

MIT GHG Inventory Overview

Methodology, Boundaries, Scope and Data Overview

November 2017

Includes information for FY14 –FY17 inventories



Office of Sustainability

MIT completed a greenhouse gas inventory to understand and manage our Institutional climate change impact.

Who should use the inventory?

How will it be used?

The inventory will be used as a tool for meeting MIT's carbon reduction goal, and as tool for learning and engaging with real-time carbon footprint assessment.

MIT is committed to becoming a test-bed for climate innovation; staff, students, and faculty can use the inventory to identify ways to reduce the Institute's footprint, understand energy and emission trends, and improve methodology in data collection.

Why Complete a GHG Inventory?

MIT completed a greenhouse gas inventory to understand and manage our Institutional climate change impact.

A greenhouse gas (GHG) inventory measures the amount and source of an organization's "carbon footprint" – that is, how institutional activities contribute to climate change.

The process looks at the impact from burning fossil fuels and using other resources, and assesses the greenhouse gases which contribute to climate change from their use into a single metric: metric tons of carbon dioxide equivalent (MTCO2e).

MIT Greenhouse Inventory Data - Basic Spreadsheet (2014-2015)

MIT Building Energy Use

	Unit	2014	2015
Electricity (Purchased)	kWh	87,445,993	80,490,556
Oil #6	Gallons	1,044,703	1,226,890
Oil #2	Gallons	779,501	665,373
Natural Gas	CCF	24,948,560	22,960,822
Electricity (Not Supplied by the Central Utility Plant)	kWh	28,130,477	28,315,832
Oil #2	Gallons	2,407	2,431
Natural Gas	CCF	858,000	855,264

MIT Greenhouse Gas Emissions

	BY CATEGORY	Unit	2014	2015
All Inventory Emissions	MIT Owned Buildings	MTCO2e	204,177	191,768
	Fleet Vehicles	MTCO2e	1,150	1,151
	Fugitive Process Gases	MTCO2e	4,000	4,000
Leased Buildings	MTCO2e	4,101	4,101	
BY TYPE				
All Inventory Emissions	MIT Owned Buildings: Fuels	MTCO2e	161,579	151,665
	Fleet Vehicles	MTCO2e	1,150	1,151
	Fugitive Process Gases	MTCO2e	4,000	4,000
	Buildings: Purchased Electricity	MTCO2e	38,765	36,494
	T&D Losses from Purchased Electricity	MTCO2e	3,834	3,609
Leased Buildings	MTCO2e	4,101	4,101	
BY SCOPE				
All Inventory Emissions	Scope 1: Direct Emissions	MTCO2e	166,729	156,816
	Scope 2: Indirect Emissions	MTCO2e	38,765	36,494
	Scope 3: Indirect Emissions	MTCO2e	7,935	7,710
Total Emissions	MTCO2e	213,428	201,020	

Space

	BY CATEGORY	Unit	2014	2015
Gross Square Footage	MIT Owned Buildings	GSF	12,145,907	12,253,281
	MIT Leased Buildings	GSF	451,064	451,064

The MIT GHG Inventory is managed by the MIT Office of Sustainability and updated annually
 Data sources: MIT SAP purchase data via MIT Data Warehouse; Department of Facilities and Office of Sustainability
 Reporting periods: Fiscal year (July-June)
 *Estimated data until calendar year data available

SUSTAINABILITY CENTER



Protocol



Calculator



Gases

Six greenhouse gases are measured and converted to metric tons of CO₂ equivalent:

Carbon dioxide (CO₂)
Methane (CH₄)
Nitrous oxide (N₂O)

Hydrofluorocarbons (HFCs)
Sulfur hexafluoride (SF₆)
Perfluorocarbons (PFCs)

GHG Inventory Methodology

[The Greenhouse Gas Protocol](#), developed by World Resources Institute (WRI) and World Business Council on Sustainable Development (WBCSD), sets the global standard for how to measure, manage, and report greenhouse gas emissions.

The [Campus Carbon Calculator](#) (formerly the Clean-Air Cool Planet calculator) is used to calculate emissions based on the GHG Protocol.

The Campus Carbon Calculator is the standard tool used for American campus greenhouse gas (GHG) data collection and inventory reporting.

Six greenhouse gases are measured and converted to metric tons of CO₂ equivalent.

