

# Greenhouse Gas Inventory Management Plan and Reporting Document (IMPRD)



Entergy Corporation  
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## Entergy's GHG Commitment Snapshot

Base Year – 2000

Original Commitment Years –	2001 to 2005
Original Commitment –	Stabilize at 2000 levels direct CO <sub>2</sub> emissions from power plants
Original Commitment Funding –	\$25 million (\$5 million per year)
Second Commitment Years –	2006 to 2010
Second Commitment –	20% below 2000 levels direct CO <sub>2</sub> emissions & cont. purchased power
Second Commitment Funding –	\$3.25 million (\$650K per year)
Third Commitment Years –	2011 to 2020
Third Commitment –	20% below 2000 levels direct CO <sub>2</sub> emissions & cont. purchased power
Third Commitment Funding –	\$10 million (\$1 million per year)

# **Entergy Corporation Greenhouse Gas Inventory Management Plan and Reporting Document**

## **Introduction and Background**

In May 2001, Entergy publicly committed to stabilize CO<sub>2</sub> emissions from its power plants at year 2000 levels through 2005, and dedicated \$25 million in supplemental corporate funding to achieve this target over the five-year period. This commitment was focused on CO<sub>2</sub> emissions from fuel combustion at the company's power plants and required that Entergy:

- Stabilize CO<sub>2</sub> emissions from its U.S. power plants at year 2000 levels through 2005.
- Establish the \$25 Million Environmental Initiatives Fund (EIF) in support of achieving the 2001-2005 stabilization targets.
- Document activities and annually report progress.
- Employ an independent third party organization to verify measurement of Entergy's CO<sub>2</sub> emissions from U.S. power plants.

Entergy joined EPA's Climate Leaders Program in 2004 (the program was discontinued in 2010) and began the process of renewing its GHG commitment by developing a detailed inventory of all GHGs resulting from its operations. The inventory development and results were documented in this Inventory Management Plan and Reporting Document (IMPRD). Entergy's second commitment included:

- Stabilize CO<sub>2</sub> emissions from all Entergy power generation plants plus controllable purchased power at 20% below 2000 levels through 2010.
- Commit funding of \$3.25 million in support of achieving the 2005-2010 target.
- Document activities and annually report progress.

In 2011, Entergy once again renewed its commitment to stabilize GHGs with a third commitment:

- Stabilize CO<sub>2</sub> emissions from all Entergy power generation plants plus controllable purchased power at 20% below 2000 levels through 2020.
- Commit funding of \$10 million in support of achieving the 2011-2020 target.

- Document activities and annually report progress.

Beginning in 2012, Entergy decided to conduct the third-party verification audit to the [International Standards Organization \(ISO\)](#) standard for GHG development and verification (ISO 14064-3:2006).

This IMPRD has been created and subsequently revised according to the requirements in the [World Resources Institute](#) and the [World Business Council for Sustainable Development](#) Greenhouse Gas Protocol, [2004 revised edition](#), and formatted according to the US EPA Climate Leaders 2004 draft checklist of IMPRD components.

This IMPRD is used to create and document an inventory that was previously reported to the Climate Leaders program and other external parties. However, EPA announced in 2010 that the Climate Leaders program was being discontinued. This IMPRD will continue to be updated and used to document Entergy's GHG Inventory methodology and results on an annual basis. Entergy has made an estimate of emissions, including small sources, for reporting externally. Entergy registers its emissions and offset purchases to the American Carbon Registry ([www.americancarbonregistry.org](http://www.americancarbonregistry.org)) and posts the GHG Inventory, along with this document, on the company's website ([www.entergy.com](http://www.entergy.com)).

The current GHG Inventory (by calendar year) is attached to this document as Attachment 1 and is referenced throughout.

## **Reporting Entity Information**

Entergy Corporation (Entergy) is an integrated energy company engaged primarily in electric power production and retail distribution operations. Entergy owns and operates power plants with approximately 30,000 megawatts of electric generating capacity, including nearly 10,000 megawatts of nuclear power, making it one of the nation's leading nuclear generators. Entergy delivers electricity to 2.9 million utility customers in Arkansas, Louisiana, Mississippi, and Texas. Entergy has annual revenues of more than \$10.8 billion (2016) and approximately 13,000 employees. Additional company information can be located at [www.entergy.com](http://www.entergy.com).

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## **Boundary Conditions**

*Consolidated Approach for Emissions Reporting* – Entergy has elected to include all company-owned assets and those under a capital lease, consistent with “equity share” reporting under WRI reporting protocols. Where partial ownership share of an asset exists, only Entergy’s owned portion of the asset/emissions is included in the inventory. Additionally, Entergy has opted to include some emissions associated with the electricity purchased to support grid operations and meet customer demand, primarily due to an increased reliance on purchased power since 2003. The GHG emissions resulting from the full life cycle of the various fuel sources are not included in the inventory.

Other emission sources that have emissions estimated to be less than 1% of the total inventory are considered *de minimus* unless they are anticipated to change dramatically and grow above this threshold. Emissions of each GHG from facilities/assets that are *de minimus* are estimated and included in the inventory for each gas and/or source. The same data are used for future years unless one of the categories of emissions changes significantly. These estimates will be recalculated approximately every five years (or as updated data becomes available), after major equipment changes, asset acquisition and/or asset divestiture in order to reconfirm *de minimus* status.

Some emission sources now require reporting under EPA’s Mandatory GHG Reporting Rule. These emissions are included for the previous calendar year due to the timing of the reporting cycle. The methodology for calculation of these categories is the same as is required under this EPA reporting program.

