GREENHOUSE GAS AND CRITERIA AIR POLLUTANT EMISSION INVENTORY FOR THE PORT AUTHORITY OF NEW YORK & NEW JERSEY

Scope 1 + 2

Calendar Year 2010

Final Report

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ACRONYMS AND ABBREVIATIONS

BSFC	brake-specific fuel consumption
Btus	British thermal units
CAD	Central Automotive Department
CAP	criteria air pollutant
ccf	cubic feet
CFCs	chlorofluorocarbons
CH_4	methane
CHP	combined heat and power
CNG	compressed natural gas
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
eGRID	Emissions & Generation Resource Integrated Database
EPA	U.S. Environmental Protection Agency
g/hp-hr	grams per horsepower-hour
gal	gallon
GHG	greenhouse gas
GRP	General Reporting Protocol
GWPs	global warming potentials
HCFC	hydrochlorofluorocarbon
HFCs	hydrofluorocarbons
hr	hour
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram
KIAC	Kennedy International Airport Cogeneration Plant
kWh	kilowatt hours
LFG	landfill gas
LPG	liquefied petroleum gas
MMBtu	million British thermal units
MS	Microsoft
N_2O	nitrous oxide
NG	natural gas
NO_x	oxides of nitrogen
NYNJR	New York New Jersey Rail
NYPA	New York Power Authority
OEEP	Office of Energy and Environmental Programs

PANYNJ	Port Authority of New York and New Jersey
PATH	Port Authority Trans-Hudson
PFCs	perfluorocarbons
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PODID	point of delivery identification number
SAR	Second Assessment Report
SEM	Simplified Emissions Methodology
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
Southern	Southern Research Institute
TAR	Third Assessment Report
TCR	The Climate Registry
TS|Pechan	TranSystems Corporation|E.H. Pechan & Associates
VOCs	volatile organic compounds
WIP	work in place
WTC	World Trade Center

EXECUTIVE SUMMARY

The Port Authority of New York and New Jersey (PANYNJ) owns, manages and maintains bridges, tunnels, bus terminals, airports, Port Authority Trans-Hudson (PATH) commuter rail system, and marine terminals that are critical to the metropolitan New York and New Jersey region's trade and transportation capabilities. Major facilities include John F. Kennedy International (JKF), Newark Liberty International (EWR), and LaGuardia (LGA) airports; the George Washington, Goethals, Bayonne and Outerbridge Crossing bridges; the Lincoln and Holland tunnels; Port Newark and the Howland Hook Marine Terminal; the Port Authority Bus Terminal; and the 16-acre World Trade Center site in Lower Manhattan. PANYNJ has set ambitious goals to conserve and enhance the region's natural resources for future generations and is committed to conducting operations in a manner that would minimize environmental impacts while enhancing regional transportation and goods movement. In June 1993, the PANYNJ formally issued an environmental policy statement recognizing its long-standing commitment to provide transportation, terminal and other facilities of commerce within the Port District, to the greatest extent practicable, in an environmentally sound manner. Additionally, the Port Authority expressed its commitment to manage its activities consistent with applicable environmental laws and regulations and to deal with identified environmental matters on a responsible, timely and efficient basis.

Consistent with its Environmental Policy, in 2007 the Port Authority established a comprehensive Sustainability Policy to address greenhouse gas (GHG) emissions. The cornerstone of the policy is a goal to reduce GHG emissions stemming from Agency, tenant, and customer operations by 80% by the year 2050 (using 2006 as the baseline year). Accordingly, the Port Authority prepares annual inventories and seeks to decrease emissions by promoting energy efficiency and renewable energy options, instituting advanced technology, reducing waste and water use, and developing sustainable design and construction guidelines. To establish the initial baseline required to monitor progress, PANYNJ conducted a GHG emissions inventory of Port Authority Agency (Scope 1 and 2) and tenant and customer (Scope 3) emissions for calendar year 2006, documented in the report *Greenhouse Gas Emission Inventory for the Port Authority of New York & New Jersey, Calendar Year 2006*. The 2006 report was followed by annual updates in 2007 and 2008. Annual GHG inventories allow the PA to quantify overall emissions, track annual trends, and identify areas to reduce GHG emissions. The inventory also tracks Port Authority criteria air pollutant (CAP) emissions to ensure GHG reduction measures maintain and enhance CAP reduction strategies. Accordingly, the Port Authority began annual inventories to track GHG and CAP emissions, and seeks to decrease emissions by promoting energy efficiency and renewable energy options, instituting advanced technology, reducing waste and water use, and developing sustainable design and construction guidelines.

The 2010 GHG and CAP EI report provides an update of the PANYNJ's GHG and CAP emissions for calendar year 2010. In 2010, the PANYNJ joined The Climate Registry (TCR), a voluntary North American GHG registry providing consistent verified inventories. Consistent with its membership, the PANYNJ commenced work on its first verified inventory, which meant that less than 5% of all emissions could be estimated or modeled via surrogates. To ensure the 2010 inventory was based on verifiable direct data (such as utility bills and fuel records), the PANYNJ concentrated only on Agency Scope 1 and 2 emissions. The 2010 inventory includes direct PANYNJ emissions (e.g., energy use at administration buildings and employee travel) and Agency directed construction, but does not include the emissions of PANYNJ tenants (e.g., airlines and container terminals) and patrons (e.g., airport passengers and PATH riders). Work on 2010 EI will allow the PANYNJ to extend direct emission reporting for Scope 3 in future years. Due to the size of PANYNJ's inventory, Scope 3 reporting will be reported every five years. Scope 1 and 2 inventories will continue on an annual basis. The Port Authority's 2010 GHG emissions inventory was verified in March 2013 by a third-party verification body and was found to be complete, accurate and in conformance with the reporting requirements of TCR.

In 2010, the PANYNJ's Scope 1 and 2 emissions were 298,223 metric tons of carbon dioxide equivalent (CO_2e). Construction emissions were 17,291 metric tons for a total of 315,514 metric tons. Aviation facilities have the highest GHG emissions (56%), followed by PATH facilities (20%), PANYNJ tunnels, bridges, and bus terminals (10%), and construction (5%) Real Estate, the Agency's Administrative offices and Port Commerce facilities contribute the remaining 9%.

1.0 INTRODUCTION

1.1. BACKGROUND

The Port Authority of New York and New Jersey (PANYNJ) owns, manages and maintains the bridges, tunnels, bus terminals, airports, Port Authority Trans-Hudson (PATH) commuter rail system, and marine terminals that are critical to the metropolitan New York and New Jersey region's trade and transportation capabilities. Major facilities owned, managed, operated, or maintained by the PANYNJ include John F. Kennedy International, Newark Liberty International, and LaGuardia airports; the George Washington Bridge; the Lincoln and Holland tunnels; Port Newark; Howland Hook Marine Terminal; the Port Authority Bus Terminal; and the 16-acre World Trade Center (WTC) site in Lower Manhattan.

As a cornerstone in its broader sustainability program, in 2007 the PANYNJ implemented a program to reduce its Agency (Scope 1 and Scope 2[1]), and tenant and customers (Scope 3[2]) GHG emissions by 80%, from 2006 levels, by the year 2050. PANYNJ utilized the services of Southern Research Institute (Southern) and TranSystems|E.H. Pechan & Associates (TS|Pechan) to conduct a GHG and CAP emissions inventory of Port Authority facilities and operations for calendar year 2006 to establish the initial baseline required for monitoring progress towards this goal. The results of that inventory effort are documented in the report entitled *Greenhouse Gas Emission Inventory for the Port Authority of New York & New Jersey, Calendar Year 2006*. Subsequent to the initial 2006 emissions inventory, the same consulting team developed GHG and CAP emission inventories for 2007 and 2008 calendar years. The 2006-2008 inventories include Agency emissions, plus the emissions of PANYNJ tenants and customers.

In 2010, the PANYNJ joined The Climate Registry (TCR), a North American nonprofit collaboration that sets consistent protocols to calculate, verify and publicly report GHG emissions into a single registry. The 2010 Report documents the PANYNJ's efforts to develop a calendar year 2010 GHG emission inventory to submit to TCR. TCR requires members to report direct Scope 1 and 2 emissions using TCR developed standardized protocols for emissions calculations from all sources, based on objective, verifiable evidence. When the systems are not in place to collect the objective evidence in accordance with the protocols, it is permissible to use a Simplified Emissions Methodology (SEM) for calculating GHG emissions, once SEM emissions are 5% or less of the total inventory. Using SEM was necessary for a few PANYNJ activities, including parts of the electricity calculations, parts of the fleet vehicle emissions, the fugitive emissions, and the tug operations from the Cross Harbor Barge. In all, these emissions must add up to less than five percent of the total entity's emissions. The member's Scope 3 emissions may be reported on a voluntary basis but are not required. The PANYNJ's 2010 inventory only includes the PANYNJ's

[1] Scope 1 encompasses an organization's direct GHG emissions, whether from on-site energy production or other industrial activities. Scope 2 accounts for energy that is purchased offsite (primarily electricity, but also including energy such as steam).
[2] Scope 3 is much broader and can include anything from employee travel, to upstream emissions imbedded in products purchased or processed by the firm, to downstream emissions associated with transporting and disposing of products sold by the organization, or activities operated by third parties.

Scope 1 and Scope 2 emission sources. Scope 3 emissions at PANYNJ-operated facilities are not accounted for in the 2010 emission inventory and their reporting protocol will be modified from annual reports to every five years. The PANYNJ decided to modify the Scope 3 reporting schedule in order to provide enough time to gather Scope 3 data from tenants and customers, and to reduce some of the variability associated with short term economic fluctuations. In keeping with past practices, CAP emissions are also included in the inventory for Scope 1 and Scope 2 source categories.

The 2010 Report, while a continuum of PANYNJ efforts, cannot be directly compared to the 2006-2008 inventories due to significant changes in data availability and categorization. Due to the complexity of the PANYNJ, direct data, such as utility and fueling records, were not previously available for all facilities. For example, the PANYNJ's electricity is provided by five utility providers in two states, all using different billing and reporting structures. Therefore, a significant portion of data used in the 2006-2008 reports was modeled based on external surrogates such as passenger counts and cargo levels. The PANYNJ has been working to standardize utility data collection and 2010 marks the first time where such data was available to achieve the TCR's 95% direct data requirement. In addition, the PANYNJ reorganized data for the 2010 report to better reflect the PANYNJ's operational realities. For example, Line Department staff housed in the PANYNJ's central administrative offices were removed from a facility's emissions profile as the central administrative staff, while providing support to the facility, does not contribute emissions at the facility. This re-categorization will serve as the new standard for future inventories and represents a natural evolution in the inventory process.

TCR reporting also involves a new distinction that had not been used in previous inventories. The inventory distinguishes between biogenic emissions and non-biogenic emissions. Biogenic emissions are the result of combustion or decomposition of biologically-based material[3], including biofuel combustion. PANYNJ uses biofuels in its vehicle fleet – purchasing B-20 biodiesel for most of its diesel equipment – and using a number of flex-fueled vehicles that run on E-85 ethanol fuel. In addition, the Port Commerce inventory includes fugitive biogenic emissions from property that was part of a closed landfill.

Another difference relates to categorizing construction emissions. In 2011, based on conversations with the TCR staff and consistent with GRP guidelines, the PANYNJ began to categorize construction emissions as Scope 3. However, because one of the core functions of the PANYNJ is to construct and maintain infrastructure and facilities supporting regional transportation, and the PANYNJ issues emission standards for construction equipment as part of

[3] Examples of "biogenic CO_2 emissions" include, but are not limited to: CO_2 generated from the biological decomposition of waste in landfills, wastewater treatment or manure management processes; CO_2 from the combustion of biogas collected from biological decomposition of waste in landfills, wastewater treatment or manure management processes; CO_2 from fermentation during ethanol production; CO_2 from combustion of the biological fraction of municipal solid waste or biosolids; CO_2 from combustion of the biological fraction of tire-derived fuel; and CO_2 derived from combustion of biological material, including all types of wood and wood waste, forest residue, and agricultural material. (USEPA).

all construction contracts documented in detailed specifications, the PANYNJ will continue to track all non-tenant construction emissions as part of its annual Scope 1 and 2 Reports.

1.1.1. TCR Reporting Objectives

The emission inventory described in this report was developed for calendar year 2010.

<u>Scope</u>

Reporting Year:	2010
Geographic Boundary:	North America
Organizational Boundary:	Management Control – Operational Criterion
Base Year:	Not Selected
Reported Type:	Complete
Reported Gases:	Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulfur Hexafluoride (SF_6)

The GHG emission estimates for 2010 were developed using TCR's General Reporting Protocol (GRP) Version 1.1 and TCR's Emissions Factors Updated March 21, 2011.

For non-CO_2 GHGs, the mass estimates of these gases are converted to CO_2 equivalent (CO_2e) by multiplying the non-CO_2 GHG emissions in units of mass by their global warming potentials (GWPs). GWPs were developed by the Intergovernmental Panel on Climate Change (IPCC) to quantify the globally averaged relative radiative forcing effects of a given GHG, using CO_2 as the reference gas. In 1996, the IPCC published a set of GWPs for the most commonly measured GHGs in its Second Assessment Report (SAR). In 2001, the IPCC published its Third Assessment Report (TAR), which adjusted the GWPs to reflect new information on atmospheric lifetimes and an improved calculation of the radiative forcing of CO_2 and these GWPs were adjusted again during 2007 in the Fourth Assessment Report. However, SAR GWPs are still used by international convention to maintain consistency with international practices, including by the United States and Canada when reporting under the United Nations Framework Convention on Climate Change. Therefore, the SAR GWP values are used in this analysis. Table 1-1 shows the SAR GWPs.

Table 1-1. Warming Potential Factors for Required GHGs

Common Name	**Formula**	**Chemical Name**	**GWP**
Carbon dioxide	CO_2		1
Methane	CH_4		21
Nitrous oxide	N_2O		310
Sulfur hexafluoride	SF_6		23,900
Hydrofluorocarbons (HFCs)			
HFC-23	CHF_3	trifluoromethane	11,700
HFC-32	CH_2F_2	difluoromethane	650
HFC-41	CH_3F	fluoromethane	150
HFC-43-10mee	$C_5H_2F_{10}$	1,1,1,2,3,4,4,5,5,5-decafluoropentane	1,300
HFC-125	C_2HF_5	pentafluoroethane	2,800
HFC-134	$C_2H_2F_4$	1,1,2,2-tetrafluoroethane	1,000
HFC134a	$C_2H_2F_4$	1,1,1,2-tetrafluoroethane	1,300
HFC-143	$C_2H_3F_3$	1,1,2-trifluoroethane	300
HFC-143a	$C_2H_3F_3$	1,1,1-trifluoroethane	3,800
HFC-152	$C_2H_4F_2$	1,2-difluoroethane	43
HFC-152a	$C_2H_4F_2$	1,1-difluoroethane	140
HFC-161	C_2H_5F	fluoroethane	12
HFC-227ea	C_3HF_7	1,1,1,2,3,3,3-heptafluoropropane	2,900
HFC-236cb	$C_3H_2F_6$	1,1,1,2,2,3-hexafluoropropane	1,300
HFC-236ea	$C_3H_2F_6$	1,1,1,2,3,3-hexafluoropropane	1,200
HFC-236fa	$C_3H_2F_6$	1,1,1,3,3,3-hexafluoropropane	6,300
HFC-245ca	$C_3H_3F_5$	1,1,2,2,3-pentafluoropropane	560
HFC-245fa	$C_3H_3F_5$	1,1,1,3,3-pentafluoropropane	950
HFC-365mfc	$C_4H_5F_5$	1,1,1,3,3-pentafluoropropane	890
Perfluorocarbons (PFCs)			
Perfluoromethane	CF_4	tetrafluoromethane	6,500
Perfluoroethane	C_2F_6	hexafluoroethane	9,200
Perfluoropropane	C_3F_8	octafluoropropane	7,000
Perfluorobutane	C_4F_{10}	decafluorobutane	7,000
Perfluorocyclobutane	$c\text{-}C_4F_8$	octafluorocyclobutane	8,700
Perfluoropentane	C_5F_{12}	dodecafluoropentane	7,500
Perfluorohexane	C_6F_{14}	tetradecafluorohexane	7,400

1.1.2. Organizational Boundaries

Table 1-2 summarizes the boundaries that were applied in this study for the departments and facilities included in the 2010 emission inventory. The organizational boundary established for GHGs was also applied to CAPs in that CAP emission estimates were developed for all of the emission sources listed in Table 1-2. This table is organized by department first, then by facility.