MIT uses the "operational control" method for inventory boundaries.

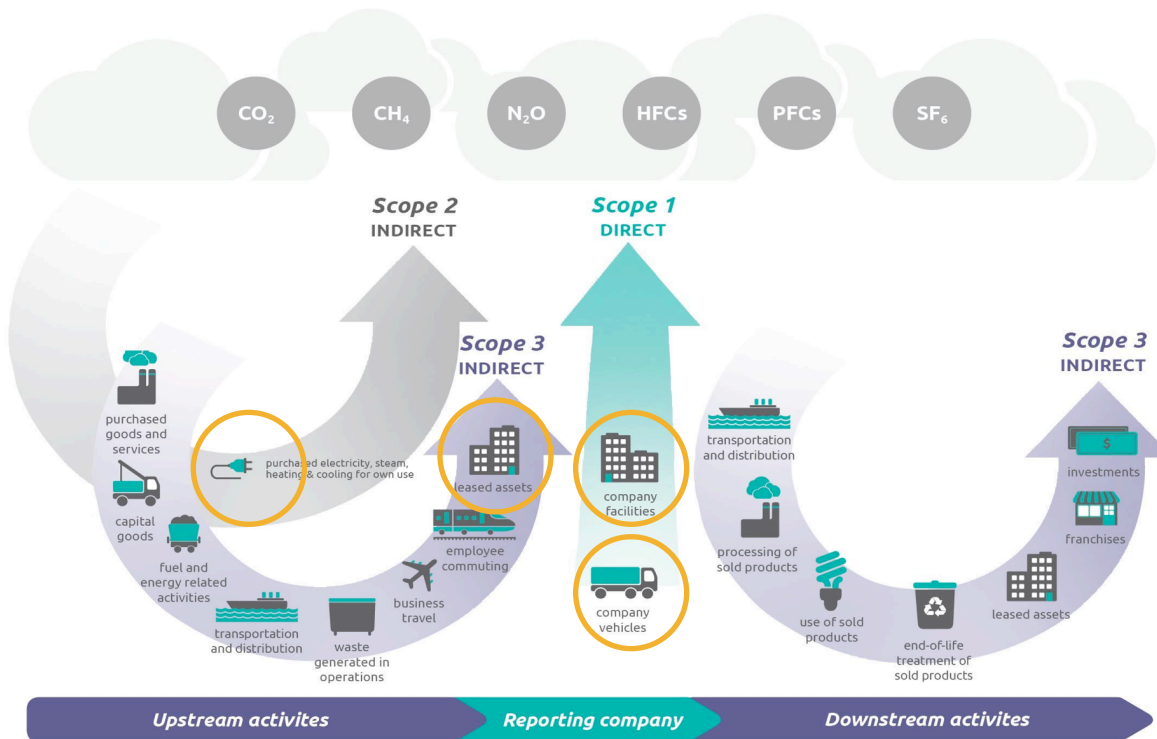


GHG Inventory Scopes Measured

Scopes measured by MIT in the FY2014 -FY2017 GHG Inventories*

*Transmission & distribution losses are not shown on this graph, but are measured by MIT in Scope 3 according to the GHG Protocol

Figure [1.1] Overview of GHG Protocol scopes and emissions across the value chain



<http://www.ghgprotocol.org/>
<http://www.ghgprotocol.org/files/gha/public/overview-of-scopes.JPG>

The GHG Protocol categorizes emissions into three broad scopes:

- 1: All direct GHG emissions.
- 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam.
- 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.

MIT measures the areas indicated on the graph, which is in line with industry best practice for higher education.



GHG Protocol Scopes

Scope 1 Direct Emissions

- Building energy use
- Campus vehicles
- Fugitive gases

Scope 2 Indirect Emissions

- Purchased electricity
- Purchased steam & chilled water

Scope 3 Indirect Emissions

- Leased space
- Transmission & distribution losses

MIT measures all of these, and organizes into three large categories:

MIT Emissions Categories



Buildings



Fugitive Gases



Campus Vehicles

GHG Inventory Scopes Measured

MIT measures all direct emissions in Scope 1 and all indirect emissions in Scope 2. MIT also currently measures T&D losses and space leased for academic purposes on the Cambridge campus in Scope 3.