*Facilities List* –The majority of Entergy’s emissions are from fossil-fueled electricity generation facilities. However, other sources include small sources at other company facilities. A full list of facilities included in the inventory is contained in Attachment 1. This list identifies Entergy’s fossil-fueled electricity generation assets and ownership share. All other GHG emissions-producing assets are assumed to be 100% owned by Entergy.

*List of GHGs Included* – Entergy includes the following GHG gasses associated with various sources in its inventory and management program:

- Carbon dioxide (CO<sub>2</sub>)
- Methane (CH<sub>4</sub>)
- Nitrous Oxide (N<sub>2</sub>O)
- Sulfur Hexafluoride (SF<sub>6</sub>)
- Hydrofluorocarbons (HFC)

Perfluorocarbons and Nitrogen Trifluoride are not included in Entergy’s inventory given the nature of its business and that this class of chemicals is not used in any of Entergy’s operations in any sizeable amount.

### **Entergy Corporation Emission Sources**

*Process for Identifying Emissions Sources* – The Climate Leaders spreadsheet “General Emission Source Checklist” (Attachment 2), was created by Platts/E source as contractors to EPA’s Climate Leaders program, and was originally utilized as an overall roadmap to help identify GHG emission sources at Entergy locations. Within each line item, a determination was made as to the applicability to Entergy’s operations. The findings of this analysis are presented in the section below. Additionally, publicly-available data, previous equipment inventories, internal company data, and existing air permit information were utilized to identify GHG sources at company locations. This includes an extensive analysis and estimates of emissions from small combustion sources co-located at electrical power generating facilities or at stand-alone facilities. The specific information gathered and its sources are shown in Attachment 1 and 2 and summarized in the sections below. Additionally, this information was further refined and updated based on data submitted to the EPA for the mandatory GHG reporting rule beginning in 2011. Entergy is confident that this methodology has captured emission estimate information for the majority of small source equipment at its locations.

### *Direct Sources*

Entergy's direct emissions are included in the following categories:

- ⇒ Stationary combustion: Entergy's direct sources of GHGs include emissions from the direct combustion of fossil-fuels in electrical generation boilers and small sources at company facilities.
- ⇒ Mobile Combustion: Fossil fuels combusted in company fleet vehicles, including corporate aircraft.
- ⇒ Fugitive Emissions: Methane (CH<sub>4</sub>) from natural gas distribution systems, SF<sub>6</sub> from power transmission and distribution equipment, and HFCs from building HVAC systems and mobile air conditioning sources (vehicles)..

Company activity data sources including contacts and information for the various emissions from and/or usage of these assets are included in Attachment 2.

### *Indirect Sources*

Entergy's indirect sources of emissions include those from some purchased electricity and electrical line transmission/conversion losses. Data sources for the various emissions from and/or usage of these assets are included in Attachment 2. All electricity consumed in the operation of the utility generating plants and consumed in Entergy's various administrative and commercial buildings and operations are accounted for in Entergy's direct emissions for stationary combustion. However, electricity consumed by the wholesale generation plants and associated facilities is accounted for separately in the inventory. Additionally, line losses for self-generated and purchased electricity are accounted for by the additional generation necessary to make-up for these losses. There are no other indirect sources included in Entergy's inventory or program.

### *Optional Sources*

Entergy is reporting some emissions associated with power purchased to meet customer demand and support grid operations. This emission source is not required under EPA and WRI reporting protocols. Entergy has elected to report some of these emissions because it has decreased its self-generation while increasing the amount of power it purchases. Beginning in 2014, employee commuting and customer combustion of the company's product (natural gas) were added to the inventory. Other optional sources such as

employee business travel and full lifecycle/supply chain emissions are not included at this time; however, these will be evaluated for inclusion in the future.

## **GHG Emissions Quantification**

### *Quantification Method and Emission Factors*

The quantification methodologies used in the Entergy inventory are commonly accepted methods for measuring GHG emissions. For inventory years 2000-2004, Entergy used methodologies outlined in the EPA Climate Leaders Protocol, or methodologies proposed by Platts/E-source (a technical consultant working for EPA as a part of the Climate Leaders Program) staff and approved by EPA Climate Leaders staff – these methodologies were carried forward in future inventory years, unless supplanted by an updated method. In a number of cases, Entergy has used conservative estimation methodologies for expected *de minimus* emission sources (<1% of corporate total). In all cases, these estimation methodologies were reviewed and approved by EPA Climate Leaders staff and subsequently verified by a third-party. When emissions are based on these conservative estimates, they are identified as such below.

Emission factors used for the initial inventory were derived from various sources including *USEPA Climate Leaders GHG Protocol* (derived from GHG Protocol and AP-42), US DOE, and EPA's eGRID system; these factors are updated as needed. The quantification methodologies, emission factors and their sources can be found in the GHG inventory calculation spreadsheets, accessible through Entergy's external website (<http://www.entergy.com/environment/performance.aspx>). Entergy remained engaged with the EPA Climate Leaders Program updates and staff until the program was eliminated by the agency. Entergy will monitor WRI protocol and other leading sources for updates in order to stay aware of any changes to quantification methodologies, emission factors, or protocol changes.



These approaches for emission quantifications were chosen because they represent the most accurate and, in most cases, the only data source for such an exercise. Other methods were not chosen due to the fact that other methods simply do not exist.

### *Direct Emissions*

Entergy's direct emissions are either measured directly via a continuous emissions monitoring (CEM) system, calculated using emission factors and fuel throughput or other relevant data, or estimated using equipment capacity factors and maximum fuel throughput data. Direct GHG emissions are quantified separately for each GHG, and then aggregated across Entergy by GHG constituent. The quantification method and data source for each major category of direct GHG sources is detailed below.