Table 1-2. Facilities Included in the 2010 GHG Emission Inventory

Facility		Direct PANYNJ GHG Emissions Scope 1	Indirect PANYNJ GHG Emissions Scope 2
PANYNJ Central Administration Functions			
Buildings[1]		✓	✓
Central Automotive Department (CAD) Fleet Vehicles[2]		✓	
Aviation Facilities			
JFK	PANYNJ operated Buildings + Common Space Lighting	✓	✓
	Refrigerants	✓	
AirTrain JFK	Terminal and Trains	✓	✓
JFK Fire Training		✓	
LaGuardia	PANYNJ operated Buildings + Common Space Lighting	✓	✓
Newark	PANYNJ operated Buildings + Common Space Lighting	✓	✓
	Refrigerants	✓	
AirTrain Newark	Terminals[3] and Trains		✓
Stewart	PANYNJ operated Buildings + Common Space Lighting	✓	✓
	Refrigerants	✓	
Teterboro	PANYNJ operated Buildings + Common Space Lighting	✓	✓
Port Commerce Facilities			
Brooklyn Marine Terminal	PANYNJ operated Buildings + Common Space Lighting	✓	✓
Port Jersey	PANYNJ operated Buildings + Common Space Lighting	✓	✓
Port Newark	PANYNJ operated Buildings + Common Space Lighting	✓	✓
Port Elizabeth Marine Terminal	PANYNJ Common Space Lighting		✓
Elizabeth Landfill	Fugitive Emissions	✓	
Howland Hook	PANYNJ operated Buildings + Common Space Lighting	✓	✓
Tunnels and Bridges Facilities			
Holland Tunnel	Infrastructure + Common Space Lighting	✓	✓
Lincoln Tunnel	Infrastructure + Common Space Lighting	✓	✓
George Washington Bridge	Infrastructure + Common Space Lighting	✓	✓
Bayonne Bridge	Infrastructure +Common Space Lighting		✓
Goethals Bridge	Infrastructure + Common Space Lighting	✓	✓
Outerbridge Crossing	Infrastructure + Common Space Lighting	✓	✓
Bus Terminals			
Port Authority Bus Terminal	PANYNJ operated space + Common Space Lighting	✓	✓
George Washington Bridge Terminal	PANYNJ operated Buildings + Common Space Lighting	✓	✓
PATH Facilities			
PATH Rail System	Trains		✓
	Diesel Equipment including Utility Track Vehicles and Generators	✓	
	Maintenance Vehicles	✓	
	PANYNJ operated Buildings + Common Space Lighting	✓	✓
Journal Square Transportation Center	PANYNJ operated Buildings + Common Space Lighting		✓
Real Estate			
Bathgate Industrial Park	Buildings + Common Space Lighting	✓	✓
The Teleport	Buildings + Common Space Lighting	✓	✓
	Fleet Vehicles	✓	
The Legal Center	Fleet Vehicles	✓	
World Trade Center	Fleet Vehicles	✓	
PANYNJ Construction Projects (non-tenant)[2]			
Administration			
World Trade Center			
Aviation			
Port Commerce			

Facility		Direct PANYNJ GHG Emissions Scope 1	Indirect PANYNJ GHG Emissions Scope 2
PATH			
TB&T			

[1]Administration Buildings include: 225/223 PAS, Gateway Newark, PATC, 5 Marine View, 1 Madison Ave, 115 Broadway, 96/100 Broadway, 116 Nassau St., and 777 Jersey Ave.
[2] In 2011, based on conversations with TCR, the PANYNJ began to categorize construction emissions as a Scope 3 source. However, due to the extent of construction emissions, especially at the World Trade Center site, the PANYNJ will continue to inventory and report non-tenant construction emissions in its Scope 1 and 2 inventory.

1.2. RESULTS SUMMARIES

The chapters that follow detail the emissions calculations by source type, and specify which facilities were responsible for each emissions source. Below is presented a summary of the total emissions from PANYNJ as an entity reporting to TCR. For the purposes of PANYNJ staff, these summaries have been made at the departmental level. Emissions from sources not expressly affiliated with one department, such as emissions from electricity and heating at the PANYNJ's Park Avenue offices (which houses the PANYNJ's Senior Management, Law, Human Resources, Media and Marketing, Planning, Government Affairs, Finance, and Environmental and Energy Program Departments, along with support staff from the PANYNJ's Engineering, Port Commerce, Aviation, and Real Estate groups), or fleet vehicles in the NY motor pool, are assigned to "Central Administration" in lieu of a facility. Buildings and properties the PANYNJ manage and lease as property managers were assigned to "Real Estate".

Table 1-3 below summarizes the total Scope 1 and 2 emissions for calendar year 2010. The Aviation department dominated the total emissions, largely as a result of the electricity and fuels used to power and heat large airport terminals. While Port Commerce also owns large maritime properties, most of the maritime terminal facilities are leased to and operated directly by tenants. As seen in Figure 1-1, 58.8% of the direct and indirect reportable emissions are from activities within the Aviation department. Emissions from PATH are the second highest at 20.8%, primarily from electricity used as traction power for the rail system. Tunnels, Bridges and Terminals contribute another 10.4%, as a result of indirect emissions from purchased electricity and steam.

Central Administration, Port Commerce, Real Estate and Development, and Multi-Department emissions make up the remaining 10%, with Central Administration producing the most. The single largest source within the Port Commerce department was the Elizabeth landfill, with biogenic emissions from landfill gas contributing over half of the 7,513 metric tons.

Table 1-3. Port Authority NY/NJ CO_2e Emissions in 2010

Department	CO_2e Emissions (metric tons)
Aviation	175,224
PATH	62,143
Tunnels, Bridges & Terminals	30,864
Central Administration	21,197
Port Commerce	7,102
Real Estate & Development	1,038
Multi-Department	655
Totals	**298,223**

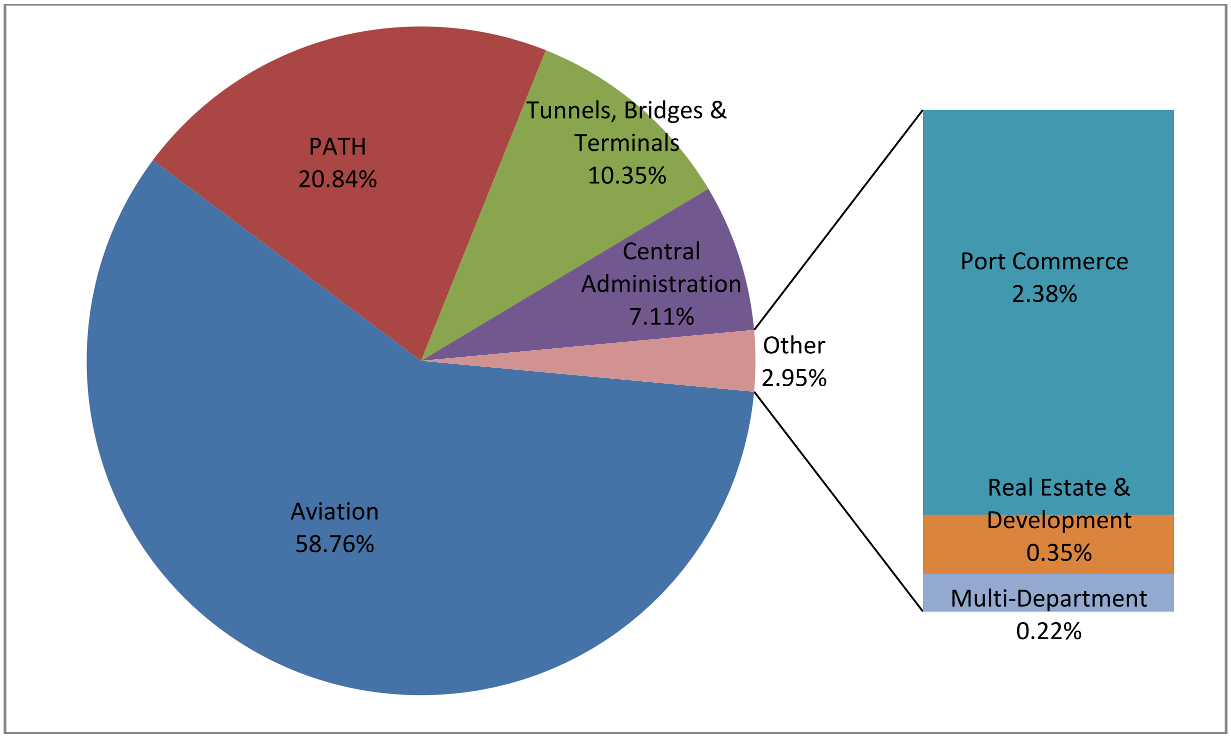

Figure 1-1. CO_2e Emissions by Department (TCR)

When construction is added to the inventory (Figure 1-2), construction becomes the fifth largest source of emissions. Because of its relatively large contribution to total PANYNJ emissions, it is important to track construction both relative to the 2006 baseline and to track how new projects or completion of existing construction projects affect the PANYNJ's 80 percent reduction goal. Construction emissions will not however be reported to TCR.

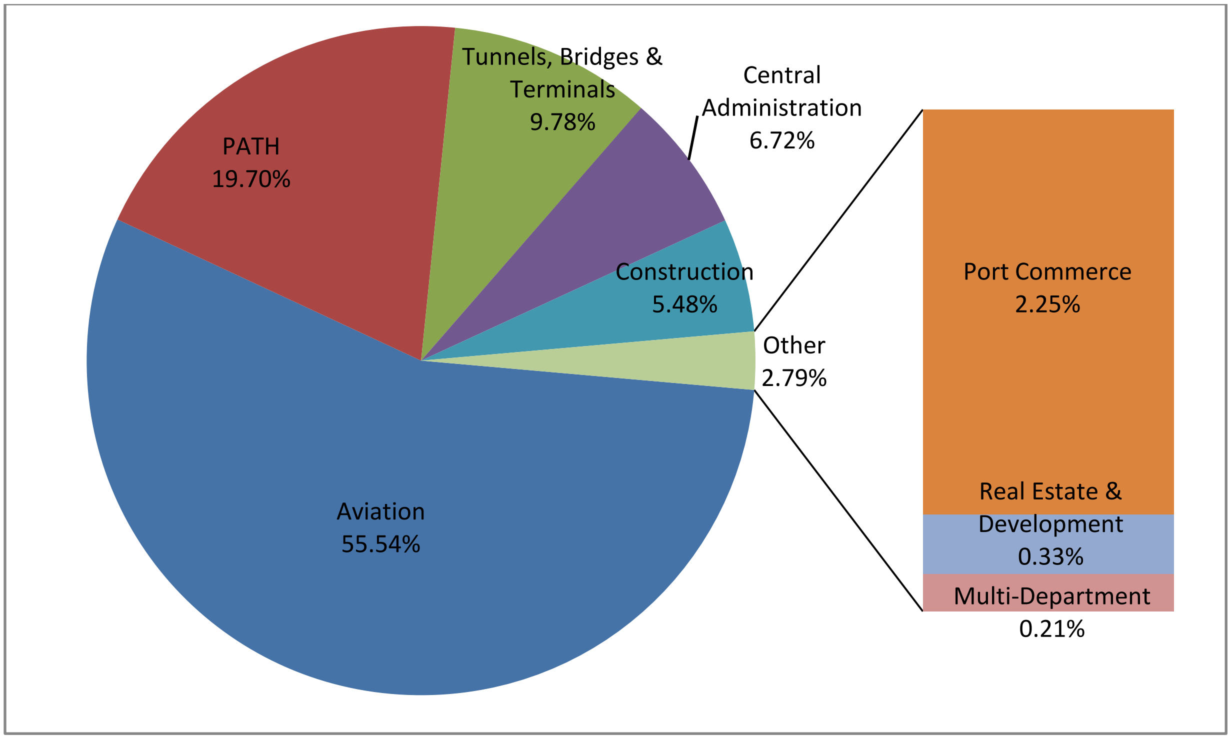

Figure 1-2. CO_2e Emissions by Department including Construction

Figure 1-3 shows the breakdown, by department, of the total emissions between Scope 1 and Scope 2 emissions. Construction has also been added for reference. In 2010, 80.2 percent of PANYNJ's reportable emissions were Scope 2 and 19.8 percent were Scope 1. For each of the three departments (Aviation, PATH and Tunnels, Bridges and Terminals) with the largest shares of the PANYNJ's Scope 1 and 2 GHG emissions, indirect emissions from electricity and steam use dominate their contributions.

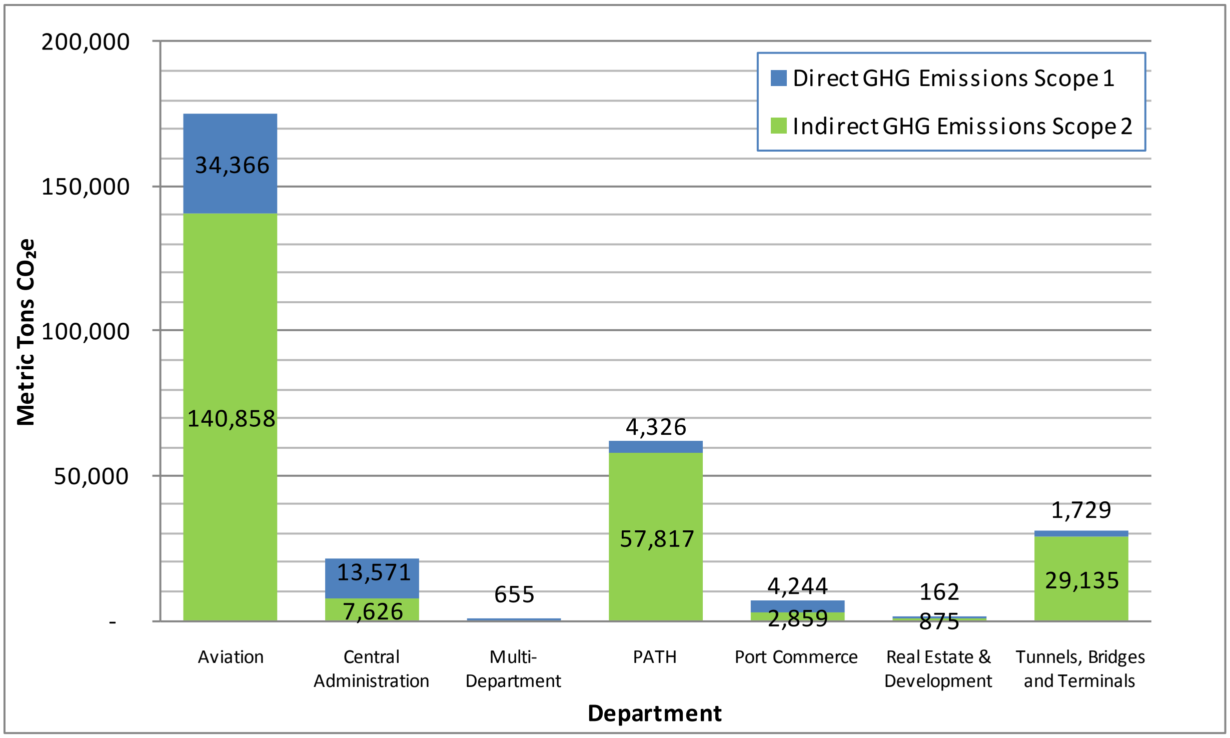

Figure 1-3. GHG Emissions by Department and Scope

Figure 1-4 shows which particular sources contributed the most to the emissions organization-wide. The largest source of emissions, totaling 75.8 percent of the emissions, was Scope 2 emissions from purchased electricity, steam, heating and cooling. JFK Airport, AirTrain JFK, and the Port Authority Bus Terminal all purchase steam for heating and cooling purposes, but this number is dominated by the purchased electricity at all the PANYNJ facilities. Purchased steam, heating and cooling accounts for only 4% of the total PANYNJ emissions.