Because “scopes” are not an easily recognizable set of categories for the general public, MIT, like most of our institutional peers, categorizes emissions into more familiar categories. Which emissions from each scope are included in these categories is shown in the diagram to the left.

The three categories used by MIT are Buildings, Fugitive Gases, and Campus Vehicles.

Self-Reporting

MIT publishes the inventory on our website – makes the information accessible where we want, how we want

Why: Transparency & accountability to our community, campus as a test bed for learning, standard best practice among our peers

Mandated Reporting

MIT is required by law to report certain institutional emissions to a central reporting agency, for public / state and federal dissemination, publish, or use.

GHG Inventory Different Reporting Boundaries

The MIT GHG inventory represents a full accounting according to industry best practice of the Institute's carbon footprint.

MIT also reports a portion of it's institutional emissions through mandated reporting to the EPA.



MIT GHG Inventory (Full Accounting)

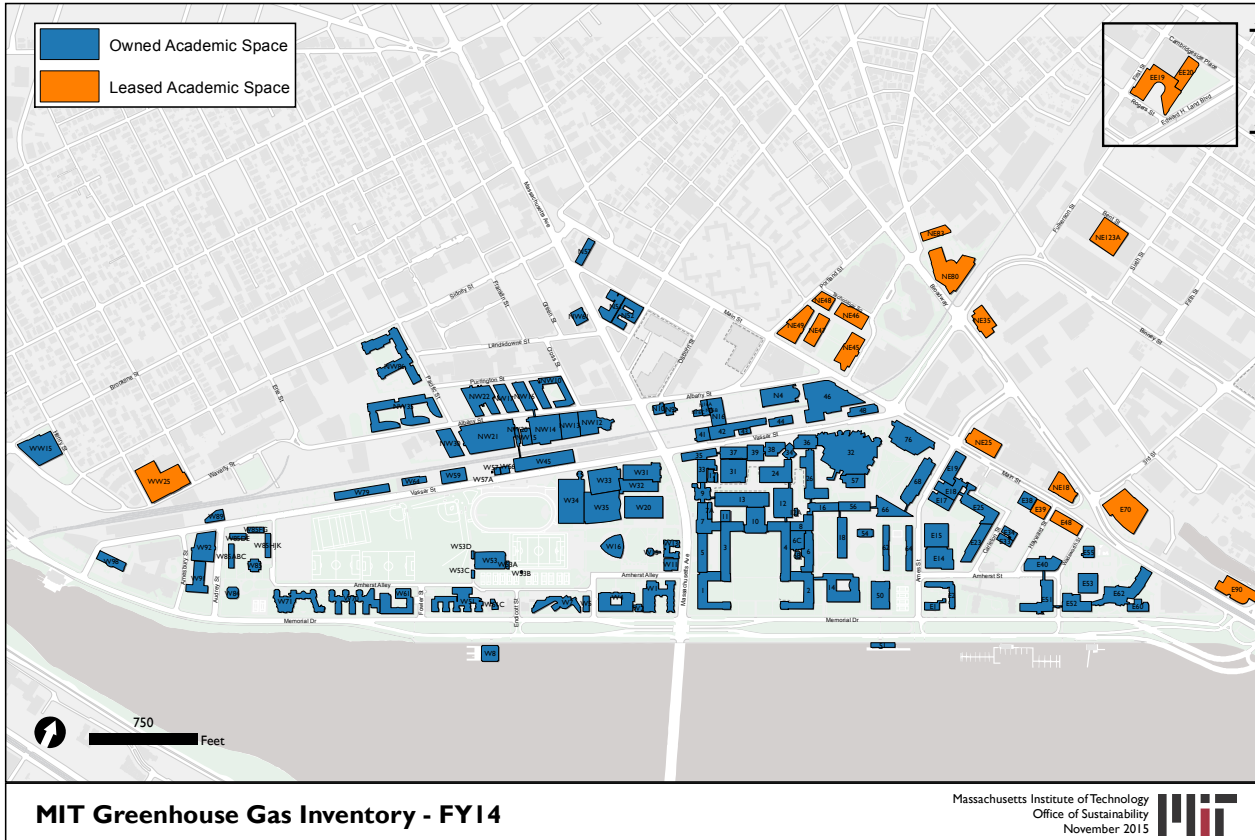
Uses the WRI GHG Protocol is voluntary and includes:

- Scope 1
- Scope 2
- Scope 3
- Boundary flexibility, defined by operational control

MIT Federal / State Reporting
(Mandated Only):

The EPA and DEP reporting is regulated and includes:

- Scope 1 Only
- No Scope 2 (purchased electricity)
- No Scope 3
- Boundary defined by source







GHG Inventory Space Measured

The MIT FY2014-FY2017 inventories include buildings owned and leased for the Cambridge campus. The inventories do not currently include real estate investment holdings managed by MITIMCO, off-campus space, Lincoln Laboratory, Endicott House, Haystack Observatory, Bates Linear Accelerator Center, or the MA Green High Performance Computing Center. The map indicates buildings included in our baseline year 2014.

- MIT OWNED BUILDINGS (FOR ACADEMIC USE)
- MIT LEASED BUILDINGS (FOR ACADEMIC USE)

Not Included

<p>MITIMCO</p> 	<p>OFF-CAMPUS SPACES</p> 	<p>LINCOLN LABORATORY</p> 	<p>ENDICOTT HOUSE</p> 	<p>HAYSTACK OBSERVATORY</p> 	<p>BATES LINEAR ACCELERATOR CENTER</p> 	<p>MA GREEN HIGH PERFORMANCE COMPUTING CENTER</p> 
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MIT GREENHOUSE GAS EMISSIONS INVENTORY

FY2014 BASELINE BUILDINGS INCLUDED

Owned Academic Spaces			Leased Academic Spaces		
number	name	number	name	number	name
1	Pierce Laboratory	68	Koch Biology Building	NW61	Random Hall
2	Building 2	76	David H Koch Institute for Integrative Cancer Research	NW86	70 Pacific Street Dormitory
3	Maclaurin Buildings (3)	E1	Gray House	W1	Fariborz Maseeh Hall
4	Maclaurin Buildings (4)	E2	Senior House	W2	Building W2
5	Pratt School	E14	Building E14	W4	Mccormick Hall
6	Eastman Laboratories	E15	Wiesner Building	W5	Green Hall
6B	Solvent Storage	E17	Mudd Building	W7	Baker House
6C	Building 6C	E18	Ford Building (E18)	W8	Pierce Boathouse
7	William Barton Rogers Building	E19	Ford Building (E19)	W11	Religious Activities Center
7A	Rotch Library Extension	E23	Health Services	W13	Bexley Hall
8	Building 8	E25	Whitaker College	W15	MIT Chapel
9	Samuel Tak Lee Building	E33	Rinaldi Tile	W16	Kresge Auditorium
10	Maclaurin Buildings (10)	E34	Building E34	W20	Stratton Student Center
11	Homberg Building	E38	Suffolk Building	W31	Du Pont Athletic Gymnasium
13	Bush Building	E40	Muckley Building	W32	Du Pont Athletic Center
14	Hayden Memorial Library	E51	Tang Center	W33	Rockwell Cage
16	Dorrance Building	E52	Sloan Building	W34	Johnson Athletics Center
17	Wright Brothers Wind Tunnel	E53	Hermann Building	W35	Sports & Fitness Center
18	Dreyfus Building	E55	Eastgate	W45	West Garage
24	Building 24	E60	Arthur D Little Building	W51	Burton-Conner House
26	Compton Laboratories	E62	Building E62	W51C	405 Memorial Drive
31	Sloan Laboratories	N4	Albany Garage	W53	Carr Indoor Tennis Facility
32	Stata Center	N9	Superconducting Test Facility	W53A	Carr Indoor Tennis Facility
33	Guggenheim Laboratory	N10	High Voltage Research Lab	W53B	Dupont Tennis Courts (Office)
34	EG&G Education Center	N16	Cooling Tower & Oil Reserve	W53C	Building W53C
35	Sloan Laboratory	N16A	Building N16A	W53D	Carr Indoor Tennis Facility (Svc)
36	Fairchild Building (36)	N16B	Fire Pump Room	W56	Building W56
37	McNair Building	N16C	Building N16C	W57	Building W57
38	Fairchild Building (38)	N51	Building N51	W57A	Building W57A
39	Brown Building	N52	MIT Museum	W59	Heinz Building
41	Building 41	N57	Building N57	W61	MacGregor House
42	Cogeneration Plant	NW10	Edgerton House	W64	Building W64
43	Power Plant Annex	NW12	Nuclear Reactor Lab	W70	New House
44	Cyclotron	NW12A	Building NW12A	W71	Next House
46	Brain and Cognitive Sciences Center	NW13	Building NW13	W79	Simmons Hall
48	Parsons Laboratory	NW14	Francis Bitter Magnet Lab	W84	Tang Hall
50	Walker Memorial	NW15	Francis Bitter Magnet Lab	W85	Westgate
51	Wood Sailing Pavilion	NW16	Plasma Science & Fusion Center	W89	MIT Police
54	Green Building	NW17	Plasma Science & Fusion Center	W91	Information Systems Operations
56	Whitaker Building	NW20	Albany St Generator Shelter	W92	Building W92
57	MIT Alumni Pool	NW21	Plasma Science & Fusion Center	W98	Building W98
62	Alumni Houses: Munroe Hayden Wood	NW22	Plasma Science & Fusion Center	W85A-K	Westgate Low Rise Residences
64	East Campus: Walcott Bemis Goodale	NW30	224 Albany Street	WW15	Building WW15
66	Landau Building	NW35	Ashtown House		

