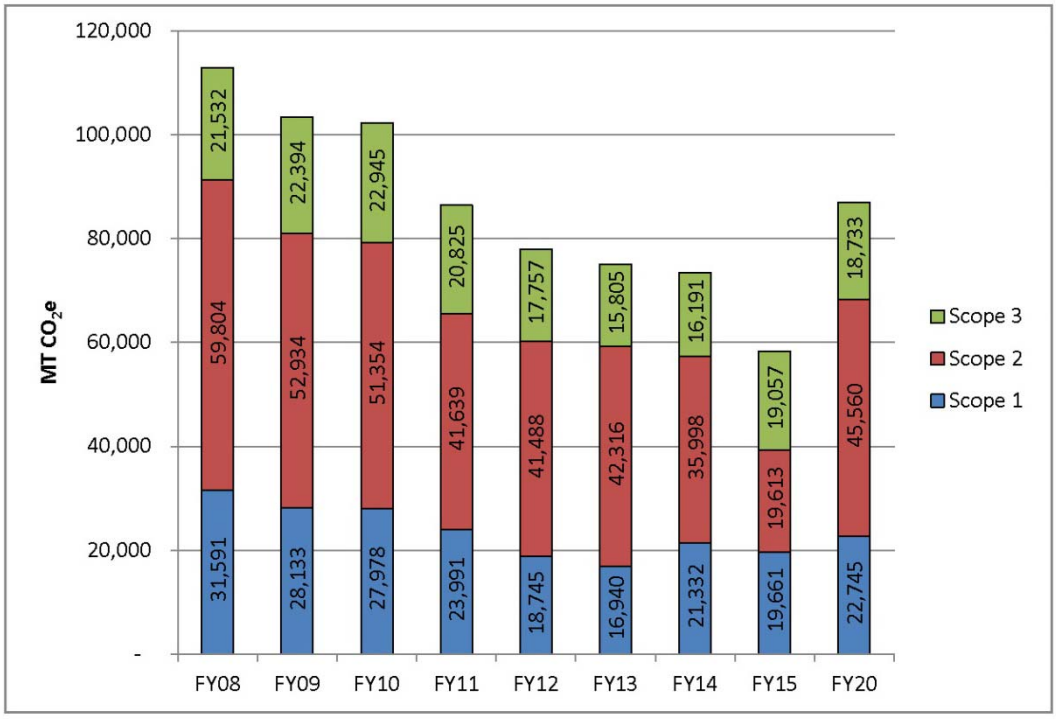

Figure 12. Comparison of INL's FY08, FY09, FY10, FY11, FY12, FY13, FY14, and FY15 actual, and FY20 goal GHG emissions, by scope.[m]

While preparing this inventory, it was observed that much of the data needed to quantify INL's GHG emissions already exist in high-quality form, since they are recorded and tracked for reports to other federal entities. Some information is less accessible, but can be approximated from existing records and will be better tracked in the future due to the standards established by INL in response to the EO and the Laboratory's concern for the environment. Some data and assumptions must be estimated using national averages supplied in the TSD.

During FY15, INL generated 58,330 MT of CO_2 equivalents, respectively. Many factors influence INL's GHG emissions, including the large land area on which the Laboratory's facilities are located. The area requires long commutes and an extensive fleet to provide transportation for desert Site workers, and contains antiquated facilities that were built before the current appreciation for energy efficiency and high-performance design. These factors tie directly to the following conclusions from INL's FY15 GHG inventory:

- Electricity (including the associated transmission and distribution losses) is the largest contributor to INL's GHG inventory, with over 50% of the CO_2e emissions
- Other sources with high emissions were employee commuting, mobile combustion (fleet fuels), stationary combustion (facility fuels), business air travel, and waste disposal (including fugitive emissions from the onsite landfill and contracted disposal)
- Sources with low emissions were wastewater treatment (onsite and contracted), business ground travel (in personal and rental vehicles), and fugitive emissions from refrigerants.

INL's GHG inventory for FY15 was performed according the guidelines contained in the TSD. INL recognizes its role as a DOE-sponsored research laboratory to "lead by example" in measuring, reporting,

m. Scope 2 numbers for FY11 and FY12 were revised in FY13 as a result of a revision to Scope 2 total calculations.

and reducing GHG emissions. To that end, the Laboratory has already moved to promote reductions in GHGs. Now that 8 years of data have been gathered, the next step is to continue to implement GHG reduction strategy activities into everyday operations that will contribute to the EO goals and continue to reduce GHG emissions.

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White House, "Federal Greenhouse Gas Accounting and Reporting Guidance," Revision 1, June 4, 2012.

White House, "Federal Greenhouse Gas Accounting and Reporting Guidance: Technical Support Document," Revision 1, June 2012.

WREGIS, "Renewable Energy Certificate Sales Agreement," Appendix F, Western Renewable Energy Generation Information System, July 15, 2014.

Appendix A

Global Warming Potentials

Appendix A

Global Warming Potentials

Table A-1 below shows the GWPs for the GHGs that were considered to have been released by INL during FY15. All GWP values shown are based on those used in the EPA Mandatory Reporting Rule.

Table A-1. Global warming potentials.

Name	CAS No.	Chemical Formula	Global Warming Potential (100 year)
Carbon dioxide	124–38–9	CO_2	1
Methane	74–82–8	CH_4	25
HFC–32	75–10–5	CH_2F_2	675
HFC–125	354–33–6	C_2HF_5	3,500
HFC–134a	811–97–2	CH_2FCF_3	1,430
PFC-218	76-19-7	C_3F_8	8,830
Sulfur Hexafluoride	2551-62-4	SF_6	22,800
Source: EPA Mandatory Reporting Rule, 40 CFR 98. Table A-1 to Subpart A of Part 98. http://www.ecfr.gov/, Web page accessed March 2016.			

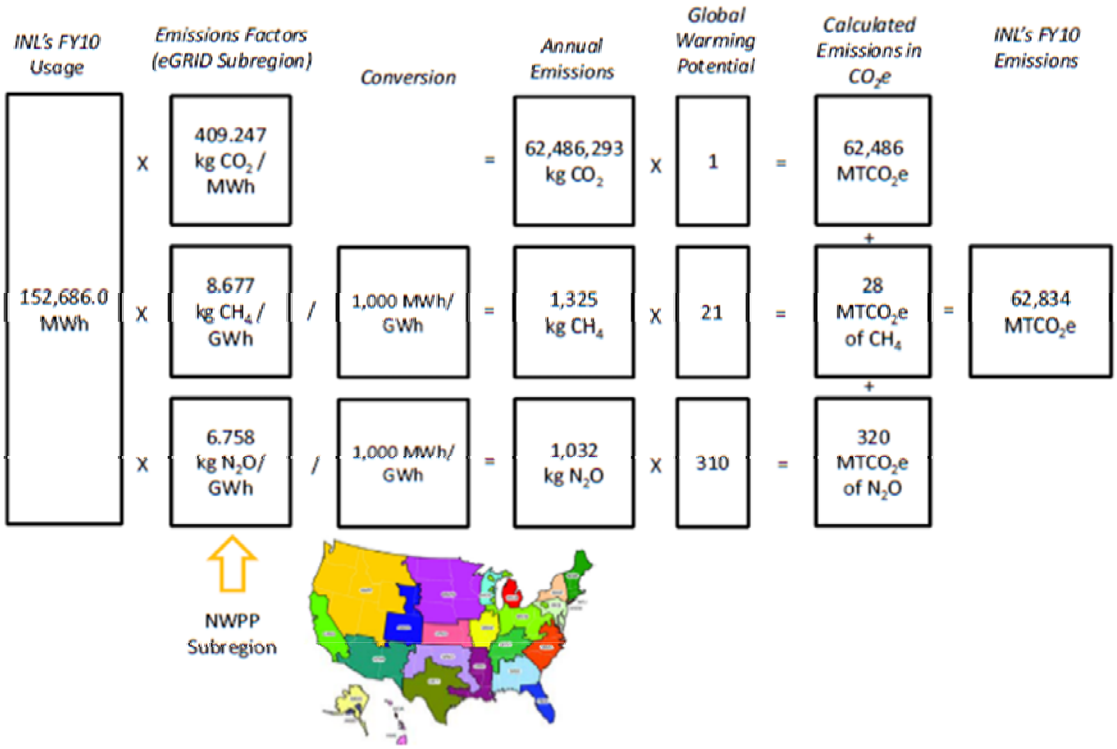
Appendix B

Sample Calculation

Appendix B

Sample Calculation

This calculation for electricity is an example of the calculation steps followed for calculating the GHG emissions from each of INL's emissions categories.



Appendix C

Scope 1 Comprehensive Tables

Appendix C

Scope 1 Comprehensive Tables

Table C-1. INL's GHG emissions from FY08 to FY15.