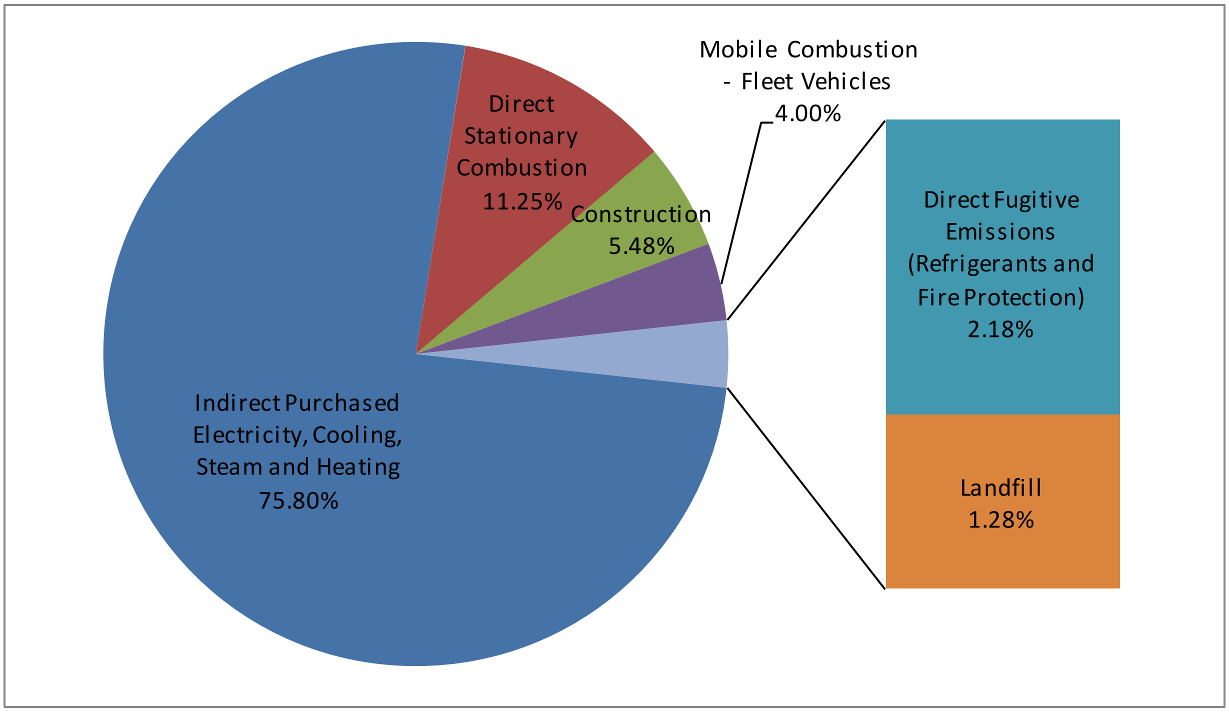

Figure 1-4. GHG Emissions by Emissions Source

Table 1-4 shows a detailed summary of the Scope 1 and 2 GHG emissions by department and broken down by sector. This information is also displayed in Figure 1-5. Because Aviation building emissions represent such a large portion of the emissions, they are not represented to scale, and the axis is truncated for better detail on some of the smaller sources. It can be seen that among direct and indirect emissions, emissions from stationary combustion at buildings and indirect emissions associated with electricity use at buildings are the largest source for most departments, with the exceptions of Port Commerce and PATH. PATH emissions are mostly associated with indirect emissions from electricity used for traction power, and as mentioned above, the Elizabeth landfill contributes about one-half of the emissions from the Port Commerce Department. Figure 1-5 does not include construction emissions.

Table 1-4. Port Authority NY/NJ CO_2e Emissions in 2010 (metric tons)

Department	Direct GHG Emissions Scope 1	Indirect GHG Emissions Scope 2	Total
Central Administration			
Buildings	954	7,626	8,580
Fleet Vehicles	12,617	0	12,617
Aviation			
AirTrain	281	26,254	26,535
Buildings	30,407	114,604	145,011
Fugitive (ODS Substitute)	3,679	0	3,679
Port Commerce			
Buildings	199	2,859	3,057
Fugitive (Landfill Gas)	4,045	0	4,045
Tunnels and Bridges			
Buildings	639	15,656	16,295
Fugitive (ODS Substitute)	2	0	2
Bus Terminals			
Buildings	675	13,478	14,153
Fugitive (ODS Substitute)	414	0	414
PATH			
Trains	0	50,157	50,157
Buildings	1,539	7,660	9,199
Fugitive (ODS Substitute)	2,787	0	2,787
Real Estate & Development			
Buildings	162	875	1,038
Entity-Wide			
Emergency Generators	655	0	655
Welding Gas	0	0	0
Total	**59,053**	**239,170**	**298,223**
Note: Totals may not add up due to rounding.			

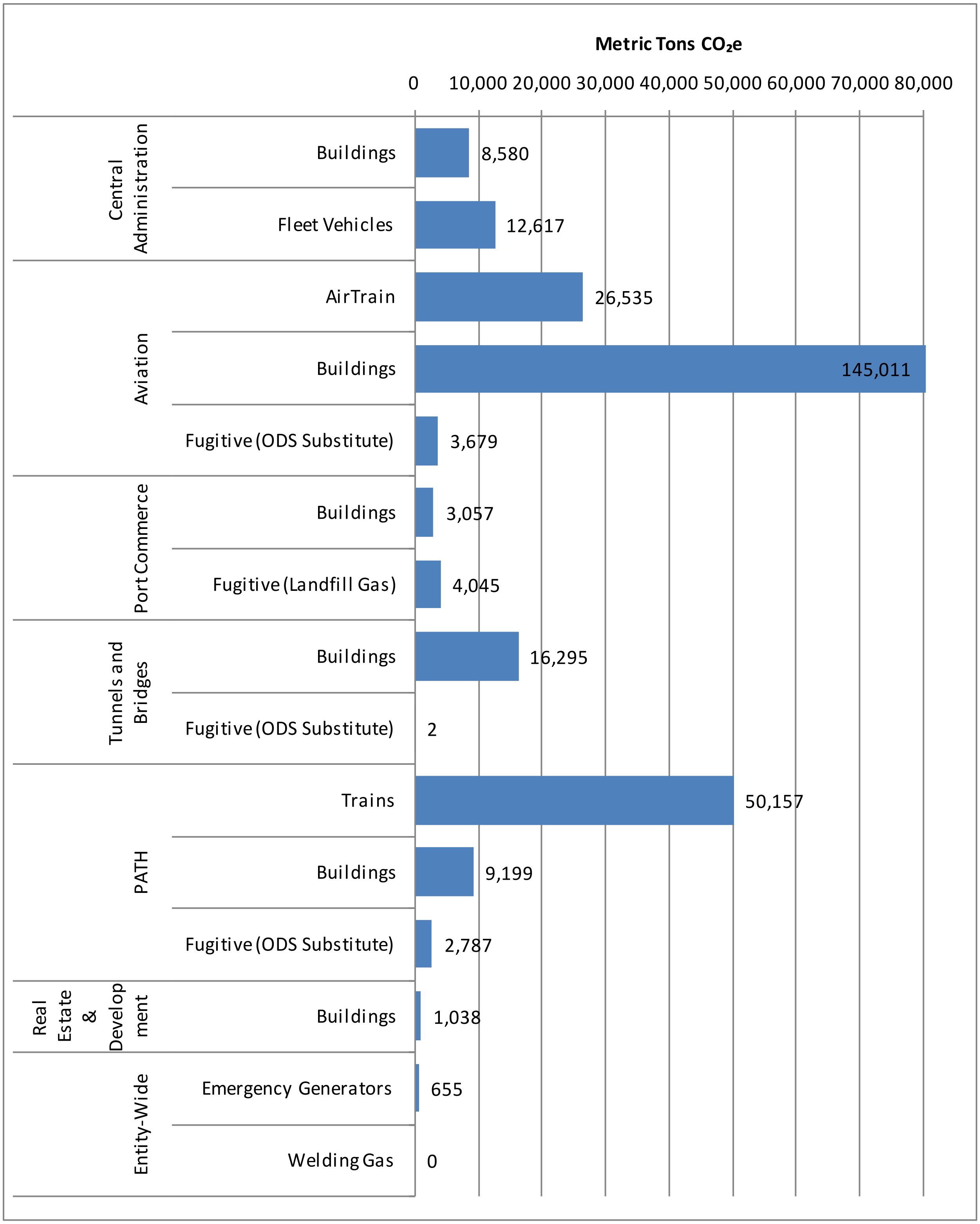

Figure 1-5. GHG Emissions by Department and Activity Type

In Table 1-5, the sources that generated biogenic emissions are noted. In addition, any emissions that were calculated with simplified methods are noted with “SEM”.

Table 1-4. CO_2e Total Emissions by Methodology, Source Type, and Department

	Stationary Combustion	Electricity	Electricity: SEM	Steam/ Heating/ Cooling	Fleet Vehicles	Fleet Vehicles: SEM	Fleet Vehicles: Biogenic	Fugitive Emissions: SEM	Landfill Gas
Central Administration	954	7,507	119	-	10,864	1,174	579	-	-
Aviation	30,687	131,602	1,180	8,077	-	-	-	3,679	-
Port Commerce	199	2,859	-	-	-	-	-	-	4,044
Tunnels & Bridges	639	14,528	1,129	-	-	-	-	2	-
Bus Terminals	675	9,884	-	3,594	-	-	-	414	-
PATH	1,539	57,817	-	-	-	-	-	2,787	-
Real Estate & Development	162	875	-	-	-	-	-	-	-
Totals	**34,855**	**225,071**	**2,428**	**11,671**	**10,864**	**1,174**	**579**	**6,882**	**4,044**

Table 1-6 consolidates the emissions by Scope and emissions calculation methodology regardless of the particular emitting activity.

Table 1-5. Port Authority NY/NJ CO_2e Emissions by Methodology and Scope

	Standard Emissions Methodology: Non-Biogenic Scope 1	Standard Emissions Methodology: Non-Biogenic Scope 2	Standard Emissions Methodology: Biogenic Scope 1	Simplified Emissions Methodology: Scope 1	Simplified Emissions Methodology: Scope 2
Central Administration	11,818	7,507	1174	579	119
Aviation	30,687	139,678	-	3,679	1,180
Port Commerce	4,244	2,859	-	-	-
Tunnels & Bridges	639	14,528	-	2	1,129
Bus Terminals	675	13,478	-	414	-
PATH	1,539	57,817	-	2,787	-
Real Estate & Development	162	875	-	-	-
Multi-Department	-	-	-	655	-
Totals	**49,763**	**236,742**	**1,174**	**8,116**	**2,428**

Figure 1-6 shows the PANYNJ total emissions by methodology and scope, as well as the amount of biogenic emissions by scope. The SEM emissions amount to only 2.9% of the emissions for the PANYNJ inventory.

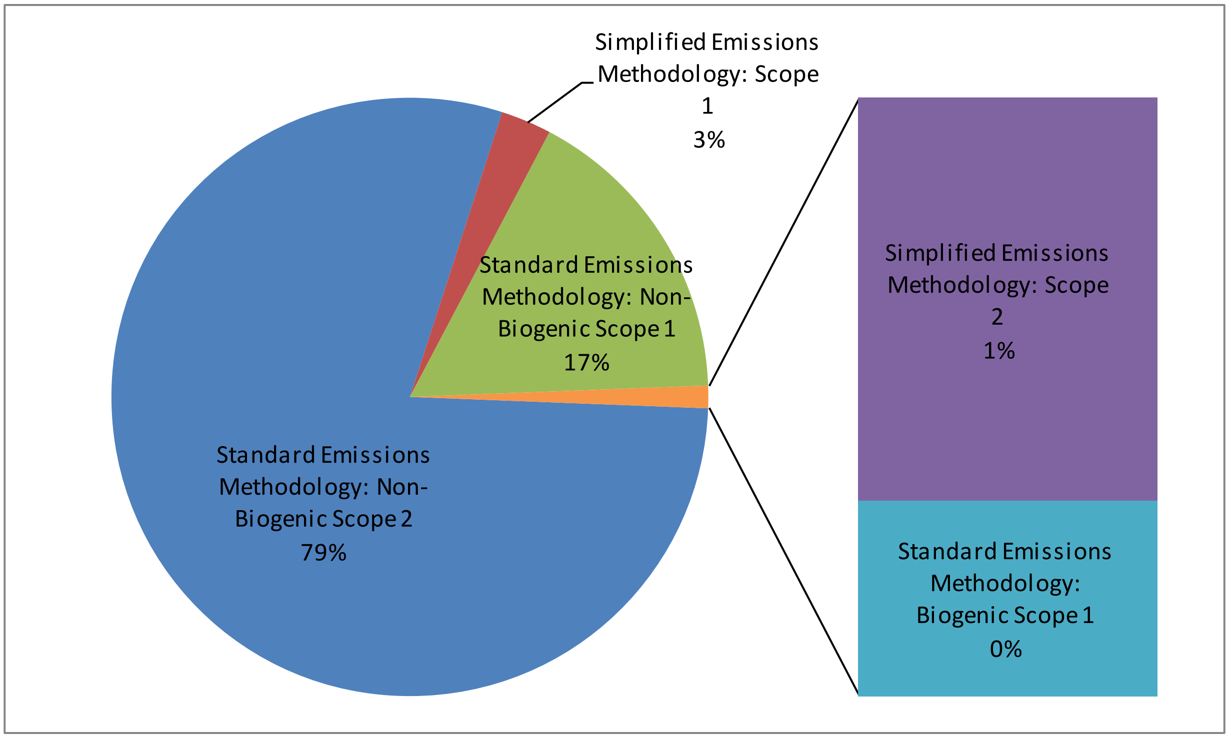

Figure 1-6. Port Authority NY/NJ CO_2e Emissions by Methodology and Scope

2.0 STATIONARY COMBUSTION

2.1. BUILDINGS

Buildings where fuel was combusted to produce electricity, heat or motive power using equipment in a fixed location were considered in the inventory – the most common being natural gas (NG) for furnace or boiler fuel. Because only Scope 1 and not Scope 3 emissions from stationary combustion are being considered in the inventory, only fuel that was combusted for PANYNJ use was included in the emissions calculations. Not all buildings within the PANYNJ's boundary combust fuel, therefore not all buildings were included in the inventory. Table 2-1 below provides a list of facilities where fuel was combusted during CY2010.

Table 2-1. Facilities with Stationary Combustion

Facility*	
225 PAS	Holland Tunnel
PATC	Lincoln Tunnel
777 Jersey Ave	George Washington Bridge
JFK	Goethals Bridge
AirTrain JFK	Outerbridge Crossing
LaGuardia	Port Authority Bus Terminal
Newark	George Washington Bridge Terminal
Stewart	PATH Buildings
Teterboro	Bathgate Industrial Park
Brooklyn Marine Terminal	The Teleport
Port Newark	Howland Hook
Port Jersey	
*Many facilities include multiple buildings	

2.1.1. Activity Data

For NG combustion, the PANYNJ provided consumption data by month for each building in therms or hundreds of cubic feet (ccf). Some of the data was transcribed from the provider's website into a Microsoft Excel (Excel) workbook by the PANYNJ and sent via email, while additional data was provided by the PANYNJ in the form of bill copies from the utility or landlord. In some cases, data was not immediately available, so SRI downloaded data from the providers' website in the form of screen shots converted to portable document format (PDF) and/or transcription of data from the website into an Excel workbook.

Very little fuel oil was combusted for PANYNJ during CY2010 due to the drop in price of NG. Two facilities, LaGuardia Airport and Port Jersey, combusted fuel oil in CY2010. The consumption data was provided by the PANYNJ in an Excel workbook that was transcribed from bill copies.

2.1.2. Emission Factors and Other Parameters

Emission estimates are developed in accordance with GRP Chapter 12: Direct Emissions from Stationary Combustion (TCR, 2008). The GHG emission factors used to calculate the greenhouse gases associated with stationary fuel combustion in buildings are shown below in Table 2-2.