GHG Inventory Space Measured

The buildings listed here are included in the baseline FY2014 MIT GHG inventory. Annual changes are included below.

Total Space FY2014 Inventory

Academic Owned Buildings 12,149,907 GSF

Academic Leased Buildings 451,064 GSF

Total Space FY2015 Inventory

Academic Owned Buildings 12,093,381 GSF

Academic Leased Buildings 451,064 GSF*

Total Space FY2016 Inventory

Academic Owned Buildings 12,164,223 GSF

Academic Leased Buildings 515,732 GSF

Total Space FY2017 Inventory

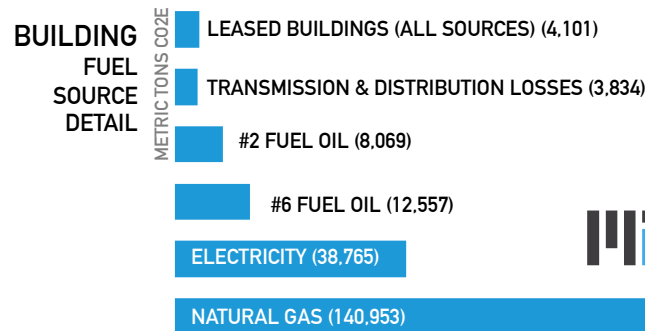
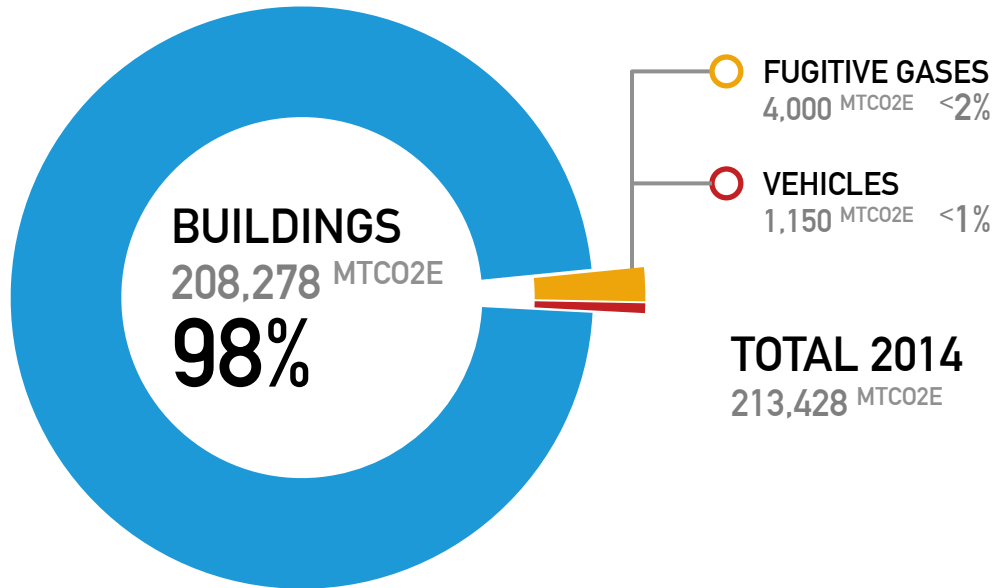
Academic Owned Buildings 12,394,103 GSF

Academic Leased Buildings 515,856 GSF

The MIT FY2014-FY2017 inventories include MIT-owned buildings on the Cambridge campus and leased academic space. The inventories do not yet include off-campus, MITMCO, Lincoln Laboratory, Bates Linear Accelerator Center, Endicott House, MGHPCC, or Haystack Observatory.