Scope	Emissions Category	FY08 GHG Emissions (MT CO_2e)	FY09 GHG Emissions (MT CO_2e)	FY10 GHG Emissions (MT CO_2e)	FY11 GHG Emissions (MT CO_2e)	FY12 GHG Emissions (MT CO_2e)	FY13 GHG Emissions (MT CO_2e)	FY14 GHG Emissions (MT CO_2e)	FY15 GHG Emissions (MT CO_2e)
1 (Direct)	Stationary Combustion	15,213	13,381	14,288	9,826	5,682	5,391	8,249	5,505
	Mobile Combustion	10,040	8,545	7,383	7,680	6,834	5,523	6,396	6,863
	Fugitive Emissions: Refrigerants	245	200	385	640	481	372	89	764
	Fugitive Emissions: Onsite Landfill	5,963	5,878	5,785	5,702	5,617	5,532	6,480	6,381
	Fugitive Emissions: Onsite Wastewater Treatment	129	130	136	142	131	123	118	148
	SCOPE 1 TOTAL	31,591	28,133	27,978	23,991	18,745	16,940	21,332	19,661
2 (Indirect)	Purchased Electricity	61,746	58,297	61,364	55,862	54,595	56,242	50,198	42,281
	Transmission & Distribution Losses (Owned)	1,532	1,450	1,470	1,109	975	796	919	652
	Purchased RECs	-3,474	-6,813	-11,480	(15,332)	(14,082)	(14,722)	(15,119)	(23,321)
	SCOPE 2 TOTAL	59,804	52,934	51,354	41,639	41,488	42,316	35,998	19,613
3 (Indirect)	Transmission & Distribution Losses (Shared)	4,170	3,937	4,141	3,754	3,662	3,759	3,367	2,786
	Employee Commuting	8,657	9,354	10,171	9,410	8,313	7,666	7,525	10,248
	Business Air Travel	6,687	7,380	6,785	5,765	4,364	3,320	3,875	4,559
	Business Ground Travel: Rental Vehicle	351	337	393	319	300	186	286	272
	Business Ground Travel: Personal Vehicle	413	411	422	531	251	185	143	183
	Contracted MSW Disposal	1,187	903	956	967	853	677	985	999
	Contracted Wastewater Treatment	190	201	214	79	13	11	10	11
	SCOPE 3 TOTAL	21,654	22,523	23,082	20,825	17,757	15,805	16,191	19,057

Table C-1 (continued).

Scope	Emissions Category	FY08 GHG Emissions (MT CO_2e)	FY09 GHG Emissions (MT CO_2e)	FY10 GHG Emissions (MT CO_2e)	FY11 GHG Emissions (MT CO_2e)	FY12 GHG Emissions (MT CO_2e)	FY13 GHG Emissions (MT CO_2e)	FY14 GHG Emissions (MT CO_2e)	FY15 GHG Emissions (MT CO_2e)
TOTAL ANTHROPOGENIC EMISSIONS[a]		113,049	103,590	102,413	86,455	77,989	75,061	73,521	58,330
Biogenic	Mobile Combustion	162	723	1,182	1,339	1,855	1,274	1,667	1,707
	Fugitive Emissions: Onsite Landfill	866	853	840	828	816	803	790	778
	Contracted MSW Disposal	155	118	125	127	112	89	108	110
TOTAL BIOGENIC EMISSIONS		1,184	1,695	2,148	2,294	2,782	2,165	2,566	2,595
TOTAL EMISSIONS (ANTHROPOGENIC + BIOGENIC)		114,233	105,285	104,561	88,748	80,771	77,226	76,087	60,925

a. These are the numbers that INL will report as their overall emissions. Furthermore, this is the number that INL will be trying to reduce in future years.

Scope 2 numbers for FY11 and FY12 were revised in FY13 as a result of a revision to Scope 2 total calculations performed in FY13.

Table C-2. Amounts of fuel used for stationary combustion at INL during FY08.

Energy Type	Fuel Used		GHG Emissions ($MT CO_2e$)
	Amount	Units	
Fuel Oil No. 2	1,247,088	Gallons	12,771
Liquefied Natural Gas (LNG)	43,590	Gallons	321
Liquefied Propane Gas (LPG)	149,475	Gallons	870
Natural Gas (Pipeline)	236,600	Therms	1,252
		TOTAL	15,213

Table C-3. Amounts of fuel used for stationary combustion at INL during FY09.

Energy Type	Fuel Used		GHG Emissions ($MT CO_2e$)
	Amount	Units	
Fuel Oil No. 2	1,098,582	Gallons	11,250
Liquefied Natural Gas (LNG)	41,259	Gallons	304
Liquefied Propane Gas (LPG)	74,660	Gallons	434
Natural Gas (Pipeline)	263,099	Therms	1,392
		TOTAL	13,381

Table C-4. Amounts of fuel used for stationary combustion at INL during FY10.

Energy Type	Fuel Used		GHG Emissions ($MT CO_2e$)
	Amount	Units	
Fuel Oil No. 2	1,173,716	Gallons	12,020
Liquefied Natural Gas (LNG)	43,284	Gallons	318
Liquefied Propane Gas (LPG)	95,586	Gallons	556
Natural Gas (Pipeline)	263,433	Therms	1,394
		TOTAL	14,288

Table C-5. Amounts of fuel used for stationary combustion at INL during FY11.

Energy Type	Fuel Used		GHG Emissions ($MT CO_2e$)
	Amount	Units	
Fuel Oil No. 2	751,045	Gallons	7,691
Liquefied Natural Gas (LNG)	35,392	Gallons	260
Liquefied Propane Gas (LPG)	58,659	Gallons	341
Natural Gas (Pipeline)	289,757	Therms	1,533
		TOTAL	9,826

Table C-6. Amounts of fuel used for stationary combustion at INL during FY12.

Energy Type	Fuel Used		GHG Emissions ($MT CO_2e$)
	Amount	Units	
Fuel Oil No. 2	371,587	Gallons	3,805
Liquefied Natural Gas (LNG)	36,263	Gallons	267
Liquefied Propane Gas (LPG)	53,366	Gallons	310
Natural Gas (Pipeline)	245,554	Therms	1,299
		TOTAL	5,682

Table C-7. Amounts of fuel used for stationary combustion at INL during FY13.

Energy Type	Fuel Used		GHG Emissions ($MT CO_2e$)
	Amount	Units	
Fuel Oil No. 2	309,029	Gallons	3,165
Liquefied Natural Gas (LNG)	32,664	Gallons	240
Liquefied Propane Gas (LPG)	57,138	Gallons	332
Natural Gas (Pipeline)	312,433	Therms	1,653
		TOTAL	5,391

Table C-8. Amounts of fuel used for stationary combustion at INL during FY14.

Energy Type	Fuel Used		GHG Emissions ($MT CO_2e$)
	Amount	Units	
Fuel Oil No. 2	466,282	Gallons	4,775
Liquefied Natural Gas (LNG)	38,997	Gallons	287
Liquefied Propane Gas (LPG)	61,495	Gallons	351
Natural Gas (Pipeline)	535,400	Therms	2,836
		TOTAL	8,249

Table C-9. Amounts of fuel used for stationary combustion at INL during FY15.

Energy Type	Fuel Used		GHG Emissions ($MT CO_2e$)
	Amount	Units	
Fuel Oil No. 2	189,217	Gallons	1,938
Liquefied Natural Gas (LNG)	24,851	Gallons	183
Liquefied Propane Gas (LPG)	98,333	Gallons	561
Natural Gas (Pipeline)	533,192	Therms	2,824
		TOTAL	5,505

Table C-10. Fuel amounts and corresponding GHG emissions for INL's FY08 fleet.

Fuel Type	Vehicle Type	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B15 Biodiesel Blend[a]	Bus	50,677.20	440	72
	Equipment	77.10	1	<1
	Heavy Duty	836.50	7	1.19
	Light-Duty Truck	19.60	<1	<1
Compressed Natural Gas (CNG)	Bus	90.00	1	—
	Light-Duty Car	54.30	<1	—
	Light-Duty Truck	437.40	3	—
Diesel	Bus	544,548.50	5,563	—
	Equipment	50,229.00	517	—
	Heavy Duty	50,066.80	512	—
	Light-Duty Truck	10,326.70	105	—
E85 Ethanol Fuel Blend	Light-Duty Car	2,063.20	4	10.08
	Light-Duty Truck	16,195.00	27	79.14
Gasoline	Bus	2,391.50	21	—
	Equipment	5,803.10	51	—
	Heavy Duty	6,852.90	64	—
	Light-Duty Car	15,529.40	141	—
	Light-Duty Truck	241,383.42	2,228	—
LNG	Bus	45,964.30	348	—
	Light-Duty Truck	30.00	<1	—
Propane	Equipment	851.90	5	—
	TOTAL	1,044,427.83	10,040	162

a. Carol Comstock clarified in a December 10, 2009, phone call that BEA utilizes a combination of B10 (used in winter) and B20 (used in summer), and the exact amounts of each blend are not currently tracked (at least not in such a way that can easily be reported). Assume a 50/50 split of B10 and B20, and therefore refer to the biodiesel blend as B15.

Since the vehicle type category was reported a bit differently than the subsequent years, only FY09-FY15 is combined in the comprehensive tables on the following pages.

Table C-11. Fuel amounts and corresponding GHG emissions for INL's fleet—FY09 to FY11.