The values in Table 2-2 assume an average heating value of 1020 British thermal units (Btus)/standard cubic foot (scf) for NG. This value was determined based upon the AP-42 average gross heating value of natural gas (EPA, 1995) and confirmed by using Public Service Enterprise Group's (PSE&G's) method for converting from therms to ccf. Additionally, because AP-42 uses a heating value of 1020 Btu/scf for all CAP emission factors, the use of the same heating value in GHG calculations will ensure congruency. The fuel oil heating value was assumed to be 138,000 Btus per gallon (TCR, 2008). The emission factors for CO_2 were derived from Table 12.1 in TCR GRP and the emission factors for CH_4 and N_2O were derived from Table 12.9 (TCR, 2008).

Table 2-2. Stationary Combustion GHG Emission Factors

	CO_2	CH_4	N_2O
Kilograms (kg)/ccf of NG	5.40	5.10×10^{-4}	1.02×10^{-5}
kg/therm of NG	5.29	5.00×10^{-4}	1.00×10^{-5}
kg/gallon (gal) of Fuel Oil	10.4	1.54×10^{-3}	8.40×10^{-5}

The CAP emission factors are based on values recommended by AP-42 (EPA, 1995). The sulfur dioxide (SO_2) emission factor assumes a 100% fuel sulfur conversion. The oxides of nitrogen (NO_x) emission factor assumes that the NG was combusted in a small [<100 million Btus (MMBtu)/hour (hr)] uncontrolled boiler. These values are presented in Table 2-3.

Table 2-3. Stationary Combustion CAP Emission Factors

	SO_2	NO_x	Particulate Matter (PM) (total)
kg/ccf of NG	2.72×10^{-5}	4.54×10^{-3}	3.45×10^{-4}
kg/therm of NG	2.67×10^{-5}	4.45×10^{-3}	3.38×10^{-4}
kg/gallon of Fuel Oil	6.44×10^{-2}	9.07×10^{-3}	9.07×10^{-4}

2.1.3. Emission Estimates

Because the GHG emission estimates related to stationary combustion were derived from bill copies, no simplified methods were necessary for calculation. Figure 2-1 provides a breakdown by percentage and Table 2-4 provides specific quantities of GHG emissions associated with stationary combustion, aggregated by department. CH_4 and N_2O emissions related to natural gas combustion are relatively small compared with CO_2. This is due to the low nitrogen content of the fuel and the hydrocarbon destruction efficiency of the combustion equipment.

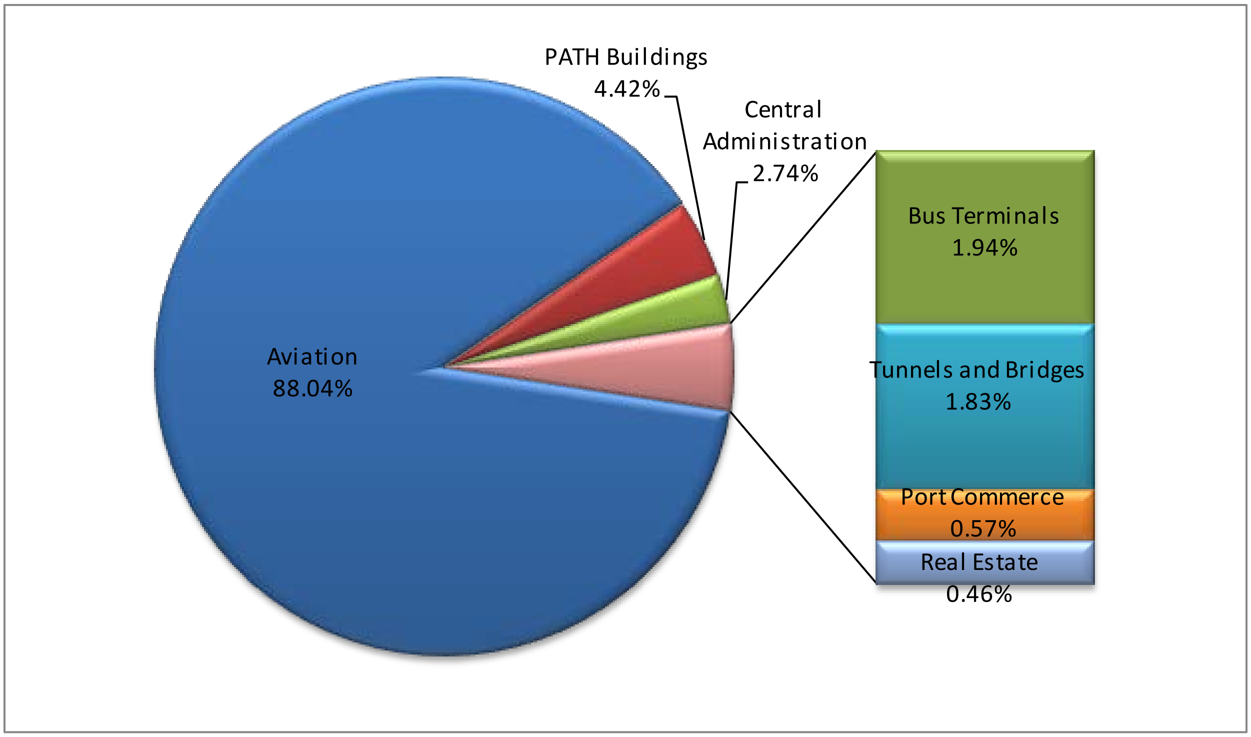

Figure 2-1. Stationary Combustion Percentage Distribution of CO_2e by Department

As can be seen in Figure 2-1, the Aviation department combusted the largest amount of fuel, followed by PATH buildings in a distant second.

Table 2-4. Stationary Combustion GHGs by Department (metric tons)

Department	CO_2	CH_4	N_2O	CO_2e
Central Administration	952	0.090	0.00180	954
Aviation	30,608	2.904	0.05912	30,687
Port Commerce	198	0.019	0.00044	199
Tunnels and Bridges	637	0.060	0.00120	639
Bus Terminals	673	0.064	0.00127	675
PATH Buildings	1,535	0.145	0.00290	1,539
Real Estate	162	0.015	0.00031	162
Totals	**32,143**	**3.04**	**0.06704**	**34,885**

Table 2-5 provides the same GHG emissions information in Table 2-4, but with the emission estimates broken down by facility, which is the way that emissions are reported to TCR.

Table 2-5. Stationary Combustion GHGs by Facility (metric tons)

Building/Facility	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
225 PAS	54	0.0051	0.00010	54
PATC	648	0.061	0.0012	649
777 Jersey Ave	250	0.024	0.00047	251
JFK	10,096	0.954	0.0191	10,121
AirTrain JFK	280	0.026	0.00053	281
LaGuardia (NG)	3,709	0.35	0.0070	3,718
LaGuardia (Oil)	72	0.011	0.0006	73
Newark	13,185	1.246	0.0249	13,219
Stewart	93	0.0088	0.00018	93
Teterboro	552	0.052	0.0010	553
Brooklyn Marine Terminal	117	0.011	0.00022	117
Port Newark	29	0.0027	0.00005	29
Howland Hook	43	0.0040	0.00008	43
Port Jersey	10	0.0015	0.00008	10
Holland Tunnel	67	0.0063	0.00013	67
Lincoln Tunnel	35	0.0033	0.00007	35
George Washington Bridge	31	0.003	0.00006	31
Goethals Bridge	371	0.035	0.0007	372
Outerbridge Crossing	133	0.013	0.00025	133
Port Authority Bus Terminal	4	0.00034	0.00001	4
George Washington Bridge Terminal	669	0.063	0.0013	671
PATH Buildings	1,535	0.145	0.0029	1,539
Bathgate Industrial Park	67	0.0063	0.00013	67
The Teleport	95	0.0089	0.00018	95

CAP emissions totals by department and facility can be found in Table 2-6 and Table 2-7, respectively.

Table 2-6. Stationary Combustion CAPs by Department

Department	**SO_2 (kg)**	**NO_x (kg)**	**PM (kg)**
Administrative	4.8	800.0	60.8
Aviation	591.8	23,531.5	1,789.9
Port Commerce	65.2	167.2	12.9
Tunnels and Bridges	3.2	535.6	40.7
Bus Terminals	3.4	565.8	43.0
PATH Buildings	7.7	1290.4	98.1
Real Estate	0.8	136.0	10.3
Totals	677	27027	2056

Table 2-7. Stationary Combustion CAPs by Facility

Building	SO_2 (kg)	NO_x (kg)	PM (kg)
225 PAS	0.3	45.2	3.4
PATC	3.3	544.5	41.4
777 Jersey Ave	1.3	210.3	16.0
JFK International Airport	50.9	8487.5	645.1
AirTrain JFK	1.4	235.5	17.9
LaGuardia (NG)	18.7	3118.0	237.0
LaGuardia (Oil)	451.0	63.5	6.4
Newark Liberty International Airport	66.5	11084.8	842.4
Stewart	0.5	78.2	5.9
Teterboro	2.8	464.0	35.3
Brooklyn Marine Terminal	0.6	98.2	7.5
Port Newark	0.1	24.1	1.8
Howland Hook	0.2	35.8	2.7
Holland Tunnel	0.3	56.3	4.3
Port Jersey	64.2	9.1	0.9
Lincoln Tunnel	0.2	29.1	2.2
George Washington Bridge	0.2	26.3	2.0
Goethals Bridge	1.9	312.3	23.7
Outerbridge Crossing	0.7	111.5	8.5
Port Authority Bus Terminal	0.0	3.0	0.2
George Washington Bridge Terminal	3.4	562.8	42.8
PATH	7.7	1290.4	98.1
Bathgate Industrial Park	0.3	56.4	4.3
The Teleport	0.5	79.5	6.0

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3.0 MOBILE COMBUSTION

PANYNJ maintains operational control of a large fleet of vehicles including passenger vehicles, police vehicles, firefighting equipment, and construction equipment. Most of these are tracked and serviced by the Port Authority's Central Automotive Division (CAD). CAD tracks fuel use for individual vehicles using fuel cards. CAD also directly dispenses alternative fuels like CNG and E85 to some vehicles, and these bulk fuel purchases are not tracked at the vehicle level. In addition, PANYNJ also has vehicles stationed at the airports and operated by or on behalf of the individual facility, which are known as the "Shadow Fleet". Fuel and mileage records for these vehicles are not tracked by the CAD, but by the individual airports. Upon verification of this inventory, the Shadow Fleet was found to be outside of the operational control of the Port Authority and has been excluded from the Scope 1 and Scope 2 GHG and CAP inventory. However, optional emissions reporting data for the Shadow Fleet can be found in Section 8.2 of this report. In cases where sufficient evidence was not available to perform the emissions calculations according to TCR guidelines, a SEM was developed, and these emissions are reported separately.

3.1. CENTRAL AUTOMOTIVE FLEET

3.1.1. Activity Data

CAD data was provided by PANYNJ. The first source of data was a Microsoft (MS) Excel file containing a list of all the CAD vehicles, which has different tabs for highway and non-highway sources. These two tabs clearly lay out the mileage and fuel consumption of each of the vehicles in the CAD. The file also contained information on vehicles for which fuel consumption estimates were not provided by PANYNJ. For these vehicles, fuel consumption was estimated by dividing the vehicle mileage estimate (provided by PANYNJ) by the estimated miles per gallon from The U.S. Environmental Protection Agency's (EPA's) fueleconomy.gov website. Most of the remaining vehicles that do not have fuel economy ratings are non-highway vehicles, where fuel consumption is not tied to mileage. There are a few highway vehicles that do not show up on EPA's fueleconomy.gov list, and in the case of those 21 vehicles, an internet search was used to estimate their curbside weight and fuel economy.

CAD also tracks fuel consumption from CNG vehicles. CNG is used in both dedicated CNG vehicles and CNG bi-fuel vehicles. In the case of bi-fuel vehicles, all reported fuel use is gallons of gasoline, and therefore the miles per gallon estimate for these vehicles will not be accurate. CNG consumption is not tracked at the vehicle level.

CAD also provided a third file contained an estimate of total 2010 CAD fuel consumption, which was used to fill in data gaps for non-highway vehicles.

3.1.2. Emission Factors and Other Parameters

All GHG emissions factors came from Table 13 in TCR's GRP where there is sufficient data to use this method. In some cases, particularly where vehicle mileage could not be used to estimate CH_4/N_2O emissions, these emissions were estimated based on the ratio of CO_2 to CH_4/N_2O emissions, as provided by TCR (TCR, 2009).

CO_2 emissions in the CAD were estimated by multiplying the fuel consumption in each highway and non-highway vehicle by the appropriate emissions factor from TCR Table 13.1. CH_4 and N_2O emissions were estimated for highway vehicles by multiplying vehicle mileage by the appropriate grams per mile (g/mi) emissions factor from TCR Table 13.4. In cases where highway vehicles had fuel consumption, but no mileage reported, the TCR simplified emissions method was used to estimate CH_4 and N_2O emissions based on CO_2 emissions (TCR, 2009). Non-highway vehicles used the g/gallon figure for non-highway vehicles in TCR Table 13.6 to estimate CH_4 and N_2O emissions.

PANYNJ provided an estimate for fuel consumption of 1.29 million gallons in 2010 for the entire CAD. Fuel consumption from highway vehicles accounted for 1.07 million gallons of fuel consumption, and non highway vehicles accounted for another 0.06 million gallons. These total gallons are removed from the fuel consumption figure, which leaves 0.16 million gallons of fuel. This remaining fuel consumption, with the exception of E85, is assumed to be from those non-highway vehicles with no fuel consumption reported. CO_2 emissions from bulk fuel combustion are estimated based on the default gasoline/diesel emissions factors from TCR's Table 13.1. CH_4 and N_2O emissions from CAD bulk fuel are estimated based on the per gallon emissions factor for non-highway vehicles, from TCR's Table 13.6.

E85 is used in CAD's flex fuel highway vehicle fleet. CO_2 emissions are estimated by multiplying the emissions factor for gasoline (from TCR Table 13.1) by 15% of total gallons, and the emissions factor for ethanol by 85%. The ethanol CO_2 emissions are assumed to be biogenic. Because this fuel consumption cannot be attributed to any particular vehicle, CH_4 and N_2O emissions are estimated based on the ratio of CO_2 to CH_4 and N_2O emissions from TCR.

CO_2 emissions from natural gas were estimated based on the CO_2 emissions factor in Table 13.1. CH_4 and N_2O emissions are estimated using a simplified estimation method, based on the ratio of CO_2 to CH_4 and N_2O emissions from TCR.

3.1.3. Emission Estimates

GHG emissions results for the CAD are shown below in Table 3-1. The majority of emissions estimates were completed using standard TCR methodologies. Simplified emissions methodologies are used for vehicles where a proper mileage figure could not be determined. The majority of the simplified emissions come from the bulk fuel reported at various airports. Biogenic emissions are those CO_2 emissions that come from biofuels such as ethanol and biodiesel.

Table 3-1. 2010 GHG Emissions Estimates from the CAD (metric tons)

	CO_2	CH_4	N_2O	CO_2e
Standard Emission Method	10,864	-	-	10,864
Simplified Emissions Method	296	16.15	266.60	579
Mobile Combustion: Biomass	1,174	-	-	1,174
Totals	12,335	16.15	266.60	12,617

CAP emissions from the CAD are shown below in Table 3-2.

Table 3-2. CAP CAD Emissions (metric tons)

	NO_x	SO_x	PM_{10}	$PM_{2.5}$
Highway Vehicles	14.03	0.139	1.086	0.752
Non Highway Vehicles	0.524	0.011	0.059	.057
CAD Bulk Fuel	3.78	0.168	0.809	0.750
Totals	**18.334**	**0.318**	**1.313**	**1.559**

3.2. PATH DIESEL EQUIPMENT

3.2.1. Activity Data

As mentioned above, PATH owns and operates certain track maintenance vehicles and emergency generators that are not accounted for by the CAD. Emissions from PATH vehicles are calculated as part of the fleet vehicles bulk fuel total. PATH uses diesel fuel exclusively for maintenance vehicles and generators (PATH commuter trains are powered by traction power).