MIT GREENHOUSE GAS EMISSIONS INVENTORY

2014 MAIN CATEGORIES



MIT / Office of Sustainability

GHG Inventory FY14 Inventory



2014 is the baseline year for MIT emissions reduction. It is the year from which MIT will begin accounting as the Institute works to achieve its GHG reduction goal and represents the first year of comprehensive and streamlined data collection.

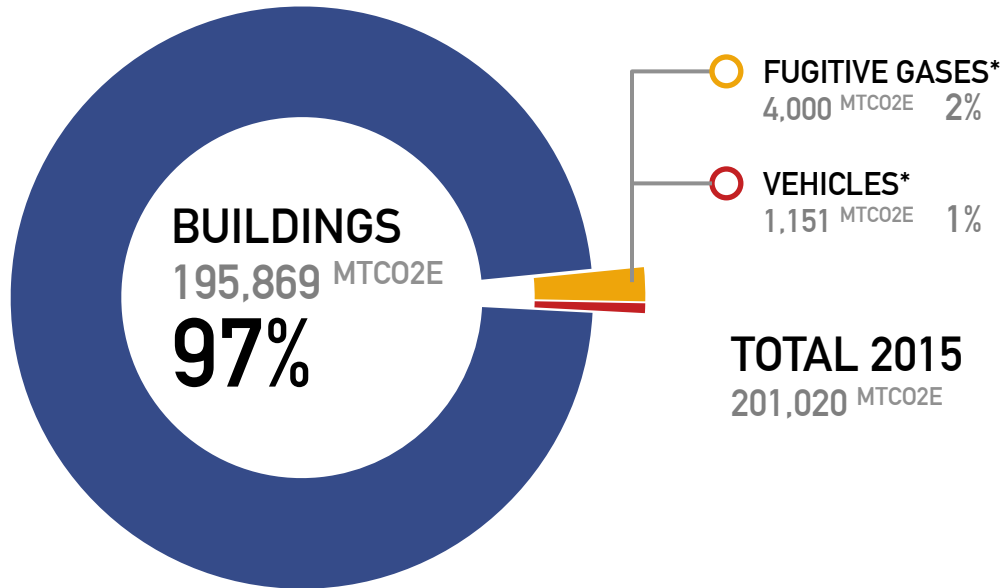
Fugitive gas emissions and fleet vehicle use comprise <3% of emissions, while 98% of emissions stem from operation of labs, offices, and facilities across campus.



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MIT GREENHOUSE GAS EMISSIONS INVENTORY

2015 MAIN CATEGORIES

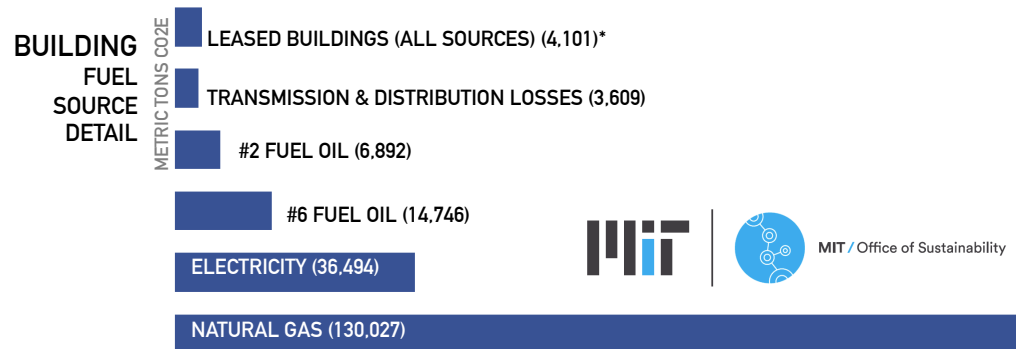


GHG Inventory FY15 Inventory

The 2015 inventory was audited by the MIT Office of Treasury and represents the second year of comprehensive inventory assessment for the Institute.