Fuel Type	Vehicle Type	FY09			FY10			FY11		
		Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B15 Biodiesel Blend[a]	Bus	219,814.50	1,909	312	331,916.34	2,883	471	363,731.46	3,159	516
	Equipment	9,462.90	83	13	14,256.11	125	20	5,454.84	48	8
	Light-Duty Truck	6,551.70	57	9	8,797.74	76	12	2,118.54	18	3
	Truck	2,351.00	20	3	3,061.95	27	4	546.93	5	1
Diesel	Bus	302,302.50	3,088	—	186,610.28	1,906	—	164,017.55	1,676	—
	Equipment	96,249.70	991	—	54,192.00	558	—	78,481.02	808	—
	Heavy Duty	21,369.20	218	—	20,127.87	206	—	32,963.00	337	—
	Light-Duty Truck	6,071.00	62	—	5,553.66	57	—	7,540.25	77	—
E10 Ethanol Fuel Blend	Bus	1,138.60	9	<1	76.20	<1	<1	—	—	—
	Equipment	76,793.90	615	44	19,590.83	157	11	22,401.88	179	13
	Light-Duty Car	14,218.80	117	8	6,646.48	56	4	6,242.52	52	4
	Light-Duty Truck	122,823.80	1,025	71	4,134.43	34	2	1,907.45	16	1
E85 Ethanol Fuel Blend	Bus	66.80	<1	<1	130,063.10	1,085	75	125,990.31	1,051	72
	Equipment	3,223.90	5	16	1,946.67	3	10	647.81	1	3
	Light-Duty Car	3,398.35	6	17	8,457.22	15	41	8,583.05	15	42
	Light-Duty Truck	46,965.15	80	230	108,806.18	186	532	138,476.16	236	677
Gasoline	Equipment	1,717.30	15	—	845.60	7	—	—	—	—
LNG	Bus	31,771.00	241	—	38.00	<1	—	—	—	—
	Equipment	231.00	2	—	76.00	<1	—	—	—	—
	TOTAL	966,521.10	8,545	723	905,196.64	7,383	1,182	959,102.76	7,680	1,339

a. Carol Comstock clarified in a December 10, 2009, phone call that BEA utilizes a combination of B10 (used in winter) and B20 (used in summer), and the exact amounts of each blend are not currently tracked (at least not in such a way that can be easily reported). Assume a 50/50 split of B10 and B20, and refer to the biodiesel blend as B15. Tad Pearson confirmed in a December 22, 2010, phone call that this assumption was valid for FY09 and FY10.

Table C-12. Fuel amounts and corresponding GHG emissions for INL's fleet—FY12 to FY15.

Fuel Type	Vehicle Type	FY12			FY13			FY14			FY15		
		Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)	Fuel Used (gal)	GHG Emissions (MT CO_2e)	Biogenic Emissions (MT CO_2e)
B20 Biodiesel Blend[a]	Bus	389,607.82	3,184.95	736.48	386,333.66	3,158.18	730.29	428,397.73	3,501.95	809.80	438,355.55	3,583.35	828.63
	Equipment	4,026.97	33.24	5.71	3,434.83	28.36	6.49	3,397.53	28.05	6.42	4,877.18	40.27	9.22
	Heavy Duty	765.48	6.26	1.45	364.34	2.98	0.69	84.42	0.69	0.16	302.04	2.47	0.57
	Light-Duty Truck	—	—	—	—	—	—	94.55	0.77	0.18	136.88	1.12	0.26
Compressed Natural Gas (CNG)	Bus	—	—	—	—	—	—	—	—	—	—	—	—
	Light-Duty Car	—	—	—	—	—	—	—	—	—			
	Light-Duty Truck	—	—	—	—	—	—	—	—	—			
Diesel	Bus	106,683.01	1,089.88	—	27,738.99	283.38	—	27,119.78	277.05	—	17,024.09	173.92	—
	Equipment	46,311.52	476.97	—	38,224.96	393.69	—	36,691.64	377.87	—	67,390.69	694.02	—
	Heavy Duty	26,717.37	273.07	—	28,485.68	291.14	—	38,909.46	397.66	—	56,982.22	582.37	—
	Light Duty Car[b]	—	—	—	6.01	0.06	—	6.01	0.06	—	—	—	—
	Light-Duty Truck	6,966.56	71.16	—	5,977.91	61.06	—	10,285.37	105.05	—	9,246.66	94.44	—
E85 Ethanol Fuel Blend	Equipment	1,367.85	2.29	6.68	2,669.71	4.33	13.05	2,749.37	4.44	13.44	1,480.46	2.39	7.23
	Light-Duty Car	7,302.10	13.17	35.68	6,292.66	11.22	30.75	6,250.13	11.06	30.54	5,262.08	9.31	25.71
	Light-Duty Truck	199,673.62	341.30	975.73	84,519.11	142.54	413.01	144,530.18	242.28	706.26	150,741.77	252.69	736.62
Gasoline	Bus	3,464.86	29.08	1.99	119.68	0.95	0.07	389.54	3.10	0.22	—	—	—
	Equipment	1,625.20	13.38	0.93	20,177.56	161.52	11.60	14,036.47	112.34	8.07	13,567.62	112.23	8.06
	Heavy Duty	133,636.56	1,114.90	76.83	2,999.46	25.17	1.72	3,883.23	32.53	2.23	3,533.71	29.60	2.03
	Light-Duty Car	—	—	—	1,501.70	12.36	0.86	1,352.14	11.12	0.78	589.16	4.84	0.34
	Light-Duty Truck	1,367.85	2.29	6.68	113,383.25	945.93	65.18	154,862.58	1,289.89	89.03	153,633.47	1,279.65	88.32
TOTAL		951,170.45	6,833.91	1,854.72	722,229.52	5,522.88	1,273.72	873,040.13	6,395.91	1,667.14	923,123.58	6,862.68	1,706.99

a. Per October 11, 2012, e-mail from Tad Pearson, BEA utilized a B20 (20% biodiesel blend) for the FY12 reporting year. BEA continued to use the B20 for subsequent years (FY13–FY15).

b. New category for FY13.

Table C-13. Fugitive refrigerants evaluated for GHG emissions from FY08 to FY13 at INL.

Common Name	GWP	FY08		FY09		FY10		FY11		FY12		FY13	
		Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)
CO_2	1	NE	NE	20,072.60	9	1,849.18	1	1,849.18	1	3.22	0.0	−39.81	−0.02
CH_4	21	NE	NE	2,842.50	27	32,961.47	314	32,961.47	314	−588.29	−5.6.0	33,106.47	315.36
N_2O	310	NE	NE	0.00	0	20.18	3	20.18	3	0.0	0.0	0.0	0.0
HFC-23	11,700	0.43	2	1.50	8	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-32	650	71.99	21	0.00	0	92.13	27	92.13	27	180.5	53.22	30.75	9.07
HFC-41	150	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-125	2,800	88.98	113	0.00	0	100.15	127	100.15	127	60.12	76.35	31.25	39.69
HFC-134	1,000	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-134a	1,300	173.15	102	238.20	140	316.35	187	316.35	187	419.61	247.44	13.07	7.70
HFC-143	300	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-143a	3,800	0.20	<1	0.00	0	−18.72	−32	−18.72	−32	20.76	35.78	0.0	0.0
HFC-152	53	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-152a	140	23.88	2	23.50	1	3.28	0	3.28	0	77.22	4.90	0.29	0.02
HFC-161	12	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-227ca	2,900	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-227ea	2,900	0.00	0	0.00	0	46.0	61	46.0	61	0.0	0.0	0.0	0.0
HFC-236ca	120	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-236cb	1,340	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-236ea	1,370	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-236fa	6,300	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-245ca	560	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-245fa	1,030	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
HFC-365mfc	794	3.86	1	38.00	14	−0.4	0	−0.4	0	0.9	0.32	0.0	0.0
HFC-c-447-ef	250	0.00	0	0.00	0	NE	NE	NE	NE	NE	NE	NE	NE
HFC-43-10mee	1,300	1.69	1	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-14	6,500	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-116	9,200	0.51	2	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-218	7,000	0.00	0	0.00	0	0.0	0	0.0	0	1.1	3.5	0.0	0.0
PFC-318 or PFCc318	8,700	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-3-1-10	7,000	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-4-1-12	7,500	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-5-1-14	7,400	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
PFC-9-1-18	7,500	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
c-C_3F_6	17,340	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
SF_6 - Sulfur Hexafluoride	23,900	0.00	0	0.00	0	−4.28	−46	−4.28	−46	6.0	65.05	0.0	0.0
NF_3	17,200	0.00	0	0.00	0	0.0	0	0.0	0	0.0	0.0	0.0	0.0
TOTAL		364.69	245	23,216.30	200	29,242.00	385	35,365.34	640	181.15	480.96	33,142.02	371.82
NE = Not evaluated. Refrigerant was not included in data call table.													

Table C-14. Fugitive refrigerants evaluated for GHG emissions for FY14–FY15 at INL.