3.2.2. GHG Emission Factors and Other Parameters

CO_2 emissions from PATH are estimated based on the gallons of diesel fuel multiplied by the appropriate TCR emissions factor from Table 13.1. CH_4/N_2O emissions are calculated based on the per gallon diesel emissions factor for non-highway equipment, from Table 13.4.

3.2.3. GHG Emission Estimates

Total PATH emissions are shown in Table 3-9.

Table 3-3. 2010 GHG Emissions from PATH Diesel Equipment (metric tons)

	CO_2	CH_4	N_2O	CO_2e
PATH Diesel Equipment	279	0.016	0.007	281.5

3.2.4. CAP Emission Factors

The emission factors for CAP for diesel equipment used in the PATH system were calculated based on the national average emission factors from the EPA MARKAL database.

3.2.5. CAP Emission Estimates

Table 3-10 reports CAP emissions for diesel equipment used in the PATH system.

Table 3-4. 2010 CAP Emissions from PATH Diesel Equipment (metric tons)

	NO_x	SO_x	PM_{10}	$PM_{2.5}$
PATH	0.325	0.004	0.027	0.027

4.0 ELECTRICITY USE

The combustion of fossil fuels for the purpose of electricity generation will yield the GHGs CO_2, N_2O and CH_4. Therefore, through a transitive relationship, the consumption of fossil fuel generated electricity will result in a certain quantity of GHGs being released. Because the fossil fuel is not being directly combusted by the PANYNJ, the indirect emissions associated with electricity consumption are considered Scope 2 emissions.

4.1. BUILDINGS

All buildings where electricity was consumed by the PANYNJ are considered in this inventory. In a handful of buildings or facilities, total electricity consumption was shared by the PANYNJ and tenants of the PANYNJ. Because of this, total electricity consumption was divided between the PANYNJ and the tenant through a number of different processes. Some facilities were divided based upon the share of square footage of each consumer, while others were divided based on the total dollars spent on electricity through lease agreements. All GHGs associated with the consumption of electricity in common areas maintained or provided as a service to the tenant by the PANYNJ such as street lighting and lobby cooling, are considered Scope 2 emissions for the PANYNJ. Table 4-1 provides a list of facilities where electricity was consumed by the PANYNJ.

Table 4-1. Facilities* with Electricity Consumption

225 PAS	LaGuardia Airport	Lincoln Tunnel
233 PAS	AirTrain Newark	George Washington Bridge
Gateway	Stewart Airport	Bayonne Bridge
PANYNJ Technical Center	Teterboro Airport	Goethals Bridge
777 Jersey Ave	Brooklyn Marine Terminal	Outerbridge Crossing
One Madison	Port Jersey Auto Marine Terminal	Port Authority Bus Terminal
115 Broadway	Port Newark	George Washington Bridge Terminal
96/100 Broadway	Port Elizabeth	PATH Buildings
116 Nassau	Howland Hook	Bathgate Industrial Park
5 Marine View	Holland Tunnel	
JFK Airport	The Teleport	
*Facilities may include multiple buildings		

4.1.1. Activity Data

The majority of raw electricity data provided by the PANYNJ was extracted from utility records from the utility provider. All electricity provided by the New York Power Authority (NYPA) and consumed by the PANYNJ is tracked by the Office of Energy and Environmental Programs (OEEP) by month. These NYPA bills were used to extract electricity data for all facilities that consumed electricity supplied by NYPA (PANYNJ, 2011a).

All electricity supplied by the Kennedy International Airport Cogeneration Plant (KIAC) and consumed by the PANYNJ is tracked by OEEP by month in the form of bill copies. These KIAC bills were used to extract electricity data for all facilities that consumed electricity supplied by KIAC (PANYNJ, 2011b).

Although TCR requires that electricity from a combined heat and power (CHP) plant, such as KIAC, be reported separately, this section includes all emissions from electricity consumption. The emissions specifically associated with electricity supplied by KIAC and consumed by JFK International Airport are included in the CHP section of this report.

Nearly all of the electricity consumed in New Jersey is tracked by the OEEP using a unique point of delivery identification number (PODID). The OEEP sent a request to The Matrix that contained a list of all PODID numbers utilized in CY2010. The product of the request was monthly consumption data for all New Jersey consumers (PANYNJ, 2011c).

For the facilities leased by the PANYNJ, bill copies from the landlord were obtained and the relevant data was extracted. In cases where the landlord billed the PANYNJ through lease payments instead of direct billing, the total amount spent on electricity was used to determine the amount of electricity consumed, using an average cost per kilowatt-hour for the electricity provider.

All remaining data was extracted through various utility providers' websites by logging in to each account and transcribing the data.

4.1.2. Emission Factors and Other Parameters

Emission estimates are developed in accordance with GRP Chapter 14: Indirect Emissions from Electricity (TCR, 2008). The GHG emission factors used to calculate the greenhouse gases associated with electricity consumption are shown below in Table 4-2.

Table 4-2. Electricity GHG Emission Factors

Emissions & Generation Resource Integrated Database (eGRID) Subregion/Provider	CO_2 (kg/kWh)	CH_4 (kg/kWh)	N_2O (kg/kWh)
NPCC NYC/Westchester	0.320	1.19×10^{-5}	1.52×10^{-6}
Reliable First Corporation East	0.481	1.24×10^{-5}	7.73×10^{-6}
KIAC	0.424	3.04×10^{-5}	7.20×10^{-6}

For facilities located in New York, the Northeast Power Coordinating Council/Westchester emission factors were used. For facilities located in New Jersey, the Reliable First Corporation emission factors were used. These emission factors were extracted from the 2011 Climate Registry Default Emission Factors (TCR, 2011a) and the boundaries were determined using the eGRID subregion map (EPA, 2010).

The eGRID emission factors include operational data such as emissions, different types of emission rates, generation, resource mix, and heat input within a specific region. For example, within Northeast Power Coordinating Council/Westchester 56% of electricity is generated from natural gas combustion and 38% is generated through nuclear means, with the balance being oil and biomass combustion. In RFC East, 42% of electricity is generated from coal combustion, 40% through nuclear means, with the balance being generated from oil, biomass and hydro power (EPA, 2011). Because there is a larger amount of GHGs associated with coal over natural gas combustion, the emission factors in RFC East tend to be higher than those in Northeast Power Coordinating Council/Westchester.

The KIAC emission factors were calculated based on parameters similar to those of Northeast Power Coordinating Council/Westchester and RFC East (TranSystems, 2011). Because KIAC is a cogeneration facility where the combustion of natural gas is divided between electricity, district heating and district cooling, the emission factors are slightly lower than the other two. Only two entities, JFK International Airport and AirTrain JFK, consumed electricity generated by KIAC.

CAP emission factors were calculated based on values derived from the 2008 EPA National Emissions Inventory, that provided State emission totals for PM and SO_2 (EPA, 2008). The eGRID SO_2 and NO_x emission factors, along with the PM and SO_2 state totals were used to determine the $PM_{2.5}$ and PM_{10} split. As with GHG emissions, the CAP emission factors vary by eGRID region and electricity source. Table 4-3 shows the CAP emission factors used for the calculations.

Table 4-3. Electricity CAP Emission Factors

eGRID subregion/Provider	SO_2 (kg/kWh)	NO_x (kg/kWh)	$PM_{2.5}$ (kg/kWh)	PM_{10} (kg/kWh)
NPCC NYC/Westchester	5.45×10^{-4}	4.76×10^{-4}	1.33×10^{-5}	2.35×10^{-5}
Reliable First Corporation East	7.92×10^{-3}	1.51×10^{-3}	1.34×10^{-3}	1.35×10^{-3}
KIAC	2.14×10^{-6}	7.57×10^{-5}	2.70×10^{-5}	2.70×10^{-5}

4.1.3. Emission Estimates

Because not all of the data for electricity consumed by the PANYNJ originated from electricity bills, meter readings or purchase records, some simplified methods were used to estimate electricity consumption. TCR requires that these emissions be reported separately and aggregated with the estimates from all other emission sources. Table 4-4 lists the GHG emissions for each department, excluding emissions associated with electricity consumption on the

PATH trains, AirTrain JFK and AirTrain Newark. Table 4-4 includes the estimated emissions associated with electricity consumption.

Table 4-4. Electricity GHGs by Department (metric tons)

Department	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Administrative	7,591	0.221	0.098	7,626
Aviation	107,410	5.713	1.634	108,037
Port Commerce	2,844	0.077	0.043	2,859
Tunnels and Bridges	15,587	0.462	0.192	15,657
Bus Terminals	9,862	0.367	0.047	9,884
PATH Buildings	7,618	0.197	0.122	7,660
Real Estate	873	0.032	0.004	951
Total CO_2e (metric tons)	**151,785**	**148**	**663**	**152,597**

As can be seen from Figure 4-1, the largest emitting department is Aviation. This is primarily due to the electricity demand associated with some of their terminal operations.

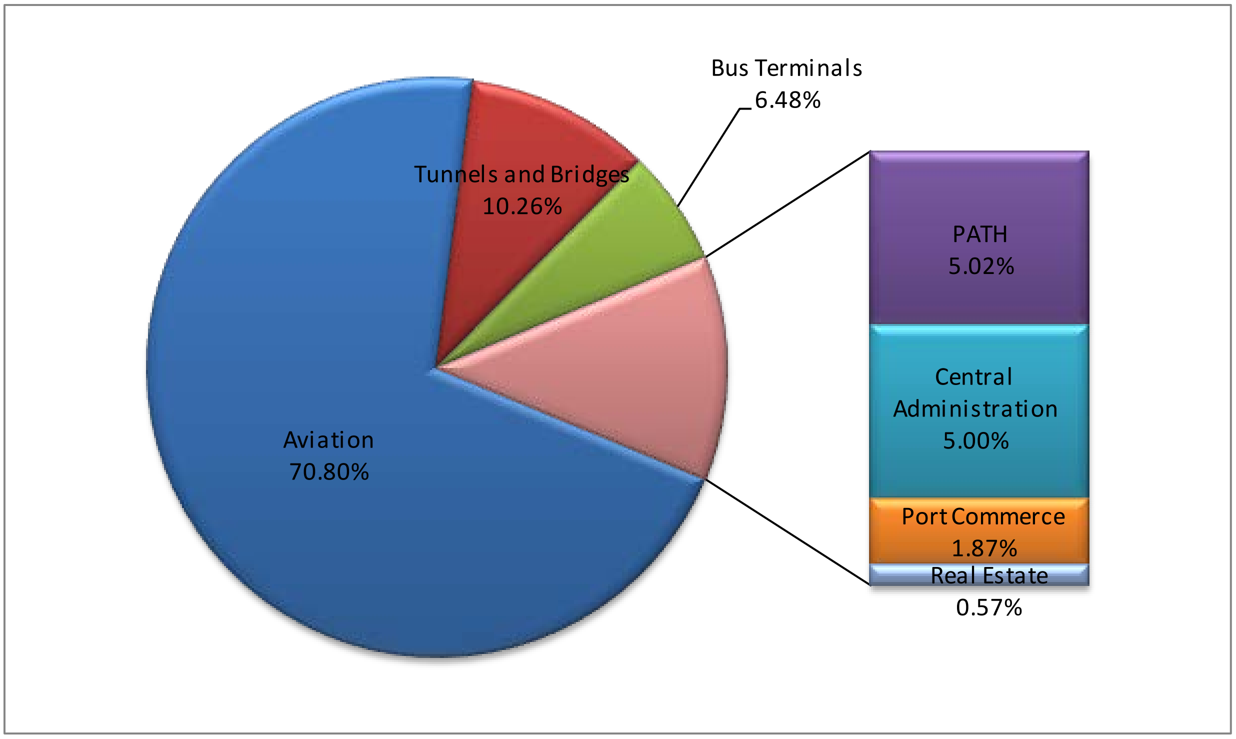

Figure 4-1. Electricity Percentage Distribution of CO_2e by Department

Table 4-5 shows the emission estimates broken down by facility. It should be noted that electricity supplied and consumed in NJ has higher emission factors, resulting in a higher CO_2e when compared to a similar quantity of electricity supplied and consumed in NY.

Table 4-5. Electricity GHGs by Building/Facility

Building	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
225 PAS	1,110	0.041	0.005	1,112
233 PAS	255	0.009	0.001	255
Gateway	738	0.019	0.012	738
PANYNJ Technical Center	3,943	0.102	0.063	3,944
5 Marine View	45	0.001	0.001	45
777 Jersey Ave	698	0.018	0.011	702
One Madison	351	0.013	0.002	351
115 Broadway	151	0.006	0.001	152
96/100 Broadway	234	0.009	0.001	235
116 Nassau	64	0.002	0	64
JFK International Airport	60,842	4.360	1.033	61.254
LaGuardia Airport	12,865	0.479	0.061	12,894
Newark Liberty International Airport	32,669	0.845	0.525	32,849
Stewart Airport	174	0.004	0.003	175
Teterboro Airport	854	0.022	0.014	859
Brooklyn Marine Terminal	199	0.007	0.001	200
Port Jersey Auto Marine Terminal	166	0.004	0.003	167
Port Newark	1,516	0.039	0.024	1,525
Port Elizabeth	888	0.023	0.014	893
Howland Hook	74	0.003	0	74
Holland Tunnel	4,032	0.124	0.045	4,048
Lincoln Tunnel	7,058	0.208	0.088	7,089
George Washington Bridge	2,892	0.075	0.046	2,908
Bayonne Bridge	275	0.009	0.002	276
Goethals Bridge	899	0.031	0.007	901
Outerbridge Crossing	433	0.015	0.003	434
Port Authority Bus Terminal	7,917	0.295	0.038	7,935
George Washington Bridge Terminal	1,945	0.072	0.009	1,950
PATH Buildings	7,618	0.197	0.122	7,660
Bathgate Industrial Park	43	0.002	0.000	43
The Teleport	831	0.031	0.004	833

CAP emissions totals are presented in a similar manner as GHGs, by department and facility. These totals can be found in Table 4-6 and Table 4-7, respectively. CAP emissions will typically follow linearly with GHG emissions.

Table 4-6. Electricity CAPs by Department (metric tons)

Department	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
Administrative	42.076	9.038	6.875	6.959
Aviation	261.639	67.519	46.381	46.917
Port Commerce	19.440	3.849	3.245	3.276
Tunnels and Bridges	81.792	18.327	13.205	13.387
Bus Terminals	7.620	6.658	0.186	0.328
PATH Buildings	56.982	10.860	9.602	9.681
Real Estate	0.675	0.590	0.016	0.029
Totals	**470.224**	**116.840**	**79.511**	**80.577**

Table 4-7. Electricity CAPs by Building/Facility (metric tons)

Building/Facility	SO_2	NO_x	$PM_{2.5}$	PM_{10}
225 PAS	0.858	0.749	0.021	0.037
233 PAS	0.197	0.172	0.005	0.008
Gateway	5.523	1.053	0.931	0.938
PANYNJ Technical Center	29.499	5.622	4.971	5.012
5 Marine View	0.336	0.064	0.057	0.057
777 Jersey Ave	5.224	0.996	0.880	0.888
One Madison	0.271	0.237	0.007	0.012
115 Broadway	0.117	0.102	0.003	0.005
96/100 Broadway	0.181	0.158	0.004	0.008
116 Nassau	0.050	0.043	0.001	0.002
JFK International Airport	0.310	10.859	3.876	3.878
LaGuardia Airport	9.941	8.685	0.242	0.428
Newark Liberty International Airport	244.386	46.573	41.183	41.519
Stewart Airport	0.139	0.122	0.003	0.006
Teterboro Airport	6.390	1.218	1.077	1.086
Brooklyn Marine Terminal	0.154	0.135	0.004	0.007
Port Jersey Auto Marine Terminal	1.240	0.236	0.209	0.211
Port Newark	11.343	2.162	1.911	1.927
Port Elizabeth	6.646	1.266	1.120	1.129
Howland Hook	0.057	0.050	0.001	0.002
Holland Tunnel	18.683	4.464	2.958	3.006
Lincoln Tunnel	37.696	8.372	6.102	6.184
George Washington Bridge	21.603	4.120	3.640	3.670
Bayonne Bridge	0.663	0.236	0.089	0.092
Goethals Bridge	2.042	0.757	0.266	0.278
Outerbridge Crossing	1.105	0.378	0.151	0.157
Port Authority Bus Terminal	6.117	5.344	0.149	0.264
George Washington Bridge Terminal	1.503	1.313	0.037	0.065
PATH Buildings	56.982	10.860	9.602	9.681
Bathgate Industrial Park	0.033	0.029	0.001	0.001
The Teleport	0.642	0.561	0.016	0.028

4.2. TRAINS

There are three separate train systems under the jurisdiction of the PANYNJ that use electricity as its primary form of energy. Two of these trains are airport monorail systems with service between JFK and two passenger stations in Queens, and Newark Airport and the Northeast Corridor transfer station, while the PATH train is a commuter subway system connecting New Jersey and New York.