Fossil-Fuel Combustion Boilers and Gas Turbines – Entergy's electrical generation equipment is heavily regulated by state and federal agencies and is required to report emissions on a periodic basis. A continuous emission monitoring (CEM) system is used at most plants to directly monitor emissions. CO<sub>2</sub> is directly monitored in these systems and other GHGs, such as CH<sub>4</sub> and N<sub>2</sub>O, are calculated based on the data collected by these systems. However, in some cases, CO<sub>2</sub> is calculated based on fuel throughput and heat rate data. However the CO<sub>2</sub> number is derived, it is reported to the EPA as required under various agency regulatory programs. In 2016, this category represented 87.6% of the corporate total.

Source: This GHG emissions data is reported to the ESP Group by Entergy's Fossil Environmental Support Group quarterly.

Small Sources at Company Facilities – This category includes equipment such as emergency generators, house service boilers, natural gas-fired comfort heaters, and other small combustion/emission sources not monitored by CEM systems at company facilities. Inventories for 2000 to 2010 used an available equipment inventory and information contained in facility air permits and compiled by facility personnel, small source emissions were calculated for each plant for which this data was available. This data was compiled in 1994 in the Fossil

Operations Equipment Inventory. Similarly, an inventory of small sources also was conducted at the Nuclear facilities in 2005 – these numbers are carried forward from year-to-year.

Beginning in 2011, Entergy reported small sources at the Fossil plants to the EPA under the mandatory GHG reporting rule Subpart C. These numbers were used beginning with the 2011 inventory in order to align regulatory reporting with this voluntary inventory. Changes to the overall number were not material. In 2016, this category represented 0.3% of the corporate total.

Transportation Fleet Vehicles – Entergy’s Transportation Group maintains a detailed inventory of vehicles owned and/or leased throughout the company. This group also tracks information regarding the fleet’s fuel usage and miles traveled. Additionally, Entergy’s Aviation Group (part of Human Resources and Administration) maintains fuel usage information for our fleet of corporate aircraft. This information was updated with 2014 data in 2015 and used to calculate GHG emissions for this equipment category. In 2016, this category represented 0.1% of the corporate total. Entergy decided not to include GHG emissions resulting from employee business travel; however, it may be included in the future. Fleet emissions were quantified using units of all mobile fossil fuels and default emission factors.

Source: The source of this information is the Manager, Transportation and the Aviation Group.

Fugitive Emissions: Methane – This category of emissions includes losses of methane from Entergy’s natural gas distribution system and Entergy’s natural gas storage facility. Losses of methane from the distribution system were estimated using the Gas Research Institute’s protocol. This protocol uses input data such as miles of pipe and number of services (steel, coated, and plastic), number of meters (commercial and residential) and gas vented to estimate methane emissions from these types of distribution systems. The emissions from the storage facility were

estimated, using Tier 1 factors for natural gas storage for both vented and fugitive natural gas. In 2016, this category represented 0.2% of the corporate total.

Source: These input data were obtained from the Manager, Gas Distribution Operations and Fossil Operations, Sabine Plant.

Fugitive Emissions: HFCs – This category of emissions includes losses of HFCs from HVAC equipment at buildings which Entergy owns or for which it holds a capital lease and from Entergy vehicular air conditioning. For the indoor air cooling equipment, square footage of company building space was collected and an emission factor developed by Platts/E-Source was applied to this number in order to estimate HFC losses from this equipment. This emission factor is based on national averages of tonnage of equipment per square foot of space and average leakage rates of common air conditioning equipment. An investigation revealed that no HFC-based air or water pre-cooling is performed at any Entergy electric power generation facilities. Additionally, vehicle HFC emissions were also estimated in a similar manner. Conservative estimates were completed for all sources of HFC emissions; this category of emissions was determined to be *de minimus*. In 2016, these categories represented <0.1% of the corporate total. PLEASE NOTE: Entergy’s district cooling/thermal operations were sold to a third-party in December of 2013. Due to the *de minimus* nature of emissions associated with these assets, no adjustments were made to the 2013 inventory; however, these assets were removed from the inventory beginning in 2014. The calculations behind all factors used in estimating HFC emissions can be found in the inventory spreadsheet (Attachment 1).

Source: The source of this information was the Manager, Real Estate Operations and the Manager, Transportation.

Fugitive Emissions: SF<sub>6</sub> – This category of emissions includes operational and unintentional releases of SF<sub>6</sub> used in electricity transmission equipment. Emissions of this gas were previously estimated using a protocol similar to the

protocol utilized for EPA's SF<sub>6</sub> Emission Reduction Partnership Program. However, beginning in 2014, the methodology was updated to be consistent with the EPA Mandatory GHG Reporting Rule. This category is reported under Subpart DD of this rule; the number included in this inventory represents the number reported under this compliance program. The emission estimate provided is from calendar year 2013. In 2016, this category represented 0.3% of the corporate total.

Source: The source of this information is the Manager, Environmental in Entergy's Transmission and Distribution Organization. SF<sub>6</sub> emission estimates are reported to ESP at least once per year.

For de minimus fugitive emission categories described above, a consistent quantity of emissions is included in the inventory and will be carried forward annually; However, SF<sub>6</sub> emissions will be updated annually.