Common Name	GWP	FY14		FY15	
		Mass Emitted (lbs)	GHG Emissions (MT CO_2e)	Mass Emitted (lbs)	GHG Emissions (MT CO_2e)
CO_2	1	−137.78	−0.06	−114.95	−0.05
CH_4	25	123.35	1.40	34,699.70	393.49
N_2O	298	0.0	0.0	0.00	0.00
HFC-23	14,800	0.0	0.0	0.00	0.00
HFC-32	675	49.2	15.06	21.90	6.71
HFC-41	92	0.0	0.0	0.00	0.00
HFC-125	3,500	38.75	61.52	22.50	35.72
HFC-134	1,100	0.0	0.0	0.00	0.00
HFC-134a	1,430	17.55	11.38	55.22	35.82
HFC-143	353	0.0	0.0	0.00	0.00
HFC-143a	4,470	0.0	0.0	0.00	0.00
HFC-152	53	0.0	0.0	0.00	0.00
HFC-152a	124	1.7	0.10	0.00	0.00
HFC-161	12	0.0	0.0	0.00	0.00
HFC-227ca	NL	0.0	0.0	0.00	0.00
HFC-227ea	3,220	0.0	0.0	0.00	0.00
HFC-236ca	NL	0.0	0.0	0.00	0.00
HFC-236cb	1,340	0.0	0.0	0.00	0.00
HFC-236ea	1,370	0.0	0.0	0.00	0.00
HFC-236fa	9,810	0.0	0.0	0.00	0.00
HFC-245ca	693	0.0	0.0	0.00	0.00
HFC-245fa	1,030	0.0	0.0	0.00	0.00
HFC-365mfc	794	0.0	0.0	0.00	0.00
HFC-c-447-ef	NL	NE	NE	NE	NE
HFC-43-10mee	1,640	0.0	0.0	0.00	0.00
PFC-14	7,390	0.0	0.0	0.00	0.00
PFC-116	12,200	0.0	0.0	0.00	0.00
PFC-218	8,830	0.0	0.0	-0.05	-0.18
PFC-318 or PFCc318	10,300	0.0	0.0	0.00	0.00
PFC-3-1-10	8,860	0.0	0.0	0.00	0.00
PFC-4-1-12	9,160	0.0	0.0	0.00	0.00
PFC-5-1-14	9,300	0.0	0.0	0.00	0.00
PFC-9-1-18	7,500	0.0	0.0	0.00	0.00
c-C_3F_6	17,340	0.0	0.0	0.00	0.00
SF_6 - Sulfur Hexafluoride	22,800	0.0	0.0	28.26	292.32
NF_3	17,200	0.0	0.0	0.00	0.00
TOTAL		95.77	89.41	34,712.58	763.83

NE = Not evaluated. Refrigerant was not included in data call table.

Updated GWPs in 2014 are in red

Appendix D

Emissions Factors Used

Appendix D

Emissions Factors Used

D-1. SCOPE ONE – DIRECT EMISSIONS

Table D-1. Stationary combustion conversion and emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
Fuel Oil No. 2	Higher Heating Value (HHV) Conversion Factor	0.138	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	73.96	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.003	kg CH_4/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0006	kg N_2O/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
Liquefied Natural Gas (LNG)	HHV Conversion Factor	0.110	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	66.88	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.001	kg CH_4/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0001	kg N_2O/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.

Table D-1. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Natural Gas (Pipeline)	Conversion Factor	0.001028	MMBtu/scf	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	Conversion Factor	96.99	scf/therm	Published conversion in common literature.
	CO_2 Emission Factor	53.06	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.001	kg CH_4/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0001	kg N_2O/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
Liquefied Propane Gas (LPG)	HHV Conversion Factor	0.092	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	61.71	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CH_4 Emission Factor	0.003	kg CH_4/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.
	N_2O Emission Factor	0.0006	kg N_2O/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-2 to Subpart C of Part 98.

Table D-2. Mobile combustion emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
Gasoline (Considered "Motor gasoline")	HHV Conversion Factor	0.125	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	70.22	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
Gasoline, Bus (Considered "Gasoline Buses")	CH_4 Emissions Factor	0.021	g CH_4/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (August 2012).xlsx"
	N_2O Emissions Factor	0.017	g N_2O/mile	Emission Factors from Cross-Sector Tools, GHG Protocol, "Emission factors from cross-sector tools (August 2012).xlsx."
Gasoline, Light-Duty Car (Considered "Gasoline Passenger Car," Tier 1 [1995–2000])	CH_4 Emissions Factor	0.0271	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0429	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Gasoline, Light-Duty Truck (Considered "Gasoline Light-Duty Trucks," Tier 1 [1995–2000])	CH_4 Emissions Factor	0.0452	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0871	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Gasoline, Equipment (Considered "Gasoline Construction Equipment")	CH_4 Emissions Factor	0.5	g CH_4/gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.22	g N_2O/gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Gasoline, Heavy Duty (Considered "Gasoline Heavy-Duty Trucks," Tier 0)	CH_4 Emissions Factor	0.0655	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.

Table D-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
LNG (Considered "Natural Gasoline")	HHV Conversion Factor	0.110	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emission Factor	66.83	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
LNG, Bus (Considered "CNG Buses")	CH_4 Emissions Factor	1.966	g CH_4/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
LNG, Equipment (Considered "LNG Heavy-Duty Vehicles")	CH_4 Emissions Factor	1.966	g CH_4/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Diesel (Considered "Distillate Fuel Oil No. 2")	HHV Conversion Factor	0.138	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	73.96	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
Diesel, Bus (Considered "Diesel Heavy-Duty Trucks")	CH_4 Emissions Factor	0.0051	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0048	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Diesel, Light Duty Car (Considered "Diesel Passenger Car, Moderate)	CH_4 Emissions Factor	0.0005	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0010	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Diesel, Light-Duty Truck (Considered "Diesel Light Trucks," Moderate)	CH_4 Emissions Factor	0.0009	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0014	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.

Table D-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Diesel, Heavy Duty (Considered "Diesel Heavy-Duty Trucks")	CH_4 Emissions Factor	0.0051	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0048	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Diesel, Equipment (Considered "Diesel Construction Equipment")	CH_4 Emissions Factor	0.58	g CH_4/gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.26	g N_2O/gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Biodiesel (Considered "Biodiesel [100%]")	HHV Conversion Factor	0.128	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	73.84	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
Biodiesel, Bus (Considered "Diesel Heavy-Duty Trucks")	CH_4 Emissions Factor	0.0051	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0048	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Biodiesel, Equipment (Considered "Diesel Construction Equipment")	CH_4 Emissions Factor	0.58	g CH_4/gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.26	g N_2O/gal	Table A-6, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Biodiesel, Light-Duty Truck (Considered "Diesel Light Trucks," Moderate)	CH_4 Emissions Factor	0.0009	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0014	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Biodiesel, Heavy-Duty (Considered "Diesel Heavy-Duty Vehicles")	CH_4 Emissions Factor	0.0051	g CH_4/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.0048	g N_2O/mile	Table A-1, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.

Table D-2. (continued).

Emissions Source	Factor Type	Amount	Units	Reference
Ethanol (Considered "Ethanol [100%]")	HHV Conversion Factor	0.084	MMBtu/gal	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
	CO_2 Emissions Factor	68.44	kg CO_2/MMBtu	EPA Mandatory Reporting Rule, 40 CFR 98, Table C-1 to Subpart C of Part 98.
Ethanol, Bus (Considered "Ethanol Buses")	CH_4 Emissions Factor	0.197	g CH_4/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Ethanol, Equipment and Heavy Duty (Considered "Ethanol Heavy-Duty Vehicles")	CH_4 Emissions Factor	0.197	g CH_4/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.175	g N_2O/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
Ethanol, Light-Duty Car and Truck (Considered "Ethanol Light-Duty Vehicles")	CH_4 Emissions Factor	0.055	g CH_4/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.
	N_2O Emissions Factor	0.067	g N_2O/mile	Table A-7, EPA Climate Leaders, Mobile Combustion Sources, EPA 430-K-08-004, May 2008.

Fugitive emissions are based directly on the GWP of the various gases emitted, so no additional table is provided from Table 8 that was shown previously in the main body.

D-2. SCOPE TWO – INDIRECT EMISSIONS

Table D-3. Electricity emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
INL Site Electricity Purchase (and T&D loss) (Considered NWPP of "WECC" eGRID Subregion)	CO_2 Emissions Factor	301.979	kg CO_2/MWh	EPA, eGRID 2012 Summary Tables, p. 3, "Output Emission Rates."
	CH_4 Emissions Factor	5.715	kg CH_4/GWh	EPA, eGRID 2012 Summary Tables, p. 3, "Output Emission Rates."
	N_2O Emissions Factor	4.708	kg N_2O/GWh	EPA, eGRID 2012 Summary Tables, p. 3, "Output Emission Rates."
FY15 RECs Purchase (Considered NWPP of "WECC" eGRID Subregion)	CO_2 Emissions Factor	716.255	kg CO_2/MWh	EPA, eGRID 2012 Summary Tables, p. 3, "Output Emission Rates."
	CH_4 Emissions Factor	17.373	kg CH_4/GWh	EPA, eGRID 2012 Summary Tables, p. 3, "Output Emission Rates."
	N_2O Emissions Factor	10.360	kg N_2O/GWh	EPA, eGRID 2012 Summary Tables, p. 3, "Output Emission Rates."

D-3. SCOPE THREE – INDIRECT EMISSIONS

Table D-4. Employee commute, rental car miles, and personal car miles emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
Passenger Cars	CO_2 Emissions Factor	0.364	kg CO_2/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	CH_4 Emissions Factor	0.031×10^{-3}	kg CH_4/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	N_2O Emissions Factor	0.032×10^{-3}	kg N_2O/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
Light-Duty Truck/Van/SUV	CO_2 Emissions Factor	0.519	kg CO_2/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	CH_4 Emissions Factor	0.036×10^{-3}	kg CH_4/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.
	N_2O Emissions Factor	0.047×10^{-3}	kg N_2O/ vehicle-mile	Table 5, EPA Climate Leaders, Commuting, Business Travel & Mobile Transport, EPA 430-R-08-006, May 2008.