4.2.1. Activity Data

The activity data for the PATH trains and AirTrain Newark were contained in the data request submission made to The Matrix that contained a list of all PODID numbers utilized in CY2010 (PANYNJ, 2011a). The PATH traction power comes from the main PSE&G account associated with PATH (1 Washington St. (Traction)) for which

PANYNJ provided electricity consumption data. The activity data for AirTrain JFK came from two sources, the monthly NYPA and KIAC bills (PANYNJ, 2011b; 2011c).

Although TCR requires that electricity from a combined heat and power plant, such as KIAC, be reported separately, this section includes all emissions from trains. The emissions estimation methods specifically associated with electricity supplied by KIAC and consumed by AirTrain JFK are included in the section to follow.

4.2.2. Emission Factors and Other Parameters

Emission estimates are developed in accordance with GRP Chapter 14: Indirect Emissions from Electricity (TCR, 2008). The GHG emission factors used to calculate the greenhouse gases associated with electricity consumption are shown in Table 4-2.

For AirTrain JFK, the Northeast Power Coordinating Council/Westchester emission factors were used. PATH trains and AirTrain Newark were applied the Reliable First Corporation emission factors. These emission factors were extracted from the 2011 Climate Registry Default Emission Factors (TCR, 2011a). The KIAC emission factors were calculated based on parameters similar to those of Northeast Power Coordinating Council/Westchester and RFC East (TranSystems, 2011).

4.2.3. Emission Estimates

Because the GHG emission estimates related to train electricity usage were derived from bill copies, no simplified methods were necessary for calculation. Table 4-8 provides specific quantities of GHG emissions associated with train electricity usage for each system. CH_4 and N_2O emissions related to electricity consumption are relatively small.

Table 4-8 shows the emission estimates broken down by train system. As expected, the PATH train system is the largest emitter because PATH train network services multiple locations, whereas the AirTrains are facility-specific supplements to the main transport system. PATH trains carry more passengers over longer distances, and the electricity is supplied by the Reliable First Corporation region, where emission rates are higher per kWh.

Table 4-8. Electricity GHG Emissions by Train (metric tons)

Train	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
AirTrain JFK	16,197	1.105	.255	16,299
AirTrain EWR	8,400	0.217	0.135	8,446
PATH Trains	49,882	1.290	0.802	50,157
Totals	**74,478**	**2.613**	**1.192**	**74,902**

CAP emissions totals for the train systems can be found in Table 4-9.

Table 4-9. Electricity CAP Emissions by Train (metric tons)

Train	**SO_2**	**NO_x**	**$PM_{2.5}$**	**PM_{10}**
AirTrain JFK	1.3	3.7	1.0	1.0
AirTrain EWR	62.8	12.0	10.6	10.7
PATH Trains	373.2	71.1	62.9	63.4
Totals	**437.3**	**86.8**	**74.4**	**75.1**

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5.0 USE OF IMPORTED STEAM, DISTRICT HEATING, COOLING AND ELECTRICITY FROM CHP

Emissions associated with purchased steam, district heat, cooling or electricity from a CHP plant are considered to be indirect or Scope 2 emissions.

5.1. JFK INTERNATIONAL AIRPORT / AIRTRAIN JFK

The KIAC is a gas-fired cogeneration facility located at JFK International Airport in Jamaica, NY. Electricity and thermal energy generated by KIAC are sold to the PANYNJ under an energy purchase agreement. This facility is operated by Calpine.

KIAC contains two natural gas-fired combustion generators that are routed to two heat recovery steam generators, which provide steam to one steam turbine at JFK's thermal plant. The chilled water delivered to JFK is produced by chillers that convert the thermal energy to chilled water.

5.1.1. Activity Data

Monthly energy consumption data for JFK and AirTrain JFK was provided by the PANYNJ for all emissions calculations associated with KIAC. JFK and AirTrain JFK are billed separately, thereby resulting in a simple division of associated emissions.

5.1.2. Emission Factors and Other Parameters

Emissions from CHP facilities represent a special case because of the simultaneous production of electricity and heat (or steam). Attributing total GHG emissions to each product stream would result in double counting; emissions are allocated based on the amount of each stream produced.

Monthly fuel consumption and fuel energy contract data provided by the PANYNJ were used to determine the GHG and CAP emissions factors for KIAC. Table 5-1 displays the GHG emission factors associated with each form of energy from KIAC. In addition to being a CHP plant, KIAC uses natural gas as its fuel source, which is cleaner burning fuel than other fossil fuel sources.

Table 5-1. KIAC GHG Emission Factors

Product	CO_2	CH_4	N_2O
Heating (kg/MMBtu)	60.300	4.32×10^{-6}	1.02×10^{-6}
Cooling (kg/MMBtu)	60.300	4.32×10^{-6}	1.02×10^{-6}
Electricity (kg/kWh)	0.4243	3.04×10^{-5}	7.20×10^{-6}

The CAP emissions for KIAC are listed below in Table 5-2.

Table 5-2. KIAC CAP Emission Factors

Product	SO_x	NO_x	$PM_{2.5}$	PM_{10}
Heating (kg/MMBtu)	3.05×10^{-4}	1.08×10^{-2}	3.84×10^{-3}	3.84×10^{-3}
Cooling (kg/MMBtu)	1.91×10^{-3}	6.74×10^{-2}	2.41×10^{-2}	2.41×10^{-2}
Electricity (kg/megawatt-hr)	2.14×10^{-3}	7.57×10^{-2}	2.70×10^{-2}	2.70×10^{-2}

5.1.3. Emission Estimates

Table 5-3 provides GHG emission estimates for the steam and electricity provided by the KIAC facility to JFK airport and AirTrain JFK. Note that the GHG emissions associated with electricity in Table 5-3 are also included in the indirect electricity emission estimates provided in Chapter 4.

Table 5-3. KIAC Supplied PANYNJ Consumed Energy GHGs (metric tons)

	CO_2	CH_4	N_2O	CO_2e
JFK Heating	1,978.8	0.142	0.034	1,992
JFK Cooling	4,544.9	0.326	0.077	4,576
JFK Electricity	60,839	4.360	1.033	61,254
JFK Totals	**67,363**	**4.828**	**1.144**	**67,822**
AirTrain Heating	674.4	0.048	0.011	319
AirTrain Cooling	824.3	0.059	0.014	830
AirTrain Electricity	14,586	1.045	0.248	16,299
AirTrain Totals	**16,084**	**1.152**	**.273**	**17,808**

Table 5-4 reports the criteria pollutant emission estimates associated with the steam and electricity supplied by KIAC to JFK airport and AirTrain JFK.

Table 5-4. KIAC Supplied PANYNJ Consumed Energy CAPs (metric tons)

	SO_x	NO_x	$PM_{2.5}$	PM_{10}
JFK Heating	0.010	0.353	0.126	0.126
JFK Cooling	0.023	0.811	0.290	0.290
JFK Electricity	0.307	10.857	3.876	3.876
JFK Totals	0.340	12.021	4.292	4.294
AirTrain Heating	0.003	0.120	0.043	0.043
AirTrain Cooling	0.004	0.147	0.053	0.053
AirTrain Electricity	0.074	2.603	0.929	0.930
AirTrain Totals	0.081	2.870	1.025	1.026

5.2. PORT AUTHORITY BUS TERMINAL

The Port Authority Bus Terminal reported some steam usage for heating in 2010. Scope 2 indirect emissions for this heating were calculated by assuming a total generation and delivery efficiency of 75%, in accordance with The Climate Registry protocol. The steam was assumed to be generated by natural gas with an energy content of 1013 Btu/pounds.

5.2.1. Activity Data

For steam, the PANYNJ provided consumption data by month in thousands of pounds. Some of the data was transcribed from the Con Edison website into a MS Excel workbook by the PANYNJ and sent via email. For data that was not immediately available, SRI signed into the Con Edison website and transcribed data from the website into a MS Excel workbook.

5.2.2. Emission Factors and Other Parameters

Since the emission factors for the purchased steam were not available from Con Edison, they must be indirectly estimated based on boiler efficiency, fuel mix, and fuel-specific emission factors per TCR method in Chapter 15 of the "TCR Guidelines". The steam purchased from Con Edison was generated by the burning of natural gas and it was assumed that the boiler efficiency and transport losses combined were 75%. The emission factors for purchased steam are listed in Table 5-5.

Table 5-5. Imported Steam GHG and CAP Emission Factors

GHG/CAP	CO_2 (kg/MMBtu)	CH_4 (kg/MMBtu)	N_2O (kg/MMBtu)	SO_2 (kg/MMBtu)	NO_x (kg/MMBtu)	PM (kg/MMBtu)
Emission Factor	70.53	0.007	0.0001	0.00016	0.027	0.002

5.2.3. Emission Estimates

Because the GHG emissions estimates related to purchased steam were derived from bill copies, no simplified methods were necessary for calculation. Table 5-6 provides specific quantities of GHG emissions associated with purchased steam for the Port Authority Bus Terminal.

Table 5-6. Imported Steam GHG Emissions by Building/Facility (metric tons)

Building	CO_2	CH_4	N_2O	CO_2e
Port Authority Bus Terminal	3,180	0.301	0.006	3,198

CAP emissions totals for the Port Authority Bus Terminal purchased steam can be found in Table 5-7.

Table 5-7. Imported Steam CAPs by Building/Facility (metric tons)

Building	SO_2	NO_x	$PM_{2.5}$	PM_{10}
Port Authority Bus Terminal	0.007	1.206	0.092	0.002

6.0 USE OF REFRIGERATION AND AIR CONDITIONING SYSTEMS

Fugitive emissions are intentional and unintentional releases of GHGs from joints, seals, gaskets, etc. Direct emissions from sources that are owned or controlled by PANYNJ are included in this inventory as Scope 1 emissions. Facilities use refrigerants for refrigeration and air conditioning systems, including motor vehicle air conditioning, chillers, retail food refrigeration, cold storage warehouses, refrigerated transport, industrial process refrigeration, and commercial air conditioning systems.

6.1. ACTIVITY DATA

SRI submitted a general data request to the PANYNJ, requesting all known refrigerant usage for 2010. As there is no standard procedure within each department, data was collected by each facility based on availability.

The data format received by SRI differed for each facility; therefore, a procedure based upon the GRP's screening method was used to estimate the amount of fugitive emissions. None of the data qualified as being a Tier A or B method; therefore, all fugitive emission estimates were computed using simplified methods.

The data was identified as being in one of four categories; charging new equipment, equipment inventory, refill existing equipment, and stock room purchase. Based on the category of data, a different method was used to estimate the amount of emitted refrigerant. Table 6-1 shows which facilities used each method of estimation.

Table 6-1. Facilities with Direct Fugitive Emissions*

Charging New Equipment	Equipment Inventory	Refill Existing Equipment	Stock Room Purchase
• Newark Airport	• Stewart Airport	• Stewart Airport	• JFK Airport
	• PATH Buildings	• Lincoln Tunnel	
	• PATH Trains	• Holland Tunnel	
		• PANYNJ Bus Terminal	
*A number of facilities/buildings also used R-22, which is not inventoried as part of the GHG reporting protocol. These buildings/facilities are not included in the above table.			

6.2. EMISSION FACTORS AND OTHER PARAMETERS

Emissions of HFCs and PFCs from refrigeration and air conditioning equipment result from the manufacturing process, leakage over the operational life of the equipment, and disposal at the end of the useful life of the equipment. Common refrigerants R-22, R-12, and R-11 are not part of the GHGs required to be reported to The Registry because they are either hydrochlorofluorocarbons (HCFCs) or chlorofluorocarbons (CFCs). The production of HCFCs and CFCs is being phased out under the Montreal Protocol and as a result, HCFCs and CFCs are not defined as GHGs under the Kyoto Protocol. Emissions of non-Kyoto-defined GHGs are not reported as emission sources to The Registry, regardless of the global warming potential of the gas.

To estimate emissions using the screening method, the types and quantities of refrigerants used were estimated and default emission factors were applied. Then, the emission estimates for each HFC and PFC were converted to units of CO_2e using the GWP factors listed in Table 1-1 to determine total HFC and PFC emissions.

6.3. EMISSION ESTIMATES

GHG emission estimates for refrigerants used by the PANYNJ during calendar year 2010 are shown in Table 6-2. All values are in kg, except the values for CO_2e, which are in metric tons.

Table 6-2 Direct Fugitive Emissions GHGs by Building/Facility

Facility	All values in kg						CO_2e (metric tons)
	CO_2	**HFC-134a**	**HFC-227ea**	**R-407C**	**R-410A**	**R-500**	
JFK International Airport		82					106
Newark		15,434	967			2,290	3,532
Stewart	5	226			16		40
Holland Tunnel		0.1					0.2
Lincoln Tunnel		1					2
Port Authority Bus Terminal		318					414
PATH Buildings	0	528	122				1,039
PATH Trains				1,145			1,748
Totals	**5**	**16,589**	**1,089**	**1,145**	**16**	**2,290**	**6,881**

7.0 LANDFILL WITH A PARTIAL LANDFILL GAS (LFG) COLLECTION SYSTEM

7.1. ELIZABETH LANDFILL

The PANYNJ property known as "Port Elizabeth" in Elizabeth, NJ, sits partially atop a former landfill site where household and industrial waste was dumped until the landfill was closed in 1970. While the PANYNJ did not own or operate the property when used as a landfill, by purchasing property that was once part of the landfill, the PANYNJ assumed the historical emissions. It is believed that dumping began at the Elizabeth Landfill (a.k.a. Kapkowski Road Landfill) site sometime in the 1940's (Wiley III, 2002). Emissions from the volume of waste believed to be underneath the property owned by PANYNJ are considered to be within the operational boundary of PANYNJ, while emissions from the waste beneath property owned by other entities (such as the adjacent IKEA store) is not considered within the operational control of PANYNJ. Only emissions within the operational boundary of PANYNJ will be considered for the 2010 reporting period.

7.1.1. Activity Data

The activity data necessary to model emissions from the Elizabeth landfill is the annual waste disposed while the landfill was open. Information provided by PANYNJ on the underground cross-sections at the site, as well as property boundary information and the average waste density from EPA's AP-42 document was used to calculate the total waste in place at the site. The total waste in place was divided by the number of years the landfill is believed to have been open (1940 through 1970).

7.1.2. Emission Factors and Other Parameters

Emission estimates were developed in accordance with Local Government Operations Protocol Chapter 9: Solid Waste Management, which is prescribed by the TCR Local Government Operations Protocol. The default anaerobically degradable organic carbon percentage[4] values from the model were used, as there is no specific information available regarding the waste disposal rates. It was assumed that the methane fraction of the LFG is 50%, and that 10% of the methane is oxidized prior to being emitted into the atmosphere.[5] The k-value is 0.057, which the model states is appropriate for areas that regularly receive more than 40 inches of annual rainfall. Carbon dioxide emissions that are calculated by the model are reported, but classified as biogenic and not included in the carbon dioxide equivalent emissions total for the site.

The same parameters used to calculate GHG emissions were entered into the EPA LandGEM model. The LandGEM model used a LFG estimation model that is similar to the TCR landfill emissions tool, but the LandGEM model estimates emissions of other gases, including volatile organic compounds (VOCs)

[4] Fraction of waste that is anaerobically degradable organic carbon.
[5] These assumptions are not optional parameters within the TCR Landfill Emissions Tool.