#### *Indirect Emissions*

Transmission/Distribution System Line Losses – Line losses associated with power purchased to support the utility operations are considered required indirect emissions under EPA and Scope 2 Indirect under WRI reporting requirements. Emissions from T&D losses of purchased power are calculated by applying Entergy's system loss factor to the total amount of power purchased. The custom loss factor is developed using power data from the 5 utilities' FERC Form 1s (specific data noted in "purchased power" worksheet in inventory). This custom factor was calculated for 2004 data using 2004 FERC forms and applied to purchased power amounts of previous years of GHG inventories (2000-2003) rather than recalculating this factor for each prior year. This emission estimate is calculated and presented; however, it is not subtracted from the purchased power emission number described below since it is assumed that the bulk of purchased power is generated from within Entergy's service area. T&D line losses are already accounted for in the extra generation required to make up for these losses.

Beginning in 2013, an estimate of emissions associated with off-site electricity usage of the generation plants (and associated facilities) was included in the inventory.

### *Optional Emissions*

Purchased Power – This category of emissions includes some of the emissions from power purchased by Entergy to supplement its own supply in order to meet customer demand and/or support utility operations. In some cases, the source of this power is known and an actual buying decision is made by Entergy (controllable or unit-contingent purchases). The remaining sources of purchased power are either not known (non-controllable or grid purchases) or cannot be controlled for some other reason (i.e., Qualifying Facility Puts [QF Puts] under PURPA). Under the EPA and WRI protocols, including emissions from power purchased by utilities is optional. From 2000 to 2013, Entergy opted to include all purchased power in its GHG inventory and subsequent tracking; however, beginning in 2014, Entergy does not include non-controllable purchases in the inventory. Non-controllable purchases are those that do not meet the definition of a controllable purchase (i.e., the source is unknown OR there is no buying decision made regarding the power). In December of 2013, Entergy transitioned into the Midwest Independent System Operator (MISO) system. As a result, there is a large decrease in the amount of controllable purchases (roughly half). Additionally, there is no mechanism for knowing from which plant/unit the power purchases from MISO are sourced. Accordingly, beginning in 2014, only purchases made under long-term contracts and other bilateral arrangements are included in the inventory. This approach avoids the potential for double counting, as some of the power purchased to serve Entergy load may actually be generated by company-owned assets already accounted for in the direct emissions category described in previous sections. In 2016, this category represented 9.5% of the corporate total.

Controllable purchase information (in terms of millions of megawatt-hours) was collected. Supplier and unit-specific emission rate information from eGRID, where available, was used to develop a supplier-specific custom CO<sub>2</sub> emissions factor (regional emission factors were used for other GHGs). If supplier-specific GHG emission factors were not available, the regional grid factor from eGRID was used as a default.

Source: All data regarding power purchases (TRADES database and ISB system) were obtained and are available from Entergy's System Planning Group. Primary contact for the data was the Sr. Staff Engineer in the Energy Analysis and Reporting Group.

Product Combustion – This optional category of emissions includes combustion of the natural gas distributed to customers in Baton Rouge and New Orleans, the only areas of the service territory where Entergy distributes natural gas to retail customers. Entergy began including these emissions in the 2014 inventory to be consistent with the EPA Mandatory GHG Reporting Rule. This category is reported under Subpart NN of this rule; the number included in this inventory represents the number reported under this compliance program. The emission estimate provided is from calendar year 2013. In 2016, this category represented 2.1% of the corporate total.

Source: All data regarding this category is sourced from the Manager, Gas Operations.

Employee Commuting – This optional category of emissions was estimated using employee survey data collected in 2014 and using EPA methodologies for Scope 3 emission estimations and emission factors. The full calculation methodology is shown on the appropriate spreadsheet of Attachment 1. In 2016, this category represented 0.1% of the corporate total. Accordingly, this is a *de minimus* category that will be carried forward annually.

Source: Survey data was provided by Corporate Communications.

## **Data Management**

### *Activity Data*

In all cases, the best available activity data was used to calculate or estimate emissions from a specific source. All collected data for each source is maintained by the data source identified in the previous section.

The primary source of data related to Entergy's largest category of emissions (representing 87.1% of total corporate emissions in 2016) is CEM system data. CEM system data from monitored plants is managed by Entergy's Fossil Environmental Support Group. CEM system data is closely managed and maintains a high level of quality control as required by EPA regulations (40 CFR Part 75). The Director, Fossil Environmental Support is responsible for maintaining these data; the primary contact for these data is the Supervisor, Emission Monitoring and Markets. CEMS data is sourced from the data acquisition and handling system (DAHS), which is the software package used to manage and query CEMS data. A report is generated for the annual CO<sub>2</sub> emissions and provided to the Manager, Corporate Environmental Operations (see further description below of how the inventory is generated).

Controllable Power purchase information is managed by the Manager, System Planning using an internally developed software package called TRADES. This system is used by the power buyers to track, validate and eventually invoice long-term power purchase contracts necessary to support grid operations. Additionally, the ISB system is used to track the final settlement of power purchases. Where there were discrepancies in the data, the ISB system was used as the correct value. Other data categories are managed as described in the section above.

Entergy transitioned system dispatch and the bulk of power purchasing operations to MISO on December 19, 2013. This transition greatly impacts the manner in which power is purchased and dispatched for Entergy. Beyond the long-term power purchase contracts described above, all power necessary to support grid operations is purchased directly from MISO. The source plant/unit of this power is not known and may in fact include power generated by Entergy.