Table D-5. Business travel airline miles emissions factors used.

Emissions Source	Factor Type	Amount	Units	Reference
Airline Miles, Short Haul (<300 miles)	CO_2 Emissions Factor	0.275	kg CO_2/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2015 Reporting – BEA Only.xlsx"
	CH_4 Emissions Factor	9.1×10^{-6}	kg CH_4/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2015 Reporting – BEA Only.xlsx"
	N_2O Emissions Factor	8.7×10^{-6}	kg N_2O/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2015 Reporting – BEA Only.xlsx"
Airline Miles, Medium Haul (300–700 miles)	CO_2 Emissions Factor	0.162	kg CO_2/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2015 Reporting – BEA Only.xlsx"
	CH_4 Emissions Factor	8.0×10^{-7}	kg CH_4/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2015 Reporting – BEA Only.xlsx"
	N_2O Emissions Factor	5.2×10^{-6}	kg N_2O/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2015 Reporting – BEA Only.xlsx"
Airline Miles, Long Haul (≥700 miles)	CO_2 Emissions Factor	0.191	kg CO_2/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2015 Reporting – BEA Only.xlsx"
	CH_4 Emissions Factor	8.0×10^{-7}	kg CH_4/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2015 Reporting – BEA Only.xlsx"
	N_2O Emissions Factor	6×10^{-6}	kg N_2O/ passenger-mile	Tab 1.3 Factors & Drop Down Key, FY 2014+ Factors from "CEDR FY 2015 Reporting – BEA Only.xlsx"

Appendix E

Scope 2 Comprehensive Tables

Appendix E

Scope 2 Comprehensive Tables

Table E-1. INL's GHG emissions from electricity and RECs purchased in FY08–FY15.

Emissions Category	FY08 GHG Emissions (MT CO_2e)	FY09 GHG Emissions (MT CO_2e)	FY10 GHG Emissions (MT CO_2e)	FY11 GHG Emissions (MT CO_2e)[a]	FY12 GHG Emissions (MT CO_2e)	FY13 GHG Emissions (MT CO_2e)	FY14 GHG Emissions (MT CO_2e)	FY15 GHG Emissions (MT CO_2e)
Purchased Electricity (includes T&D losses within INL's operational controls)	63,278	59,747	62,834	56,971	55,570	57,038	51,117	42,933
Purchased RECs (displaced GHG emissions)	-3,474	-6,813	-11,480	-15,332	-14,082	-14,722	-15,119	-23,321
SCOPE 2 TOTAL	59,804	52,934	51,354	41,639	41,488	42,316	35,998	19,613

a. Scope 2 numbers for FY11 and FY12 were revised in FY13 as a result of a revision to Scope 2 total calculations.

Appendix F

Receipt for RECs Purchased in FY15

Appendix F

Receipt for RECs Purchased in FY15

INL FORM
PROC-1811
08/30/2010

CONTRACT NO. 00160325
BATTELLE ENERGY ALLIANCE, LLC (BEA)
2525 FREMONT AVENUE, P. O. BOX 1625, IDAHO FALLS, ID 83415
OPERATING UNDER U.S. GOVERNMENT CONTRACT NO. DE-AC07-05ID14517

To: Idaho Falls Power
140 S Capitol
Idaho Falls, ID 83402

Effective Date: 08/05/2015

To: Bear Prairie
Phone: (208) 612-8234
Fax: (208) 612-8435

Completion Date: 09/30/2015

1. **STATEMENT OF WORK**

1.1. Idaho Falls Power (Subcontractor) shall furnish the following services, in accordance with the requirements, terms and conditions specified or referenced in this Contract.

No.	Qty	UOM	Description	Unit Price	Extended Price
1	32,400	EA	New Western Renewable Energy Generation Information System (WREGIS) Renewable Energy Certificates from Wind Generation Facilities during the time period June, 2014 – May, 2016. Subcontractor will retire in the WREGIS systems the contract quantity of REC's on behalf of BEA in a Retirement Sub-account in accordance with the Idaho Falls Power Renewable Energy Certificate Sales Agreement with an effective date of July 15, 2015 (Attachment A).	$1.25	$40,500.00

2. **RESOURCES**

2.1. The Subcontractor shall provide all resources, e.g., materials, labor, equipment, necessary to fulfill the requirements of this Contract, except as otherwise specified.

3. **APPLICABLE DOCUMENTS**

3.1. The following documents are incorporated into, and become a part of, this Contract:

3.1.1. Form 540.33, "Change Request."

Contract Specialist: George Wood	Telephone: (208) 526-7085	Fixed Price: $40,500.00
Ship via: N/A	F.O.B./Trans.: N/A	Cash Terms: Net 30 Days

Billing:
Accounts Payable
Send invoice in PDF format to acctpay@inl.gov
or
Mail to:
Accounts Payable
P.O. Box 1625
Idaho Falls, ID 83415-3117
Attn: Contract No. 00160325
ACH and W-9 to Vendorinfo@inl.gov

Ship To:
N/A

(BEA Use Only)

Signed: George Wood
Digitally signed by George Wood
DN: cn=George Wood, o=Battelle Energy Alliance, LLC, ou=Procurement Services, email=George.Wood@inl.gov, c=US
Date: 2015.08.05 13:35:00 -06'00'

George Wood — Date

Title: Contract Specialist

Signed: _____

(Subcontractor's Official) — Date

Title: _____

Return one signed copy of this Contract No. 00160325 to George Wood

4. TERMS AND CONDITIONS

4.1. General Provisions: The following document is incorporated by reference and hereby forms a part of this action: Form PROC-202, BEA General Provisions for Commercial Items/Services dated November 2014 Note: BEA's General Provisions are available at the following Internet address: https://inlportal.inl.gov/portal/server.pt/community/procurement/346/documents_and_forms.

4.2. Certification of Eligibility: Subcontractor, by entering into this Contract, certifies that it is not debarred, or proposed for debarment, by the Federal Government. Disclosure that Subcontractor was debarred, suspended, or proposed for debarment, by the Federal Government on or before the effective date of this Contract shall constitute an additional basis for termination under the Default Article of the General Provisions.

4.3. IRS Forms: Pursuant to U.S. tax law, BEA is required to report certain payments to the Internal Revenue Service (IRS). The Subcontractor agrees to furnish a completed IRS Form W-9, (for U.S. persons), W-8 (for non-U.S. persons) or other applicable IRS form to BEA prior to any request for payment. Forms can be accessed at http://www.irs.gov/app/picklist/list/formsInstructions.html. (W-9 form can be accessed at: http://www.irs.gov/pub/irs-pdf/fw9.pdf?portlet=3) Forms may be submitted electronically to: Vendorinfo@inl.gov or faxed to (208) 526-8240.

4.4. Sales Tax: Subcontractor's price shall include Idaho sales tax for materials specified under this Contract, if any.

4.5. Tax Reporting: In addition to the Federal, State and Local Tax requirements, contained in the applicable General Provisions, the Subcontractor is reminded of its obligation to comply with tax reporting requirements, including the reporting of assets that may be subject to any personal property or transient personal property tax. Subcontractor should be aware that the geographical boundaries of the INL encompass multiple counties. A map of counties within the INL boundaries is available at https://inlportal.inl.gov/portal/server.pt/community/procurement/346/documents_and_forms.

4.6. Sustainable Acquisition: Subcontractor shall comply with the sustainable acquisition clauses contained in the Article of the General Provisions entitled Materials and Workmanship (i.e., recycled items, energy efficiency in recycled products, environmentally preferable purchasing for electronic products, electronic items, biobased material, environmentally preferable material, low emitting materials, WaterSense-labeled materials). The following online resources are available: Green Procurement Compilation Tool at http://sftool.gov/greenprocurement?CFID=108518&CFTOKEN=42165006,Energy Star Qualified Products at http://www.energystar.gov/products,FEMP Energy Efficient Product Procurement at http://www1.eere.energy.gov/femp/technologies/procuring_eeproducts.html, EPA's Comprehensive Procurement Guideline at http://www.epa.gov/cpg, CPG Product Supplier Directory at http://www.epa.gov/wastes/conserve/tools/cpg/directory.htm, EPEAT registered computer products at http://www.epeat.net/, BioPreferred Products at http://www.biopreferred.gov/bioPreferredCatalog/faces/jsp/catalogLanding.jsp, Whole Building Design Guide Low-Emitting Materials at http://www.wbdg.org/references/mou_lem.php, Whole Building Design Guide Enhance Indoor Environmental Quality at http://www.wbdg.org/design/ieq.php, Federal Green Construction Guide for Specifiers at http://www.wbdg.org/design/greenspec.php, EPA Water Sense at http://www.epa.gov/watersense/, EPA Water Sense Label at

http://www.epa.gov/watersense/about_us/watersense_label.html, Water Sense Products at http://www.epa.gov/watersense/products/index.html.

4.7. Supplier Performance Evaluation (SPES): BEA evaluates Subcontractor performance in accordance with the SPES. The Subcontractor shall be formally evaluated no less than quarterly as applicable, and upon completion of the work. A minimum score of 80 points out of 100 is required to maintain approved status.