7.1.3. Emission Estimates

The 2010 GHG emissions estimates for the Elizabeth Landfill are shown below in Table 7-1. Note that GHG emission estimates are just for the landfill portion that is under the operational control of the Port Authority.

Table 7-1. 2010 GHG Emission Estimates from Elizabeth Landfill

	Biogenic CO_2 (metric tons)	CH_4 (metric tons)	CH_4 (metric tons CO_2e)
Elizabeth Landfill Emissions - Scope 1	645.9	192.6	4,044

The CAP emissions estimates for the Elizabeth Landfill included VOC emissions and are shown below in Table 7-2.

Table 7-2. 2010 CAP Emission Estimates from Elizabeth Landfill

	CAP Emissions (metric tons)
	VOC
Elizabeth Landfill	0.812

8.0 OPTIONAL EMISSIONS SOURCES

This chapter covers emissions estimates for sources that are within the geographical boundary of the Port Authority but that fall outside of the operational control of the Port Authority. It includes emissions from the Shadow Fleet, the Cross-Harbor Freight Program, and use of construction equipment. In previous inventories, the Shadow Fleet and the Cross Harbor Barge were considered to be within the Scope 1 and 2 boundaries of the Port Authority. However, during the verification process, a determination was made that emissions from the Shadow Fleet and Cross Harbor Barge are outside of the Port Authority's operational control.

8.1. SHADOW FLEET

8.1.1. Activity Data

Data on the PANYNJ shadow fleet varies for each airport.

- La Guardia Airport has a shadow fleet consisting of seven buses.
- JFK Airport provided information on fuel consumption and mileage for each vehicle in their shadow fleet.
- For Stewart Airport, total diesel and gasoline fuel consumption is available for 2010, but the information at the vehicle level is incomplete. Total fuel consumption was reported under bulk purchases.
- Teterboro Airport has an onsite pump that is used for gasoline vehicles, but not for diesel vehicles. Diesel vehicles are fueled offsite, and these gallons are totaled under bulk fuel purchases.
- Mileage and fuel consumption were reported for six airport vehicles at Newark Airport. This information is contained in the file "PLATED VEH MIL-GAS 2010.xlsx," (PANYNJ, 2011h) whereas bulk fuel consumption is from the spreadsheet "Allied Fuel Use 2010.xlsx" (PANYNJ, 2011i). The fuel consumption from these six vehicles is subtracted from the bulk fuel total.

8.1.2. Emission Factors and Other Parameters

All GHG emissions factors came from Table 13 in TCR's GRP, unless otherwise noted. Emissions for La Guardia and JFK were estimated based on the CO_2 per gallon emissions factor for each vehicle and the CH_4/N_2O emissions per mile (TCR, 2008).

For Stewart airport, fuel consumption is available for diesel vehicles, although mileage is not. CO_2 emissions were estimated based on total fuel consumption multiplied by the CO_2 emissions factor. CH_4 and N_2O emissions are estimated using the simplified emissions methodology, based on the ratio of CO_2 to CH_4 and N_2O emissions from TCR. For gasoline vehicles, the mileage information was used to estimate fuel consumption, based on the average city miles per gallon of each vehicle, from the fueleconomy.gov website, which was then used to estimate CO_2 emissions for each vehicle. The mileage information was also used to estimate CH_4/N_2O emissions from gasoline vehicles. The remaining fuel consumption is allocated to bulk purchases, which do not correspond to any individual vehicle. CO_2 emissions factors per gallon were used for bulk diesel and gasoline. For diesel fuel, CH_4/N_2O emissions were estimated based on the per gallon emissions for non-highway equipment. Bulk gasoline CH_4/N_2O emissions were estimated using the simplified emissions method based on the ratio of CO_2 to CH_4 and N_2O emissions from TCR.

Emissions from Teterboro Airport were estimated based on transportation CO_2 emissions factors from Table 13.1 of the GRP. Where vehicle mileage information was available, CH_4 and N_2O emissions were estimated using the per mile emissions from Table 13.4. Per gallon non-highway emissions are were used to estimate CH_4 and N_2O emissions from diesel consumption. Bulk gasoline CH_4/N_2O emissions were estimated using the simplified emissions method based on the ratio of CO_2 to CH_4 and N_2O emissions from TCR.

Emissions were estimated for Newark Airport based on the CO_2 per gallon emissions factor for each vehicle and the CH_4/N_2O emissions per mile. Emissions from the remaining bulk fuel were estimated based on the appropriate TCR CO_2 emissions factors. Bulk gasoline and diesel CH_4/N_2O emissions were estimated using the simplified emissions method based on the ratio of CO_2 to CH_4 and N_2O emissions from TCR.

CAP emission factors for highway vehicles were calculated based on the EFs from MOVES. These EFs are expressed in a g/mi estimate by model year and vehicle type. Criteria pollutant emissions from B20 vehicles were assumed to be the same as for diesel vehicles.

Nonhighway and bulk fuel emissions were calculated based on the national average emission factors from the MARKAL database.

8.1.3. Emission Estimates

GHG emissions results for the Shadow Fleet are shown below in Table 3-3. The majority of emissions estimate can be completed using standard EPA methodologies. Simplified emissions methodologies are used for vehicles where a proper mileage figure could not be determined. The majority of the simplified emissions come from the bulk fuel reported at various airports. Biogenic emissions are those CO_2 emissions that come from biofuels such as ethanol and biodiesel.

Table 8-1. 2010 GHG Emissions Estimates from the Shadow Fleet (metric tons)

	CO_2	CH_4	N_2O	CO_2e
Highway Vehicles				
Standard Estimation Method	2,554	0.020	0.014	2,559
Simplified Emissions Method	0	0.002	0.002	1
Biogenic Emissions	449	-	-	449
Non-Highway Vehicles (includes Bulk Fuel)				
Standard Estimation Method	3,029	0.020	0.009	3,032
Simplified Emissions Method	0	0.194	0.217	71
Biogenic Emissions	432	-	-	432
Totals	**6,464**	**0.236**	**0.242**	**6,544**

CAP Emissions from the Shadow Fleet are shown below in Table 3-4. The Bulk CNG includes the CAD and the Shadow Fleet.

Table 8-2. CAP Shadow Fleet Emissions (metric tons)

	NO_x	SO_x	PM_{10}	$PM_{2.5}$
Highway Vehicles	4	0.027	0.135	0.054
Non Highway Vehicles	0.203	0.003	0.02	0.019
Shadow Fleet Bulk Fuel	8	0.358	2	2
Bulk CNG	69	0.018	0.101	0.101
Totals	**20**	**0.406**	**2**	**2**

8.2. CROSS HARBOR BARGE

In 2008, to facilitate the continuation of cross-harbor rail service, PANYNJ acquired New York New Jersey Rail (NYNJR). NYNJR operates the only car float across the New York Harbor between Brooklyn and Jersey City. The car float operations consist of two parts: using ultra-low emissions locomotives to move cars on and off the non-motorized rail barge, and towing the barge across the harbor. NYNJR owns and operates the locomotives, and they contract with tug operators to tow the barge. In 2010, NYNJR contracted exclusively with McAllister towing.

Using the cross-harbor barge is an alternative to transporting the same cargo much greater distances by truck or by rail. As such, the activity represents part of a Port Commerce GHG mitigation strategy for cargo transport.

8.2.1. Activity Data

For the switch locomotives, NYNJR provided an estimate of the gallons of diesel used in the locomotives during 2010.

For the tug operations, NYNJR was unable to obtain fuel records from McAllister, so a simplified emissions method was used to derive an estimate of the gallons of marine diesel used. McAllister supplies NYNJR with invoices that detail the hours of use in various modes as well as the ship used. From the horsepower of the ship, and a load factor typical of tug vessels, the hours of operation were converted into horsepower-hours of work. A brake-specific fuel consumption estimate was applied to this number to determine the mass of fuel consumed. This was divided by the typical density of marine diesel to determine gallons of fuel use. The formula used to estimate fuel use was:

$$F = t \times HP \times LF \times Bsfc \div d$$

where:

F=fuel use (gallons),

t=time (hours),

HP=main engine horsepower,

LF=load factor,

Bsfc=Brake-specific fuel consumption [grams per horsepower-hour (g/hp-hr)], and

d=density of marine diesel (g/gallon)

8.2.2. Emission Factors and Other Parameters

Emission estimates are developed in accordance with GRP Chapter 13: Direct Emissions from Mobile Combustion. The GHG emission factors used to calculate the greenhouse gases associated with mobile fuel combustion in the switch locomotives and the tugboat are shown below in Table 3-5.

Table 8-3. GHG Emission Factors for Switching Locomotives and Tugboats

	CO_2 (kg/gal)	CH_4 (g/gal)	N_2O (g/gal)
Locomotives	10.21	0.80	0.26
Ships and Boats	10.21	0.74	0.26
Source	GRP Table 13.1	GRP Table 13.6	GRP Table 13.6

The CAP Emission factors used to calculate the criteria air pollutants associated with mobile fuel combustion in the switch locomotives and the tugboat are shown in Table 3-6. Tug emissions were based on Tier 1 Cat 2 engines for harbor craft from EPA guidance (EPA, 2009a).

Table 8-4. CAP Emission Factors for Switching Locomotives and Tugboats

	CAP Emission Factors			
	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Switch Locomotive (g/gal)	274.0	18.0	19.3	19.3
Tug Vessel [g/kilowatt hour (kWh)]	9.8	1.3	1.1	1.1

8.2.3. Emission Estimates

The GHG emissions estimates for the Cross Harbor Barge are shown below in Table 3-7. Because fuel activity data was not available from PANYNJ for the tug boat operations, the GHG emissions associated with the substitute activity data are considered separately as SEM emissions. SEM emissions are itemized separately with TCR and they must amount to less than 5 percent of the total organization's GHG emissions.

Table 8-5. 2010 GHG Emission Estimates from Cross Harbor Barge (metric tons)

	CO_2	CH_4	N_2O	CO_2e
Switch Locomotives - Mobile Combustion - Scope 1	203.2	0.016	0.005	205.1
Tug Operations - SEM: Mobile Combustion - Scope 1	204.3	0.015	0.005	206.2
Totals	**407.5**	**0.031**	**0.01**	**411.3**

The CAP emissions estimates for the Cross Harbor Barge are shown below in Table 3-8. CAP emissions are not reported to TCR, so there is no differentiation between SEM and normal emissions estimation methods. In addition, the concept of Scope does not apply to CAP emissions, so all emissions were combined.

Table 8-6. 2010 CAP Emission Estimates from Cross Harbor Barge

	CAP Emissions (metric tons)			
	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Switch Locomotive	5.453	0.358	0.384	0.384
Tug Vessel	2.774	0.368	0.311	0.311

8.3. CONSTRUCTION EQUIPMENT

This category includes any construction equipment used during the 2010 calendar year in Port Authority capital projects. Construction equipment activity and associated emissions were estimated for projects occurring at the WTC site, and at other Port Authority facilities. Construction at non-WTC sites was managed directly by the PANYNJ. This source category is listed as optional here because under TCR protocols, the PANYNJ is not operationally or financially liable for the equipment used by contractors. However, the PANYNJ sets contracting parameters in the form of detailed construction specifications, including clean diesel equipment requirements and sustainable construction guidelines. In addition, PANYNJ-directed construction is also tracked because building and maintaining major infrastructure is a core function of the Agency and a significant source of annual emissions. Therefore, estimates of GHG and CAP emissions for this construction equipment have been estimated for 2010 and are included in this report.

8.3.1. Activity Data

WTC Projects

For the WTC facility, 2010 diesel fuel consumption was provided by the PANYNJ (PANYNJ, 2011d). Reporting of diesel fuel consumed as recorded by fuel supplier receipts is one of the requirements of the WTC Environmental Performance Commitments. Table 8-1 provides the gallons of fuel consumed per WTC site in 2010.

Table 8-7. 2010 Diesel Consumption for World Trade Center Facility by Project[6]

PROJECT	Diesel Gallons
TOWER 1	180,571
TOWER 2	54,151
TOWER 3	37,453
TOWER 4	33,370
MEMORIAL	20,058
VSC	72,970
HUB	700,352
CCP	919
DEWATERING	20,360
SITE TOTAL	**1,120,203**

Reporting of non-diesel fuel use is not required under the WTC Environmental Performance Commitments. Consumption of gasoline, liquefied petroleum gas (LPG) and compressed natural gas (CNG) were estimated by applying multipliers to the total diesel consumption using the fuel distribution ratio reported by EPA's NONROAD model (EPA, 2009b). NONROAD estimates that close to 97% of total fuel consumed by construction equipment is diesel fuel, about 2% is gasoline, and the remaining portion is LPG and CNG.

Non-WTC Projects

For the vast majority of non-WTC projects, estimates of diesel fuel consumed in 2010 were not available. TranSystems obtained data on the amount of work-in-place (WIP) for 2010 for all non-WTC projects (PANYNJ, 2011e; 2011f). These data represent the dollar amounts for contracts with actual construction taking place in 2010, and also account for WIP associated with security-related contracts at many of the facilities. The sum total of WIP for 2010 for non-WTC projects was $543,663,154.

Fuel consumption for all non-WTC PANYNJ facilities was estimated by multiplying 2010 dollars of WIP by a factor that relates the amount of diesel fuel consumed per dollars WIP, as calculated from WTC projects (PANYNJ, 2011g). Per the latest WTC fuel consumption and expenditure data reported for 2010, the fuel consumption factor is calculated to be 0.0009 gallons/$WIP. This figure was used to estimate diesel fuel consumption at all non-WTC sites. Consumption of gasoline, LPG and CNG fuels were all estimated based on NONROAD's default NONROAD fuel distribution.

8.3.2. Emission Factors and Other Parameters

Greenhouse gas emissions for all construction projects were estimated by multiplying fuel consumption estimates by the appropriate emission factor for each fuel type. All emission factors were obtained from the 2011 Climate Registry Default Emission Factors (TCR, 2011b), and are presented in Table 8-2.

[6] Note that diesel consumption reported in Table 8-2 includes diesel fuel consumed by all diesel engines, including those engines less than 50 horsepower that are not otherwise subject to the WTC emission control and reporting provisions.

Table 8-8. GHG Emission Factors for Construction Equipment by Fuel Type

Fuel	CO_2 (kg/gal)	CH_4 (kg/gal)	N_20 (kg/gal)
Diesel	10.21	0.0006	0.0003
Gasoline	8.78	0.0005	0.0002
LPG	5.79	0.0003	0.0009
CNG	4.87	0.0097	0.0009

CAP Emission Factors for WTC Projects

For CAP emission factors, fleet information provided for each WTC project in their June/July 2010 monthly report was used to estimate CAP emissions from diesel engines.[7] As part of the PANYNJ Environmental Performance Commitments, contractors must submit an on-site inventory list of the type and number of equipment, engine horsepower, age, tier level, emissions control devices, and other manufacturer information, before work commences. The steps used to develop CAP emission factors and associated emissions at each of the WTC project sites are described below.

First, the engines operating at each project site were identified as either EPA Tier 2 or Tier 3. For all engines assigned to the same tier, the average horsepower of the engines was then determined. Depending on the average engine horsepower, the appropriate emission factor from EPA's NONROAD model is assigned to each group of Tier 2 and Tier 3 engines (EPA, 2009b). Emission factors for both groups of engines were then weighted by the number of engines within each Tier classification. This procedure resulted in a distinct diesel emissions factor for HC, carbon monoxide, NO_x, and PM_{10} that was applied to fuel for each separate WTC project, although a few project sites were reported jointly.

CAP emission factors in NONROAD are expressed in grams per horsepower-hour (g/hp-hr), and were converted to g/gallon using a brake-specific fuel consumption (BSFC) of 0.367 gallons of diesel fuel per hp-hr. The fuel-based emission factor was then multiplied by diesel fuel consumption to estimate CAP emissions. HC emissions were converted to VOC, and $PM_{2.5}$ emissions were estimated from PM_{10} emissions based on EPA conversion factors (EPA, 2009b).