### *Data Management*

All data required for the inventory is either reported to or collected by the Manager, Corporate Environmental Operations in the ESP Group in the December/January/February timeframe. This information is maintained in electronic files and calculation spreadsheets. The specific steps of the process are described further below:

- **DATA RECEIPT** – the data described above are transmitted to ESP in the form of spreadsheet files via email attachment. This transmittal method is secure and reliable. Once received, the spreadsheet files are saved to a shared Directory under the ‘GHG Inventory’ folder.
- **DATA REVIEW AND MANIPULATION** – spreadsheets are accessed and reviewed for the relevant information. In some cases, the data are sorted, totaled and formatted to facilitate entry into the inventory spreadsheet. The data also is reviewed during this step to evaluate the overall magnitude to identify any obvious errors or omissions.
- **DATA ENTRY** – data is entered into the draft working version of the GHG inventory. During this step, an additional review for data reasonableness and completeness is performed. Any obvious errors or omissions are addressed directly with the data manager by phone or email, as needed. All of the data sources are either entered directly into the inventory or are used for further calculation of the necessary data points required to develop the overall inventory. All supporting calculations and spreadsheets are housed on the shared directory noted above.
- **QA/QC AND TECHNICAL REVIEW** – where data entry is required, a double check and a reverse double check is always performed. A double check review is simply another review of the numbers entered into the working draft version of the inventory, while a reverse double check is an evaluation of the data entered



against the working draft version of the inventory to ensure all data points are included. Once this review is completed, the draft version is circulated to several technical reviewers within the company; feedback is used to modify the inventory as needed.

Annual inventories and IMPRD updates are published and posted on ESP's SharePoint site, Entergy's intranet site for all information maintained by ESP. Additionally, Entergy posts the total inventory number, along with the verification statement and other information to its registry account with the American Carbon Registry ([www.americancarbonregistry.org](http://www.americancarbonregistry.org)) and on Entergy's external website (<http://www.entergy.com/environment/performance.aspx>). Entergy will continue to use and update the inventory template in future years in order to remain as consistent as possible.

#### *Key Performance Indicator Selection and Data Collection*

Entergy's current goal is to stabilize GHG emissions at 20% below 2000 levels on an absolute basis through 2020. The goal does not use emissions intensity; however, on an as needed basis, Entergy does calculate and evaluate GHG emission intensities. The primary intensity measure used is tons of emissions per megawatt hour.

#### *Data Collection Process Quality Assurance*

The owners of data identified in the previous section are responsible for maintaining data quality assurance. Every effort should be made to ensure that the data reported are accurate and complete. ESP will evaluate the data, once collected, to ensure that it is reasonable and consistent with past years. ESP will also conduct and document QA checks during the production of the inventory.

As part of the process each data manager uses for collecting GHG data, they must define and document any areas of possible error and the QA/QC actions they use to maintain accuracy. CEMS data quality is maintained in accordance with the compliance requirements contained in EPA regulations (40 CFR Part 75). Any departures from these

data quality measures (i.e. non-compliance events) should be communicated to ESP. Possible errors in emissions factors and calculations are also documented with the emissions factors and calculations records. Any inconsistencies and large unexpected changes from the previous year's data should be sufficiently explained when the data is transmitted. The Manager, Corporate Environmental Operations will compare the current year's data for each source category to the previous year's data in order to identify any large, unexpected variations. The data also is reviewed and all calculations validated to ensure that the calculations are correct.

#### *Data Collection System Security and Integrated Tools*

Data is typically transferred through Entergy's e-mail system. Security of this system is the responsibility of the IT group. Security of the data once it is collected and consolidated is the responsibility of ESP. Every effort will be made to ensure the security of the inventory information, primarily by saving this information to the shared directory in the 'GHG Inventory' folder. The shared directory is only accessible by employees in the ESP group. Entergy's external website ([www.energy.com](http://www.energy.com)) and the Entergy's registry account with the American Carbon Registry ([www.americancarbonregistry.org](http://www.americancarbonregistry.org)) will serve as the final publication repository for the GHG inventory using read-only, redacted versions.

#### *Frequency*

Data will be reported to/collected by ESP on an annual basis (at a minimum). This information will be used to produce an updated GHG inventory each year. No later than the end of the 1<sup>st</sup> quarter of each year, ESP will produce an updated inventory for the previous calendar year. A verification audit will be conducted by an independent third-party. Beginning in 2012, this verification audit will be conducted in accordance with the international standard – ISO 14064.3. This updated inventory will be used to track progress against the reduction goal discussed above.

## Base Year

*Adjustment for Structural Changes* – The base year (2000) will be adjusted for material mergers, acquisitions, and divestitures that occur during the reporting time frame for the goal. Actual yearly emissions the acquisition of each material emission-producing entity/asset that existed during the base year will be added to the base year and each year that follows. Emissions from divestitures of material emission-producing assets that existed during the base year will be removed from the base year and every year that follows. Mergers and capital leases on material emission-producing assets will be planned in the same manner as the acquisitions to the degree that it is practical. There are no planned adjustments for outsourcing. Mergers, acquisition, divestitures, and capital leases will be identified by ESP and integrated into the GHG inventory for the calendar year when the deal closes. Additionally, data managers should keep ESP informed of any such changes. Finally, ESP will monitor such changes through the investment approval process, which it participates in on as a subject matter expert for environmental issues.

Since 2000, Entergy has purchased and divested several assets. The table below shows these transactions and describes any adjustments to the base year that were required, along with a justification of such changes.