4.8. Technical Changes: Technical changes to the Contract are authorized only upon receipt and acceptance of Form 540.33, Change Request or Contract Amendment.

5. **ORDER OF PRECEDENCE**

5.1. In the event of any inconsistency between provisions of this Contract, the inconsistency shall be resolved by giving precedence as follows:

5.1.1. Contract Change documents, if any

5.1.2. Contract

5.1.3. General Provisions

5.1.4. Other provisions of this Contract, whether incorporated by reference or otherwise.

5.2. Subcontractor shall notify BEA prior to performing work based on resolution of an inconsistency by the order of precedence set forth herein.

6. **PRICE**

6.1. The firm-fixed price of this Contract is $40,500.00.

6.2. Invoicing:

6.2.1. Submittal of an invoice constitutes Subcontractor's certification that services have been provided, and invoiced amounts are in accordance with the Contract provisions.

6.2.2. Unless otherwise authorized in the Contract, invoices may not be submitted more than once per calendar month.

6.2.3. Invoices shall indicate the cumulative amount invoiced to date. Invoices that include a discount for prompt payment must be clearly marked to receive priority handling.

6.2.4. Invoices shall be submitted electronically in .pdf format to Accounts Payable at acctpay@inl.gov. Measurement of the payment period and prompt payment discount period shall not start until Accounts Payable receives a correct invoice, or the services are complete, whichever is later. *Invoices sent to a recipient other than Accounts Payable* may be rejected and returned to the Subcontractor.

6.2.5. Subcontractor shall separately identify services performed and billable under this Contract.

7. **COMPLETION DATE**

7.1. Subcontractor shall retire in the WREGIS systems the REC's required by this Contract on or before 09/30/2015.

8. **ADMINISTRATION**

8.1. Subcontractor Administration: The Subcontractor's responsibilities shall be administered by Bear Prairie. Subcontractor agrees that Bear Prairie will have overall technical direction of the work to be performed by Subcontractor and shall be available at all reasonable times in connection therewith.

8.2. Legal and Administrative Jurisdiction: Unless the Subcontractor is otherwise notified in writing, BEA's legal responsibilities under this action shall be administered by George Wood, Contract Specialist, or Procurement Manager.

8.3. Technical Representative: All work performed under this Contract shall be subject to the technical direction of Ernest Fossum at (208) 526-2513.

8.4. Notices: Any notice provided for this action shall be considered as having been given: To BEA, if mailed electronically via e-mail (George.Wood@inl.gov) or fax, or if delivered personally to George Wood, or if mailed by U. S. Mail addressed to George Wood, Battelle Energy Alliance, LLC, 2525 Fremont Avenue, P. O. Box 1625, Idaho Falls, ID 83415; or to the Subcontractor, if delivered personally to its duly authorized representative at the site of work, or if mailed electronically via e-mail or fax, or by U. S. Mail addressed to the Subcontractor at 140 S Capitol, Idaho Falls, ID 83402.

IDAHO FALLS POWER

RENEWABLE ENERGY CERTIFICATE SALES AGREEMENT

This sales agreement ("Confirmation") confirms the transaction ("Transaction") between **Idaho Falls Power** ("Seller") and **Battelle Energy Alliance** ("Purchaser"), each individually a "Party" and together the "Parties", effective as of **July 15, 2015** (the "Confirmation Effective Date").

COMMERCIAL TERMS

<table>
<tr><td colspan="2">Seller: COUNTERPARTY A</td><td>Purchaser: COUNTERPARTY B</td></tr>
<tr><td>Contact Information:</td><td>Seller
Address:
140 S. Capital
Idaho Falls, ID 83405

Contact: Bear Prairie
Tel: 208-612-8429
Email: bprairie@ifpower.org
Fax: 208-612-8435</td><td>Purchaser
Address:
PO Box 1625
Idaho Falls, ID 83415

Contact: George Wood
Tel: 208-526-7085
Email: george.wood@inl.gov
Fax: 208-526-7095</td></tr>
<tr><td>Addresses For Formal Notices:</td><td>Seller
Address:
P.O. Box 50220
Idaho Falls, ID 83405-0220

Attention: Bear Prairie
Tel: 208-612-8429
Email: bprairie@ifpower.org
Fax: 208-612-8435</td><td>Purchaser
Address:
PO Box 1625
Idaho Falls, ID 83415

Attention: George Wood
Tel: 208-526-7085
Email: george.wood@inl.gov
Fax: 208-526-7095</td></tr>
<tr><td>REC TRANSACTION</td><td colspan="2">
<table>
<tr><th>Product: (Check One):</th></tr>
<tr><td>☑ Firm REC</td></tr>
<tr><td>□ Firm Bundled REC</td></tr>
<tr><td>□ Resource Contingent REC</td></tr>
<tr><td>□ Resource Contingent Bundled REC</td></tr>
<tr><td>□ Facility As-Run REC</td></tr>
<tr><td>□ Facility As-Run Bundled REC</td></tr>
<tr><td>□ Other I(specify) _____</td></tr>
</table>
<table>
<tr><th>Type of REC</th></tr>
<tr><td>□ All Attributes (this designation is effective only if a Renewable Energy Source or Renewable Energy Facility is designated below)</td></tr>
<tr><td>☑ Program Attributes (this designation is effective only if an Applicable Program is identified below) (Note: WREGIS and possibly other Tracking Systems will not recognize a Program Attributes REC, or may treat it as an All Attributes REC)</td></tr>
<tr><th>Applicable Program</th></tr>
<tr><td>Green-e Energy Eligible</td></tr>
</table>
<table>
<tr><th>Certification Authority</th></tr>
<tr><td>☑WREGIS</td></tr>
<tr><td>□ Center for Resource Solutions Green-e</td></tr>
<tr><td>□ Other _____.</td></tr>
</table>
</td></tr>
</table>

Contract Quantity:	**32,400** WREGIS Renewable Energy Certificates
Product Vintage:	June 2014 – May 2016
Resource Type:	Wind Generation Facilities & Qualifying Hydro Efficiency Upgrades
Project (s)	**Name of Facility:** Horse Butte Wind Project **Location:** Bonneville County, Idaho **WREGIS ID:** W3260 **Vintage:** June 2014 – May 2016 **Name of Facility:** Condon Wind Power Project Phase II **Location:** Oregon **WREGIS ID:** W833 **Vintage:** June 2014 – May 2016 **Name of Facility:** Condon Wind Power Project **Location:** Oregon **WREGIS ID:** W774 **Vintage:** June 2014 – May 2016 **Name of Facility:** Foote Creek I **Location:** Wyoming **WREGIS ID:** W201 **Vintage:** June 2014 – May 2016 **Name of Facility:** Foote Creek II **Location:** Wyoming **WREGIS ID:** W1363 **Vintage:** June 2014 – May 2016 **Name of Facility:** Stateline (WA)-FPL Energy Vansycle LLC **Location:** Washington **WREGIS ID:** W248 **Vintage:** June 2014 – May 2016 **Name of Facility:** Klondike III **Location:** Oregon **WREGIS ID:** W237 **Vintage:** June 2014 – May 2016 **Name of Facility:** Klondike I **Location:** Oregon **WREGIS ID:** W238 **Vintage:** June 2014 – May 2016 **Name of Facility:** Bonneville Dam – G1 **Location:** Oregon **WREGIS ID:** W3996 **Vintage:** June 2014 – May 2016

	Name of Facility:	Grand Coulee – G3
	Location:	Washington
	WREGIS ID:	W3802
	Vintage:	June 2014 – May 2016
Contract Price:	**$40,500.00 Dollars**	
Delivery Term:	Idaho Falls Power will retire in the WREGIS system the contract quantity of REC's on behalf of the Purchaser in a Retirement Sub-account.	

SPECIAL PROVISIONS

2.01 Additional Definitions.

"Environmental Attributes" means "Green Attributes". "Green Attributes" means any and all credits, benefits, emissions reductions, offsets, and allowances, howsoever entitled, attributable to the generation from the Project, and its avoided emission of pollutants. Green Attributes include but are not limited to Renewable Energy Credits, as well as: (1) any avoided emission of pollutants to the air, soil or water such as sulfur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO) and other pollutants; (2) any avoided emissions of carbon dioxide (CO2), methane (CH4), nitrous oxide, hydro fluorocarbons, per fluorocarbons, sulfur hexafluoride and other greenhouse gases (GHGs) that have been determined by the United Nations Intergovernmental Panel on Climate Change, or otherwise by law, to contribute to the actual or potential threat of altering the Earth's climate by trapping heat in the atmosphere;[1] (3) the reporting rights to these avoided emissions, such as Green Tag Reporting Rights. Green Tag Reporting Rights are the right of a Green Tag Purchaser to report the ownership of accumulated Green Tags in compliance with federal or state law, if applicable, and to a federal or state agency or any other party at the Green Tag Purchaser's discretion, and include without limitation those Green Tag Reporting Rights accruing under Section 1605(b) of The Energy Policy Act of 1992 and any present or future federal, state, or local law, regulation or bill, and international or foreign emissions trading program. Green Tags are accumulated on a MWh basis and one Green Tag represents the Green Attributes associated with one (1) MWh of Energy. Green Attributes do not include (i) any energy, capacity, reliability or other power attributes from the Project, (ii) production tax credits associated with the construction or operation of the Project and other financial incentives in the form of credits, reductions or allowances associated with the Project that are applicable to a state or federal income taxation obligation, (iii) fuel-related subsidies or "tipping fees" that may be paid to the Seller to accept certain fuels, or local subsidies received by the generator for the destruction of particular preexisting pollutants or the promotion of local environmental benefits, or (iv) emission reduction credits encumbered or used by the Project for compliance with local, state, or federal operating and/or air quality permits. If the Project is a biomass or biogas facility and Seller receives any tradable Green Attributes based on the greenhouse gas reduction benefits or other emission offsets attributed to its fuel usage, it shall provide Purchaser with sufficient Green Attributes to ensure that there are zero net emissions associated with the production of electricity from the Project.