The CAP emissions for gasoline, LPG and CNG, as well as SO_2 emissions for diesel, are based on 2010 national average emission factors developed in support of EPA's MARKAL database (Pechan, 2010). These emission factors were back-calculated from national 2010 NONROAD model construction emissions and activity reported by SCC, Tier level, and horsepower, then weighted by fuel consumption for each engine record. National average emission factors were reported on a grams/hp-hr basis, and similar to diesel engine emission factors, were converted to a grams per gallon basis using EPA BSFC estimates (EPA, 2009b).

[7] As a simplifying assumption, equipment operating in these months was chosen to represent the year-round average fleet.

CAP Emission Factors for Non-WTC Projects

Since information to adequately characterize the construction fleet operating at all of these sites was not readily available, CAP emissions were based on fuel consumption multiplied by national average emission factors as derived from the EPA MARKAL database for all fuel types, including diesel. Similar to the WTC projects, adjustments to the average CAP emission factors, available in g/hp-hr, were made to place the emission factors on a g/gallon basis.

8.3.3. Emission Estimates

The GHG emissions estimates by facility for construction equipment activity are shown below in Table 8-3. Note that the WTC facility contributes to a large majority of the total GHG emissions (68%), with JFK Airport being the second most significant contributor (~13%).

Table 8-9. 2010 GHG Emissions for Construction Facilities (metric tons)

Facility Name	CO_2	CH_4	N_2O	CO_2e
World Trade Center	11,723	0.75	0.31	11,834
Newark Airport	669	0.04	0.02	675
Teterboro Airport	191	0.01	0.01	193
JFK Airport	2,187	0.14	0.06	2,208
La Guardia	295	0.02	0.01	298
Stewart Airport	172	0.01	0.00	174
New Jersey Marine Terminal - Port Elizabeth	155	0.01	0.00	157
New Jersey Marine Terminal - Port Newark	169	0.01	0.00	170
New York Marine Terminal - Brooklyn Pier	25	0.00	0.00	25
New York Marine Terminal - Howland Hook	108	0.01	0.00	109
PATH	721	0.05	0.02	728
PAT/WTC (Security)	1	0.00	0.00	1
AMT (Security)	0	0.00	0.00	0
Port Authority Bus Terminal	196	0.01	0.01	198
George Washington Bridge	193	0.01	0.01	194
Holland Tunnel	187	0.01	0.00	189
Lincoln Tunnel	69	0.00	0.00	70
SIB - Arthur Kill	23	0.00	0.00	23
SIB - Bayonne Bridge	12	0.00	0.00	13
SIB - Goethals Bridge	26	0.00	0.00	26
SIB - Outerbridge Crossing	5	0.00	0.00	5
Total - All Facilities	**17,128**	**1.10**	**0.45**	**17,291**

Emission estimates for select criteria air pollutants by facility and county for construction activity are shown below in Table 8-4. Though still a significant contributor to total CAP emissions, the relative contribution of the WTC to total NO_x and PM_{10} emissions is relatively less than for CO_2, since the CAP emission factors at this facility represent more stringent emission levels compared to the rest of the PANYNJ projects.

Table 8-10. 2010 CAP Emissions for Construction Facilities, Metric Tons

Facility Name	NO_X	SO_2	PM_{10}	$PM_{2.5}$
World Trade Center	12.02	0.24	0.82	0.78
Newark Airport	0.87	0.01	0.08	0.08
Teterboro Airport	0.25	0.00	0.02	0.02
JFK Airport	2.83	0.05	0.27	0.26
La Guardia	0.38	0.01	0.04	0.03
Stewart Airport	0.22	0.00	0.02	0.02
New Jersey Marine Terminal - Port Elizabeth	0.20	0.00	0.02	0.02
New Jersey Marine Terminal - Port Newark	0.22	0.00	0.02	0.02
New York Marine Terminal - Brooklyn Pier	0.03	0.00	0.00	0.00
New York Marine Terminal - Howland Hook	0.14	0.00	0.01	0.01
PATH	0.93	0.01	0.09	0.08
PAT/WTC (Security)	0.00	0.00	0.00	0.00
AMT (Security)	0.00	0.00	0.00	0.00
Port Authority Bus Terminal	0.25	0.00	0.02	0.02
George Washington Bridge	0.25	0.00	0.02	0.02
Holland Tunnel	0.24	0.00	0.02	0.02
Lincoln Tunnel	0.09	0.00	0.01	0.01
SIB - Arthur Kill	0.03	0.00	0.00	0.00
SIB - Bayonne Bridge	0.02	0.00	0.00	0.00
SIB - Goethals Bridge	0.03	0.00	0.00	0.00
SIB - Outerbridge Crossing	0.01	0.00	0.00	0.00
Total - All Facilities	**19.03**	**0.36**	**1.48**	**1.42**

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APPENDIX A. EMISSIONS COMPARISONS WITH PREVIOUS YEARS

This appendix provides comparisons of 2010 GHG emission estimates for the PANYNJ with those made previously for 2006-2008 calendar years. Because the 2010 inventory differs in many ways from the previous years' inventories, many of the results do not lend themselves to direct comparison and the information is being included as a reference only. The most obvious difference is that previous years' inventories were dominated by Scope 3 emissions, which are not included in the 2010 inventory, but there are other differences as well. For instance, since this was the first year the inventory will be submitted for verification, and because the OEEP has completed their recent "energy audit," many small accounts for stationary combustion and electricity use were found that were not individually accounted for in previous years. In addition, the emissions calculation methodology for the emissions from JFK's co-gen, KIAC, was different from previous years to meet with The Climate Registry protocols for emissions accounting. The addition of new sources and the elimination of old sources, like the Downtown Manhattan Heliport and Shadow Fleet also affect the comparisons.

What follows are some comparisons of emissions from the same Scope 1 and 2 sources over different years, offered at the level of detail at which they are meaningful.

The Stationary combustion GHGs from Chapter 2 of this report are compared with previous years' emissions totals in Table A-1. There are several striking differences. The most important is the number of records where the comparison with previous baseline (2006) is not applicable because the source was not reported as having stationary combustion in the first year of compiling these inventories. Others include the dramatic increase in reported combustion at Newark Liberty and LaGuardia airports. The year-by-year Newark Liberty International Airport results suggest fuel consumption reporting issues for this facility, given the much lower reported values in 2006 and 2008 than for the other two years. This is likely a result, at least in part, of improved data collection, rather than a representation of increased demand.

Table A-1. Stationary Combustion GHG Annual Emissions Comparison by Building/Facility

	CO_2e (metric tons)				Percentage Difference (2006 vs. 2010)
Building	**2006**	**2007**	**2008**	**2010**	**%**
225 PAS	2,245	55	72	54	-57.5%
PATC		672	633	649	
777 Jersey Ave		0	227	251	
115 Broadway		0	140	NA	
5 Marine View		0	13	NA	
JFK International Airport	14,792	18,977	10,904	10,121	-31.6%
LaGuardia	1,613	5,811	3,431	3,791	135.0%
Newark Liberty International Airport	1,911	11,756	114	13,219	591.7%
Stewart	0	0	0	93	NA
Teterboro	0	376	0	553	NA
Port Jersey	0	0	0	10	NA

	CO_2e (metric tons)				Percentage Difference (2006 vs. 2010)
Building	**2006**	**2007**	**2008**	**2010**	**%**
Brooklyn Marine Terminal	0	0	0	117	NA
Port Newark	0	0	0	29	NA
Howland Hook	0	0	0	43	NA
Holland Tunnel	84	104	74	67	-20.1%
Lincoln Tunnel	27	38	38	35	28.7%
George Washington Bridge	0	0	557	31	NA
Bayonne Bridge	0	0	0	NA	NA
Goethals Bridge	359	434	422	372	3.7%
Outerbridge Crossing	192	287	186	133	-30.8%
Port Authority Bus Terminal	0	0	0	4	NA
George Washington Bridge Terminal	0	0	0	671	NA
PATH Buildings	0	0	0	1,539	NA
Bathgate Industrial Park	0	0	348	67	NA
The Legal Center	0	0	1175	NA	NA
The Teleport	0	62	198	95	NA

The total CO_2e emissions from the CAD and the Shadow Fleet for 2010 are shown in Table A-2 below:

Table A-2. GHG emissions for all Fleet Vehicles (Metric Tons CO2e)

Comparison with Previous Years	2008	2010
All Fleet Vehicles and Shadow Fleet	11,999	20,698

This estimate includes the Shadow Fleet and the CAD emissions, as well as all bulk fuel purchases and PATH fuel emissions. Emissions are much higher in 2010 than in 2008 as a result of improved data collection, which resulted in a more accurate estimate for 2010. After conducting interviews with PANYNJ staff, it was clear that many of the emissions associated with bulk fuel and the Shadow Fleet were not being counted in previous inventories. Because the Shadow Fleet alone accounts for over 6,000 metric tons of CO_2e, this helps explain the discrepancy between 2008 and 2010 estimates.

ELECTRICITY

Table A-3 shows that there is an overall downward trend in indirect electricity GHG emissions for PANYNJ occupied buildings. About 70 percent of the indirect electricity emissions are from the three major airports. Differences between 2008 and 2010 emissions at these three airports are larger than one would expect from normal year-to-year variations in electricity usage. It is important to note that an increase or decrease over base year measurements may not necessarily indicate energy efficiency improvements or decreases. The movement of tenants in and out of a building, the purchase of additional buildings and even local weather patterns will have an effect on the total amount of electricity consumed within a given year. In addition, as mentioned above, the emission factor methodology for purchased steam and electricity at JFK was different from previous years, and this resulted in lower emission factors for electricity in the 2010 calendar year.

Table A-3. Indirect Electricity GHG Annual Comparison by Building/Facility

Building/Facility	CO_2e (metric tons)				Percentage Difference (2006 vs. 2010)
	2006	2007	2008	2010	%
225 PAS	9,660	1,811	2221	1,112	-21.1%
233 PAS		219	466	255	
Gateway		631	777	742	
PANYNJ Technical		2,838	4407	3,965	
777 Jersey Ave		764	708	702	
5 Marine View		76	63	45	
One Madison		449	416	351	
115 Broadway		608	554	152	
96/100 Broadway		0	0	235	
116 Nassau		0	0	64	
JFK Airport	124,607	116,312	111,618	61,254	50.8%
LaGuardia Airport	17,773	22,240	21,927	12,894	27.5%
Newark Airport	23,756	23,723	7,073	32,849	38.3%
Stewart Airport	0	0	0	174.73	NA
Teterboro Airport	0	1,116	0	859	NA
Brooklyn Marine	0	0	0	200	NA
Port Jersey Auto	0	0	0	167	NA
Port Newark	0	0	0	1,525	NA
Port Elizabeth	0	0	0	893	NA
Howland Hook	0	0	0	74	NA
Holland Tunnel	5,506	4,847	3,336	4,048	-26.5%
Lincoln Tunnel	7,543	7,536	3,117	7,089	-6.0%
George Washington	3,095	5,106	2,605	2,908	-6.0%
Bayonne Bridge	268	1,280	276	276	3.0%
Goethals Bridge	750		831	901	20.2%
Outerbridge Crossing	375		435	434	15.7%
Port Authority Bus	0	0	0	7,935	NA
GWB Bus Terminal	0	0	0	1,950	NA
PATH Buildings	12,743	12,632	12,983	7,660	-39.9%
Bathgate Industrial	0	0	0	43	NA
The Teleport	0	0	0	833	NA
Total	**196,416**	**194,792**	**164,201**	**152,590**	**-22.3%**

TRAINS

When compared with emissions from previous years, it is apparent that overall emissions on the two AirTrains have decreased, while rising slightly on the PATH system. Table A-4 shows emission estimates from previous inventories. AirTrain JFK uses purchased steam and electricity from the KIAC co-generation facility, for which the emission factor methodologies differed this year from previous years in accordance with TCR protocols. The drop in AirTrain JFK emissions from 2008 to 2010 is counter to ridership trends – with ridership increasing each year for the past five years.

Table A-4. Electricity GHG Annual Comparison by Train System

Building/Facility	CO_2e (metric tons) 2006	2007	2008	2010	Percentage Difference (2006 vs. 2010) %
AirTrain JFK	17,716	19,469	19,475	16,197	-8.6%
AirTrain EWR	19,041	9,744	9,744	8,400	-55.9%
PATH Trains	40,161	40,206	42,194	49,882	24.2%

FUGITIVE EMISSIONS

When compared with emissions from previous years, refrigerant emissions increased in 2010, and this is attributable to improved reporting. Table A-5 show emission estimates from previous inventories and it can be seen that there are more facilities reporting refrigerant usage than in past years. The methodology used to determine fugitive emissions is a simplified one and does not accurately reflect loss throughout the year, but rather charging, purchasing, and filling. This methodology therefore is expected to produce yearly fluctuations as well as certain sources not being represented in certain years. This suggests that further improvements in tracking refrigerant usage are needed in order to accurately report to TCR.

Table A-5. Direct Fugitive Emissions GHG Annual Comparison

Department/Facility	CO_2 Equivalent (metric tons) 2006	2007	2008	2010	Percentage Difference (2006 vs. 2010)
Newark Airport	0	0	265.4	3,532	NA
JFK International Airport	0	0	194.6	106	NA
LaGuardia Airport	0	0	53.1	0	NA
Stewart Airport				40	NA
PATH Buildings	17.7	35.4	39.3	1,039	15,645.7%
PATH Trains				1,748	
NJ Marine Terminals	17.7	0	0	0	-100.0%
Lincoln Tunnel	35.4	17.7	19.7	2	-94.6%
Holland Tunnel				0	NA
Port Authority Bus Terminal				414	NA
Operation Services Department-CAD	707.5	636.8	294.8	0	-100.0%
Engineering	0	7.8	11.7	0	NA
Totals	**778.3**	**697.7**	**878.6**	**6,881**	**784.1%**

APPENDIX B. UTILITY CONSUMPTION TOTALS

Table B-1. Utility Consumption Totals by Facility

Central Administration	**Electricity (kWh)**	**Gas (Therms)**
225 PAS	3,471,979	10,166
233 PAS	797,324	-
Gateway (real)	1,506,583	-
Gateway (estimated)	30,005	-
Gateway (total)	1,536,588	-
PATC (real)	8,206,246	122,407
PATC (estimated)	552	-
PATC (total)	8,206,798	122,407
777 Jersey Ave	1,453,399	47,282
5 Marine View	93,600	-
One Madison (real)	913,518	-
One Madison (estimated)	184,645	-
One Madison (total)	1,098,163	-
115 Broadway	473,596	-
96/100 Broadway	732,674	-
116 Nassau	200,793	-
Totals	18,064,915	179,855
Aviation		
JFK International Airport	143,389,632	1,908,059
Airtrain JFK	39,413,122	54,004
LaGuardia Airport	40,243,057	17,574
Newark (real)	65,546,403	22,083
Newark (estimated)	2,442,400	-
Newark (total)	67,988,803	22,083
Airtrain EWR	17,480,801	-
Stewart	563,234	17,574
Teterboro	1,777,624	104,884
Totals	310,856,273	2,124,178
Port Commerce		
Brooklyn Marine Terminal	623,531	22,083
Port Jersey Auto Marine Terminal	345,031	-
Port Newark	3,155,580	5,416
Port Elizabeth	1,848,800	-
Howland Hook	231,381	8,049
Brooklyn Cruise Terminal	-	-
Totals	6,204,324	35,548

Tunnels, Bridges & Terminals	**Electricity (kWh)**	**Gas (Therms)**
Holland Tunnel	10,181,635	12,660
Lincoln Tunnel	17,044,815	6,551
GWB (real)	3,687,944	5,913
GWB (estimated)	2,335,979	-
GWB (total)	6,023,923	5,913
Bayonne Bridge	789,215	-
Goethals Bridge	2,600,503	70,209
Outerbridge Crossing	1,232,823	25,064
Port Authority Bus Terminal	24,763,719	672
George Washington Bridge Terminal	6,084,364	126,530
Totals	68,720,997	247,598
PATH		
PATH Buildings	15,854,507	290,085
PATH Trains	103,812,211	-
Totals	119,666,718	290,085
Real Estate & Development		
Bathgate Industrial Park	133,761	12,689
The Teleport	2,598,310	17,874
Totals	2,732,071	30,563
PANYNJ Totals	527,343,460	2,907,828