Transaction/Asset	Year of Close	Year of COD	Comments
Union Plant (acquisition)	2016	2003	Did not exist in base year – no adjustment needed
Top of Iowa Windfarm (divestiture)	2016	2003	No emissions from these assets – did not exist in base year – no adjustment needed
White Deer Windfarm (divestiture)	2016	2003	No emissions from this asset – did not exist in base year – no adjustment needed
Ninemile 6 – NOLA (new self-build CCGT)	NA	2014	Did not exist in base year – no adjustment needed
Thermal Plant – Houston (divestiture)	2013	Pre-2000	Estimated plant emissions fall well below materiality threshold (1%) – no adjustment needed
Thermal Plant – NOLA (divestiture)	2013	Pre-2000	Estimated plant emissions fall well below materiality threshold (1%) – no adjustment needed
Hinds County Plant (acquisition)	2012	2001	Did not exist in base year – no adjustment needed
Hot Spring Plant (acquisition)	2012	2002	Did not exist in base year – no adjustment needed
Rhode Island Plant (acquisition)	2011	2002	Did not exist in base year – no adjustment needed

Rhode Island Plant (divestiture)	2015	2002	Did not exist in base year – no adjustment needed
Harrison County Plant (divestiture)	2011	2003	Did not exist in base year – no adjustment needed
Acadia Plant (acquisition)	2011	2002	Did not exist in base year – no adjustment needed
Ouachita Plant (acquisition)	2008	2002	Did not exist in base year – no adjustment needed
Calcasieu Plant – Unit 1 (acquisition)	2008	2000	Estimated plant emissions fall well below materiality threshold (1%) – no adjustment needed
Calcasieu Plant – Unit 2 (acquisition)	2008	2001	Did not exist in base year – no adjustment needed
Perryville Plant (acquisition)	2005	2001/2	Did not exist in base year – no adjustment needed
Spindletop Gas Storage (acquisition)	2004	Pre-2000	Estimated plant emissions fall well below materiality threshold (1%) – no adjustment needed
Thermal Plant – Houston (acquisition)	2003	Pre-2000	Estimated plant emissions fall well below materiality threshold (1%) – no adjustment needed
Thermal Plant – NOLA (acquisition)	2000	Pre-2000	Estimated plant emissions fall well below materiality threshold (1%) – no adjustment needed

*Adjustment for Methodology Changes* - Changes will be made to calculations and emissions factors only if justified by regulatory changes, scientific/engineering judgment, or updates to the various protocols employed. As an example, several emission factors were updated in 2014 due to adjustments made by EPA. The Vice President, Environmental Strategy & Policy will make the final decision as to whether or not make such adjustments. In cases where changes are made, the changes will be made to all years in the inventory, including the base year, so that all emissions are reported using the same basis for all years.

An **IMPRD Revision Log** is included in this document as Attachment 4 and should be used to document any structural or methodological changes to corporate greenhouse gas inventories or this IMPRD.

### **Management Tools**

#### *Roles and Responsibilities*

The Vice President, Environmental Strategy & Policy is responsible for overall GHG program management and external reporting. This individual is also responsible for

compiling the data required to update the GHG inventory on an annual basis before the end of Q1 and for evaluating the reasonableness of the GHG data.

He/she also reviews changes to the programs that Entergy participates in and updates the IMPRD as needed. These responsibilities are defined in more detail in specific sections of this IMPRD. ESP then produces and distributes needed reports summarizing the emissions inventory and progress toward the goal.

ESP also provides guidance and feedback to relevant company Managers and Directors on what sources to include in the inventory, what data to use and collect, and what emissions factors are most appropriate.

Various Managers and Directors around the company are responsible for maintaining the data necessary to complete the inventory and subsequent updates. Entergy's Environmental Leadership Team (ELT) reviews and approves the summary of each year's data.

#### *Communication*

The IMPRD will be communicated upon initial finalization and subsequently on a periodic basis, when major revisions occur or as needed. Opportunities for communication with Data Managers include when training is delivered, when data requests are made, during the third-party review of the inventory, and when the IMPRD is revised.

#### *Training*

Entergy currently has no training materials available regarding GHG management or inventory. Training will be delivered on an ad hoc basis to employees involved in the process. The Director, Environmental Reporting & Climate will conduct this training as needed.

#### *Document Retention and Control Policy*

Entergy's GHG management program and all relevant records and documentation should be managed in accordance with [Entergy's Records Management & Retention Policy](#). Entergy's external website will serve as the final publication repository for the GHG inventory. The external website is accessible via the internet. Additionally, the annual inventory, verification statement and IMPRD will be submitted to the American Carbon Registry for posting on Entergy's registry account. This is accessible to anyone via the ACR website ([www.americancarbonregistry.com](http://www.americancarbonregistry.com)).

Data verification and documentation is essential for the authenticity of this program. To maintain a high standard, all records verifying the GHG inventories and registry contents will be maintained by ESP for a minimum of three years. Documentation of GHG reduction project expenditures and project close-out reports shall also be maintained for a minimum of three years.

## **Auditing and Verification**

### *Internal Auditing*

Internal auditing of the GHG program will be conducted by ESP staff or designee. Some of the data used to develop emission estimates are also audited through Entergy's Safety and Environment Audit Program (i.e., CEMS data/processes, reporting under the Mandatory Reporting Rule, etc.) administered by ESP. Findings related to the GHG Inventory will be provided to the VP, ESP who will determine the responsible individual for each finding's corrective action. The audit will include a review of the IMPRD and the latest version of the inventory. A consistency check is also performed against the prior year's data, especially in the area of direct emissions. Changes to the IMPRD driven by audit results will also be entered into the IMPRD Revision Log (Attachment 4).

### *External Validation and/or Verification*

Entergy is committed to an external third-party audit of the GHG baseline/inventory data, calculations, and records. This third-party verification of the program will be conducted at least every other year, including 2006 and the goal year. Since 2006, Entergy has sought annual, third-party verification of the GHG Inventory. The verification statement and report are made available via the ACR website and Entergy's external website.