"PPT" means Pacific Prevailing Time.

"Project" means the Eligible Renewable Resource(s) specified in Article One.

"WREGIS" means the Western Renewable Energy Generation Information System or its successor organization recognized under applicable laws for the registration, transfer or ownership of RECs,

[1] Avoided emissions may or may not have any value for GHG compliance purposes. Although avoided emissions are included in the list of Green Attributes, this inclusion does not create any right to use those avoided emissions to comply with any GHG regulatory program.

Environmental Attributes or Green Attributes.

"WREGIS Certificate" means "Certificate" as defined by WREGIS in the WREGIS Operating Rules. A WREGIS Certificate represents all of the renewable and environmental attributes from one MWh of electricity generation from a renewable energy Generating Unit registered with the WREGIS tracking system or a certificate imported from a Compatible Certificate Tracking System that has been converted to a WREGIS Certificate unless otherwise specified in more detail in Resource Type from table above.

"WREGIS Operating Rules" means the operating rules and requirements adopted by WREGIS.

"Retirement Sub-account" means the repository for WREGIS Certificates that the Account Holder wants to designate as retired and removed from circulation. Once a Certificate has been transferred into a WREGIS Retirement Sub-account, it cannot be transferred again to any other account or Subaccount.

"Retirement of Certificates" means the action taken to remove a Certificate from circulation within WREGIS.

2.02 Additional Representations and Warranties.

(a) During the Term, each Party represents and warrants to the other that:

(i) It is an "eligible commercial entity" and an "eligible contract participant" within the meaning of United States Commodity Exchange Act §§1a(11) and 1a(12), respectively, and this Transaction has been subject to individual negotiation by the Parties;

(ii) It is duly organized, validly existing and in good standing under the law of the jurisdiction of its formation;

(iii) It shall maintain its status as a "forward contract merchant" within the meaning of the United States Bankruptcy Code (for as long as such term has the same definition as in effect as of the date of this Transaction) and

(iv) It is acting for its own account and is sophisticated, experienced and knowledgeable regarding the electricity industry and financial matters, is able to evaluate the risks and merits of the transactions contemplated herein and is not relying in any manner on the other Party for advice or analysis regarding the risks or merits of any such transaction; and

(v) Neither Party is a fiduciary of the other.

(b) Seller, and, if applicable, its successors, further represents and warrants to Purchaser throughout the Term of this Transaction that:

(i) Seller hereby provides and conveys all Green Attributes associated with all electricity generation from the Project to Buyer as part of the Product being delivered. Seller represents and warrants that Seller holds the rights to all Green Attributes from the REC's, and Seller agrees to convey and hereby conveys all such Green Attributes to Buyer as included in the delivery of the Product from the Project.

(ii) Seller has not and will not sell, pledge, assign, transfer or otherwise dispose of any of its rights and interests in and to the Green Attributes sold to Purchaser pursuant to this Transaction to any person or entity other than Purchaser, or report to any person or entity that such Green Attributes belong to any person or entity other than Purchaser;

(iii) All of the Green Attributes and energy generation from the REC's being sold to Purchaser have been sold to Purchaser and have not been sold or committed separately to any third party;

(iv) The Projects qualifies and is certified by WREGIS as an Eligible Renewable Energy Resource;

(v) The Green Attributes have not been used to meet any federal, state or local renewable energy requirement, renewable energy procurement, renewable portfolio standard, or

other renewable energy mandate by Seller or, to Seller's knowledge, any third party;

(vi) Seller has and during the Term shall continue to maintain Certification from WREGIS.

2.03 Payment and Title Transfer of RECs.

(a) Seller's invoice shall include a charge for the REC's. Ownership of Green Attributes will be transferred through WREGIS to the Purchaser through permanent retirement in WREGIS on the Business Day following receipt of payment from Purchaser to Seller and notification to permanently retire the RECs into the Sellers designated Retirement Sub-account.

(b) Failure of Title Transfer: In the event that WREGIS fails to deliver or restricts acceptance of the Green Attributes, then each Party will provide the other Party with all documents, communications, and information sent to or received from WREGIS that pertain thereto. The Parties will cooperate, each at its own expense, to assure the completion of all actions and items required for transfer of the Green Attributes, and will promptly complete any and all uncompleted actions and items. If following such efforts WREGIS does not transfer the Green Attributes for reasons beyond either the Buyer's or Seller's control, Seller will provide an Attestation to Buyer and the event described hereto will not be considered an Event of Default or a failure to deliver Green Attribute

2.04 Governing Law. THIS CONFIRMATION AGREEMENT AND THE RIGHTS AND DUTIES OF THE PARTIES HEREUNDER SHALL BE GOVERNED BY AND CONSTRUED, ENFORCED AND PERFORMED IN ACCORDANCE WITH THE LAWS OF THE STATE OF IDAHO, WITHOUT REGARD TO PRINCIPLES OF CONFLICTS OF LAW. TO THE EXTENT ENFORCEABLE AT SUCH TIME, EACH PARTY WAIVES ITS RESPECTIVE RIGHT TO ANY JURY TRIAL WITH RESPECT TO ANY LITIGATION ARISING UNDER OR IN CONNECTION WITH THIS AGREEMENT.

2.05 Regulatory. The Parties intend the rates, terms and conditions of service specified in this Transaction to remain fixed throughout the Term regardless of any changes in underlying costs that would justify a change in rates under traditional cost of service principles. The Parties agree that they shall not make unilateral application to FERC for a change in rates, terms and conditions herein under Section 205 and/or 206 of The Federal Power Act nor shall either Party seek any change in the rates, terms and conditions herein based upon changes in its costs of service. Neither Party shall unilaterally seek to obtain from the FERC any relief changing the rate, charge, classification, or other term or condition of this Transaction, notwithstanding any subsequent changes in applicable law or market conditions that may occur.

Appendix G

Scope 3 Comprehensive Tables

Appendix G

Scope 3 Comprehensive Tables

Table G-1. Number and type of commute miles traveled by INL employees during FY08 to FY15.

Type of Miles	FY08		FY09		FY10		FY11		FY12		FY13		FY14		FY15	
	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)	Number of Miles	GHG Emissions (MT CO_2e)
Passenger Car Miles, Gasoline	NA[a]	0	14,667,892	5,494	15,876,348	5,947	13,148,613.94	4,925	12,191,061.62	4,566.42	10,557,232.51	3,954.43	10,156,632.59	3,801.74	10,668,699.81	5,343.24
Passenger SUV or Truck Miles, Gasoline	NA[a]	0	7,224,484	3,860	6,472,196	3,458	6,762,734.90	3,612	5,790,039.03	3,093.77	5,318,564.68	2,841.85	5,444,415.77	2,906.81	5,966,269.03	3,811.81
Motorcycle Miles	NA[a]	0	NA[b]	0	260,255	44	206,003.65	35	141,226.58	24.10	99,987.66	17.06	134,752.07	23.02	97,138.84	23.45
Passenger Car Miles, Diesel	NA[a]	0	NA[b]	0	132,135	74	397,064.15	223	227,665.87	102.92	455,001.37	205.68	474,717.50	214.60	331,921.20	181.66
Passenger SUV or Truck Miles, Diesel	NA[a]	0	NA[b]	0	1,153,449	648	1,091,658.30	613	772,147.64	433.52	971,366.78	545.37	809,677.42	454.43	863,313.19	753.99
Passenger Car Miles, Alternative Fuel	NA[a]	0	NA[b]	0	NA[c]	—	481,231.75	35	489,078.99	92.44	540,463.54	102.08	655,286.82	124.49	621,265.39	133.36
TOTAL VEHICLE MILES	20,260,127	8,657	21,892,377	9,354	23,894,383	10,171	22,087,306.70	9,410	19,611,219.73	8,313.16	17,942,616.54	7,666.47	17,675,482.17	7,525.08	18,548,607.46	10,247.52
Walk, run, or bike Miles	NA[a]	0	65,315	0	85,636	0	514,043.20	0	84,320.40	0	48,837.72	0	46,189.87	0	80,688.11	0
TOTAL COMMUTE MILES	20,260,127	8,657	21,957,691	9,354	23,980,019	10,171	22,601,349.90	9,410	19,695,540.14	8,313.16	17,991,454.27	7,666.47	17,721,672.04	7,525.08	18,629,295.57	10,247.52

a. This category was not considered in the FY08 commute calculations, which only estimated total number of commute vehicle miles.
b. This category was not considered in the FY09 commute calculations, which assumed employees drove only gasoline cars and SUVs/trucks.
c. This was a new category included in the FY11 employee commute survey and was not included in the FY10 commute survey.

Table G-2. Number of miles flown by INL employees during FY08.

Type of Miles	Number of Passenger-Miles	GHG Emissions ($MT CO_2e$)
Domestic	18,861,146	5,165
International	5,558,308	1,522
TOTAL	24,419,454	6,687

Since airline miles were further broken down into short-, medium-, and long-haul flights, subsequent years are included in the following table:

Table G-3. Number of miles flown by INL employees during FY09–FY15.

	FY09		FY10		FY11		FY12		FY13		FY14		FY15	
Type of Miles	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)	Number of Passenger-Miles	GHG Emissions (MT CO_2e)
Short Haul	3,797,347	1,063	3,302,333	924	2,861,280	801	2,231,351	653	1,676,050	491	1,924,764	535	2,200,131	611
Medium Haul	7,965,079	1,847	7,631,935	1,770	4,750,674	1,102	3,482,410	582	2,477,466	414	3,038,297	497	3,702,956	605
Long Haul	23,795,526	4,470	21,778,636	4,091	20,561,904	3,863	16,371,756	3,129	12,639,219	2,415	14,745,751	2,843	17,332,661	3,341
TOTAL	35,557,952	7,380	32,712,904	6,785	28,173,858	5,765	22,085,517	4,364	16,792,735	3,320	19,708,812	3,875	23,235,748	4,558

Table G-4. Number of vehicle-miles traveled in rental cars by INL employees during FY08–FY15.

	FY08		FY09		FY10		FY11		FY12		FY13		FY14		FY15	
Vehicle Class	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)	Number of Vehicle Miles	GHG Emissions (MT CO_2e)
Passenger Cars	499,500	187	533,177	200	490,076	183	632,548	237	478,904	179	415,295	156	636,701	238	625,821	234
Light-Duty Truck/Van/SUV	306,413	164	257,392	138	254,027	136	292,809	156	225,320	120	56,992	30	90,108	48	70,737	37
TOTAL	805,913	351	790,569	338	744,103	319	925,357	393	704,225	300	472,287	186	726,809	286	696,558	272

Appendix H

Calculation Spreadsheets and Notes

Appendix H

Calculation Spreadsheets and Notes

Table H-1 summarizes the following for each of INL's emissions categories considered during FY15:

- Source spreadsheets for data calculation (e.g., calculating how much waste INL produced based on quantities from each facility)
- Source spreadsheets for GHG calculation (e.g., calculating how many GHGs were produced by INL's annual waste disposal)
- Applicable comments (the TSD equation number[s] used, who provided the data, etc.).

Table H-1. Calculation spreadsheets and comments for emissions categories included in the INL FY15 GHG inventory.

Scope	Emissions Category	FY15 Spreadsheet for Data Calculation	FY15 Spreadsheet for GHG Calculation	Comments
All	Summary	Sheet: "Sheet1," "Overall Summary Stats 11Jan16.xlsx"	Sheet: "Sheet1" and "Summary for Plots," "Overall Summary Stats 11Jan16.xlsx"	None.
1	Stationary Combustion	Sheet: "Fuel Data," "FY15 Summary for GHG - Stationary Combustion 7Mar16.xlsx"	Sheet: "GHG Emissions," "FY15 Summary for GHG - Stationary Combustion 7Mar16.xlsx"	Default Methodology, Equations A-1, A-2, and A-3. Fuel data provided by Ernest Fossum and Jacqueline Dedic (INL Energy Management).
	Mobile Combustion	Sheet: "Report (Sorted)," "FY15 Summary for GHG - Mobile Combustion 7Mar16.xlsx"	Sheet: "GHG Emissions," "FY15 Summary for GHG - Mobile Combustion 7Mar16.xlsx"	Advanced Methodology, Equations A-5, A-9, and A-10 (A-11 and A-12 for biogenic). Fuel data extracted from INL TIMS database – GHG Summary Revised Report by Kim Frerichs (INL Pollution Prevention).
	Fugitive Emissions: Refrigerants	Sheet: "Emissions Summary Sheet,", "CEDR FY15 Backup Summary Sheets.xlsx"	Sheet: "Emissions Summary Sheet,", "CEDR FY15 Backup Summary Sheets.xlsx"	Advanced Methodology, Equation A-15. Data compiled by Kim Frerichs (INL Pollution Prevention).

Table H-1. (continued).

Scope	Emissions Category	FY15 Spreadsheet for Data Calculation	FY15 Spreadsheet for GHG Calculation	Comments
1 (cont'd)	Fugitive Emissions: Onsite Landfill	Sheet: "Landfill Data," "Landfill Report for LandGEM 14Oct15.xlsx"	Sheet: "FY15 GHG Calcs," "Landfill Report for LandGEM 14Oct15.xlsx"	Used LandGEM and Equation A-34 from TSD. Data pulled from INWMIS by Kim Frerichs (INL Pollution Prevention).
	Fugitive Emissions: Onsite Wastewater Treatment	Sheet: "Wastewater Types," "FY15 Wastewater for GHG (Scope 1+3) 14Oct15.xlsx"	Sheet: "Onsite Wastewater," "FY15 Wastewater for GHG (Scope 1+3) 14Oct15.xlsx"	Default Methodology, Equations A-23 and A-24 from TSD. Employee counts provided by Lynette Martin (INL Human Resources).
2	Purchased Electricity	Sheet: "Elec Totals," "FY15 Summary for GHG - Scope 2 7Mar16.xlsx"	Sheet: "GHGCalcs," "FY15 Summary for GHG - Scope 2 7Mar16.xlsx"	Default Methodology, Equations B-1 and B-2 from TSD. Data provided by Ernest Fossum and Jacqueline Dedic (INL Energy Management).
	Transmission and Distribution Losses (Owned)	Sheet: "GHGCalcs," "FY15 Summary for GHG - Scope 2 7Mar16.xlsx"	Sheet: "GHGCalcs," "FY15 Summary for GHG - Scope 2 7Mar16.xlsx"	Default Methodology, Equations B-1 and B-2 from TSD. T&D loss information provided by Ernest Fossum (INL Energy Management).
	Purchased RECs	"160325 Contract – Executed FY 2015.pdf"	Sheet: "GHGCalcs," "FY15 Summary for GHG - Scope 2 7Mar16.xlsx"	Default Methodology, Equations B-28 and B-29 from TSD. RECs Receipts provided by Ernest Fossum (INL Energy Management).
3	Transmission and Distribution Losses (Shared)	Sheet: "GHGCalcs," "FY15 Summary for GHG - Scope 2 7Mar16.xlsx"	Sheet: "GHGCalcs," "FY15 Summary for GHG - Scope 2 7Mar16.xlsx"	Default Methodology, Equations C-3, C-4, and C-5 from TSD.
	Employee Commuting	Sheet: "BEA Totals," "Commuting Behaviors 2015.xlsx"	Sheet: "GHGs," "Commuting Behaviors 2015.xlsx"	Default Methodology, Equations C-14, C-15, and C-16 from TSD. FY15 Employee data provided by Lynette Martin (INL Human Resources).

Table H-1. (continued).

Scope	Emissions Category	FY15 Spreadsheet for Data Calculation	FY15 Spreadsheet for GHG Calculation	Comments
3 (cont'd)	Business Air Travel	Sheet: "Sheet1," "INL-100114-093015.xlsx"	Sheet: "8.1 Air Travel," "CEDR FY 2015 Reporting – BEA Only.xlsx"	Default Methodology, Equations C-1 and C-2 from TSD. Data provided by TMP Travel on behalf of Bruce Cook (INL Travel Office).
	Business Ground Travel: Rental Vehicle	Sheet: "Avis-All," "FY15 Rental Car Miles Summary 12Oct15.xls"	Sheet: "GHGs," "FY15 Rental Car Miles Summary 12Oct15.xlsx"	Advanced Methodology 2, Equations C-11, C-12, and C-13 from TSD. Data provided by travel vendor on behalf of Bruce Cook (INL Travel Office).
	Business Ground Travel: Personal Vehicle	Sheet: "POV Totals," "2015 POV Miles - ER.xlsx"	Sheet: "GHGs," "2015 POV Miles - ER.xlsx"	Advanced Methodology 2, Equations C-11, C-12, and C-13 from TSD. Data pulled from INL Expense Reports - provided by Roni Bounmixay (INL Travel Office).
	Contracted MSW Disposal	Sheets: "FY15 sml," "FY15 30yd," and "Summary," "Sanitation Department Report FY15.xls"	Sheet: "Offsite MSW," "FY15 Offsite MSW for GHG – 14Oct15.xlsx"	Default Methodology, Equation C-6 from TSD (C-7 for biogenic). Data compiled by Kim Frerichs (INL Pollution Prevention).
	Contracted Wastewater Treatment	Sheet: "Wastewater Types," "FY15 Wastewater for GHG (Scope 1+3) 14Oct15.xlsx"	Sheet: "Offsite Wastewater," "FY15 Wastewater for GHG (Scope 1+3) 14Oct15.xlsx"	Default Methodology, Used Equations A-19, A-20, and A-22 from TSD. Employee counts provided by Lynette Martin (INL Human Resources).