In 2012, Entergy decided to elevate this third-party verification audit to the ISO standard for GHG Inventory preparation and verification (ISO 14064.3). This is an expanded verification effort that requires a higher level of scrutiny and additional data review/evaluation. The verification report will include a statement regarding the type of verification, level of assurance and an uncertainty analysis. The uncertainty analysis identifies, describes and quantifies the largest sources of uncertainty for the GHG Inventory. See Attachment 3 for the full verification report.

### *Management Review*

The GHG emissions summary data will be reviewed and approved annually by the ELT. Goal setting, progress toward meeting goals, and any additional action or options necessary to meet the goals will be covered in this management review. The VP, ESP

will verify that the information has been reviewed and found to be substantially compliant with this IMPRD. Additionally, this information will be presented to the Audit Committee of the Board of Directors during the annual reporting cycle.

#### *Corrective Action*

Any findings identified through QA/QC and internal and external reviews related to the greenhouse gas inventory or IMPRD are assigned to the appropriate Manager or Director for action by the VP, ESP. The VP, ESP will maintain a list of identified gaps related to the program, the person that is responsible for closing the gap, and the required timing for gap closure. Changes to the IMPRD driven by this process will also be entered into the IMPRD Revision Log (Attachment 4).

Any findings identified through QA/QC and internal and external audits related to the GHG emission inventory, calculations, or reporting are assigned to the VP, ESP or his designee.

### **Voluntary Commitment and Reduction Efforts**

#### *Voluntary Commitments*

In May 2001, Entergy publicly committed to stabilize CO<sub>2</sub> emissions from its power plants at year 2000 levels through 2005, and dedicated \$25 million in supplemental corporate funding to achieve this target over the five-year period. This commitment was focused on CO<sub>2</sub> emissions from fuel combustion at the company's power plants and required that Entergy:

- Stabilize CO<sub>2</sub> emissions from its U.S. power plants at year 2000 levels through 2005.
- Establish the \$25 Million Environmental Initiatives Fund (EIF) in support of achieving the 2001-2005 stabilization targets.
- Document activities and annually report progress.
- Employ an independent third-party organization to verify measurement of Entergy's CO<sub>2</sub> emissions from U.S. power plants.



Entergy completed this first commitment 23 percent below year 2000 levels.

Entergy's second commitment, made in 2005, included:

- Stabilize CO<sub>2</sub> emissions from all Entergy operations at 20% below 2000 levels through 2010.
- Commit funding of \$3.25 million in support of achieving the 2005-2010 target.
- Document activities and annually report progress.

Entergy completed this second commitment more than three percent below the target. On a cumulative basis, Entergy bettered the two commitments by over 14 percent.

In 2011, Entergy once again renewed its commitment to stabilize GHGs with a third commitment:

- Stabilize CO<sub>2</sub> emissions from all Entergy operations at 20% below 2000 levels through 2020.
- Commit funding of \$10 million in support of achieving the 2011-2020 target.
- Document activities and annually report progress.

Additional information on these commitments can be viewed on [Entergy's website](#).

#### *Voluntary Reductions*

Since 2001, Entergy has invested in various types of internal and external emission reduction projects. These projects range from internal plant efficiency improvements, to reforestation projects, to carbon offset purchases. These projects are described annually in the Environmental Section of [Entergy's Integrated Report](#).

In addition to the projects described above, Entergy owns several facilities that generate electricity without emission of GHGs. Entergy's nuclear fleet (10,000 MW), and hydro plants (74 MW) generate virtually emission-free electricity and constitute a major portion of Entergy's overall generation mix (more than 33% at the end of 2016).



**Attachment 1**

**2016 GHG Inventory – FINAL and VERIFIED**

**Attachment 2**

**Entergy Corporation General Emissions Source Checklist**

## Entergy Corporation General Emission Source Checklist

Emissions source category	GHG	Emissions source	Data Source/Comments
<b>Direct emissions</b>			
<b>Stationary Combustion</b>			
Fossil fuels	CO2	Boilers	CEMS data from Fossil Environmental Support Group
		Emergency/Backup Generation and other Small Sources	An inventory of all potential emission sources at Entergy locations was performed in 1994. The package of information for each Fossil site that includes a summary table of potential emission sources and maximum heat input for each non-boiler combustion source. This information was supplemented by information in air permits.
		cogeneration	RS Cogen is the only cogeneration plant in Entergy. CEMS data for this site is available from public sources. Ownership share was accounted for.
	CH4	CH4 from stationary combustion	Calculated from CEMS data
	N2O	N2O from stationary combustion	Calculated from CEMS data
<b>Mobile Combustion</b>			
Fossil Fuels	CO2	employee transportation in company vehicles	See spreadsheet for fuel activity by year, mileage driven by year, number of vehicles by type (car, light truck, heavy trucks, etc.) and by fuel. These data, along with emission factors, were used to estimate emissions from these sources. Source is Corolanne Nichols, Entergy's Fleet Mgmt. Analyst n (501-379-6803)
		company service vehicles	
	CH4	CH4 from mobile combustion	
	N2O	N2O from mobile combustion	
<b>Fugitive Emissions</b>			
Gas Distribution System Line Losses	CH4	Leaks in or venting of gas distribution system in New Orleans and Baton Rouge	<p>Lost and Unaccounted for Gas (LUGF) for 2000 - 2004 from the Statistical Report is one source of this data; however, it may not be accurate enough. Subsequently, an alternative equipment-based calculation was used for estimating emissions (see below)</p> <p>Gas Distribution Operations provided these data and they can also be found in the Statistical Report. (Line Losses (LUGF)) - Mike Leger - Manager, Gas Distribution Operations Support (8-567-3579)</p> <p>Basically, these numbers represent the starting inventory + purchases -</p>

## Entergy Corporation General Emission Source Checklist

			<p>sales. However, it is likely that the majority of this is attributed to meter inaccuracy, company uses, and other factors which introduce uncertainty. Mike Leger, Entergy's Gas Distribution Operations Support Manager, estimates that at most, 30% of these numbers represent actual, physical losses.</p> <p>An equipment-based quantification methodology was used for these emissions. Mike Leger also provided a spreadsheet that contains a list of gas distribution assets (miles of pipe and what type, number of meters, etc.) and Platts used a GRI protocol to develop emission estimates.</p>
T&D Equipment Gas Loss	SF6	Leakage of SF6 from certain types of T&D equipment	<p>2003 1605(b) report SF6 Management Program – Rick McCabe established as the SME for this particular gas – provided 2004 emissions</p> <p>1997 - 1082.42 lbs 1998 - 649.62 lbs 1999 - 649.62 lbs 2000 – NO DATA 2001 – NO DATA 2002 - 30,360 lbs 2003 – NO DATA 2004 – 22700 lbs</p> <p>Rick McCabe (T&amp;D Environmental Management) developed a protocol to derive these emissions.</p>
Cooling Operations	HFC	Building cooling/air conditioning	<p>Owned square footage: 2,578,000 Capital leased square footage: 830,000 These numbers do not include power plants, estimate 25,000 - 50,000 square feet per power plant</p> <p>Source is Ken Looper - Manager, Real Estate (576-4505)</p>
		Mobile air conditioning	Derived from vehicle usage information – see item above. Emission factor used to estimate HFC emissions from this source
		District Cooling Operations	Information regarding equipment/coolant ratings and capacities obtained from the Director, Thermal Operations (John Carlson – 8-561-2120). Emission factors used to estimate emissions.
Indirect Emissions			
Fossil Fuels	CO2	purchased electricity	<p>2000 – 24.05 million MWh 2001 – 19.32 million MWh 2002 – 27.16 million MWh 2003 – 37.57 million MWh (Controllable = 6.61; balance is UC) 2004 – 38.05 million MWh (Controllable = 9.23; balance is UC)</p>
	CH4	purchased electricity	<p>Information regarding specific sources of purchased power was not tracked in 2000 - 2002; therefore, unit-specific data required to calculate emissions is not available for this timeframe. However, unit-specific data is available for 2003 and 2004.</p> <p>All of this information obtained from System Planning and Operations (Jim Lanning 504-576-6337)</p>
	N2O	purchased electricity	
Transmission and Distribution	CO2	Losses from electricity T&D for purchased power only	USEPA/Climate Leaders is currently developing a protocol to calculate these emissions. Currently, this is not included in Entergy's GHG inventory.
Green power		Purchased Green Power (non-biomass)	<p>2000 - 488,922 MWh</p> <p>In 2000, Entergy owned and operated 3 hydro facilities totaling 150 MW. Additionally, Entergy purchased power from other hydro assets...this total is shown.</p> <p>This information was obtained from Entergy's 1605(b) report.</p>

**Attachment 3**

**2016 GHG Inventory Verification Statement and Report**

**Attachment 4**  
**IMPRD Revision Log**



## Entergy GHG IMP and Reporting Document Revision Log

Revision No	Revision Date	Reason for Revision	Additional Comments
1	July 2005	Original DRAFT	
2	8/16/05	Revised Draft	Editorial/technical comments from Fossil Operations, Nuclear Operations, and T&D included
3	9/30/05	FINAL DRAFT	Editorial/technical comments from Platts/E source
4	12/21/05	FINAL VERSION	Changes made to reflect approved GHG reduction goal – 2 <sup>nd</sup> commitment
5	10/10/06	Revised based on comments from Climate Leaders and E-source	Clarified various data sources and communication requirements in document
6	04/28/09	Revised based on findings during verification of 2006 and 2007 GHG Inventories	Various editorial changes; added Thermal facilities and Spindletop to facilities list
7	08/25/09	Revised based on findings during verification of 2008 GHG Inventory	Revised fugitive emissions methodology for SF <sub>6</sub> ; other minor editorial changes
8	04/01/10	Revised based on findings during verification of 2009 GHG Inventory	Various editorial changes; noted need to subtract EAM from total purchases (ISB); updated facility list; enhanced QA/QC discussion
9	3/10/11	Revised based on findings during verification of 2010 GHG Inventory	Various editorial changes; updated status of EPA Climate Leaders Program; clarified review requirements, QA/QC measures and training
10	03/09/12	Revised to comply with ISO 14064-3:2006 and based on findings during verification audit of 2011 GHG Inventory	Major revision – expanded document to include aspects necessary to comply with ISO standard. Expanded discussions of data management, quantification methods, targets, actions, base year adjustments and uncertainty.
11	03/08/13	Revised based on findings during verification audit of 2012 GHG Inventory	Various editorial changes; updated plant acquisitions during 2012
12	03/07/14	Revised based on findings during verification audit of 2013 GHG Inventory	Various editorial changes; updated to reflect plant divestitures during 2013, inclusion of off-site power for plants out of utility territory, discussion of transition to MISO, updated internal website address
13	03/09/14	Revised to reflect changes caused by transition to MISO and based on findings during verification audit of 2014 GHG Inventory	Various editorial changes; updated to reflect new plant started up in 2014, described impacts of MISO transition, updated website addresses
14	03/11/15	Revised based on findings during verification audit of	Various editorial changes; updated plant sales

		<b>2012 GHG Inventory</b>	
<b>15</b>	<b>03/02/17</b>	<b>Revised based on findings during verification audit of 2016 GHG Inventory</b>	<b>Various editorial changes; updated to reflect plant acquisition and divestitures closed during 2016.</b>