The total change in emissions from 2014 was a reduction of 12,408 MTCO₂e, or 6%.

* This data is based on the calendar year, where MIT building data is fiscal year.



MIT / Office of Sustainability

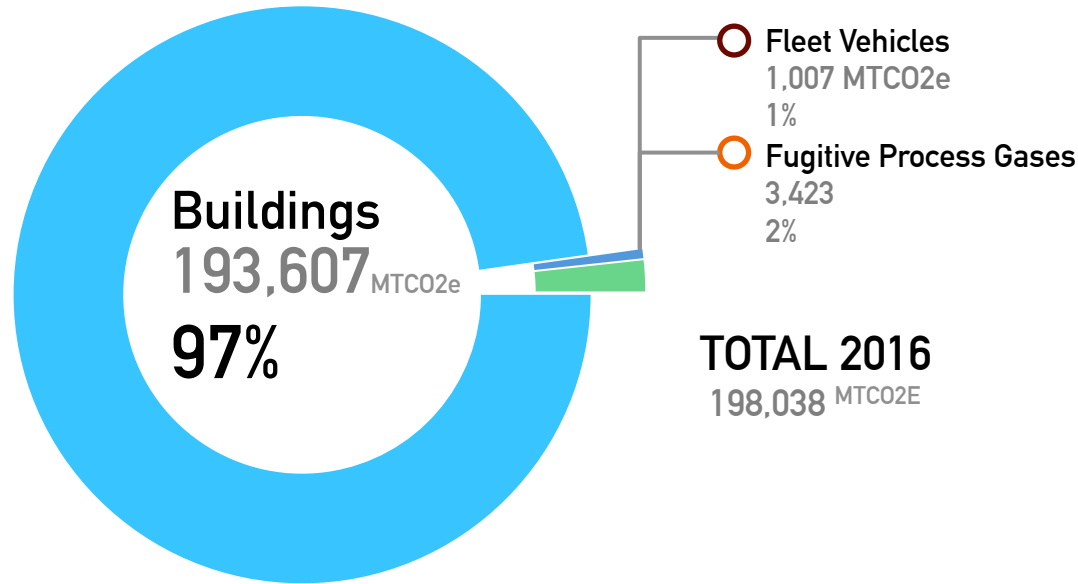
* Estimated. The GHG inventory will be updated in early 2016 when final data for these categories become available



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MIT GREENHOUSE GAS EMISISONS INVENTORY

2016 MAIN CATEGORIES

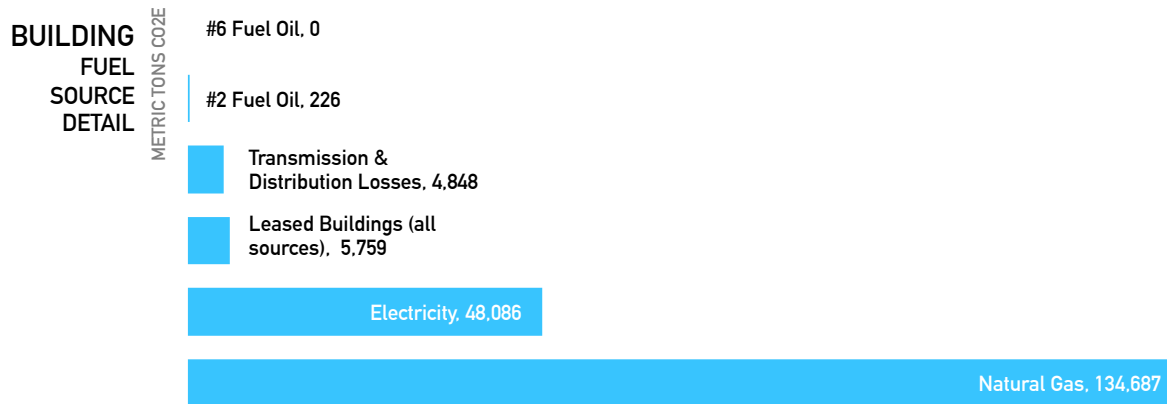


GHG Inventory FY16 Inventory

The 2016 inventory was audited by the MIT Office of Treasury and represents the third year of comprehensive inventory assessment for the Institute.

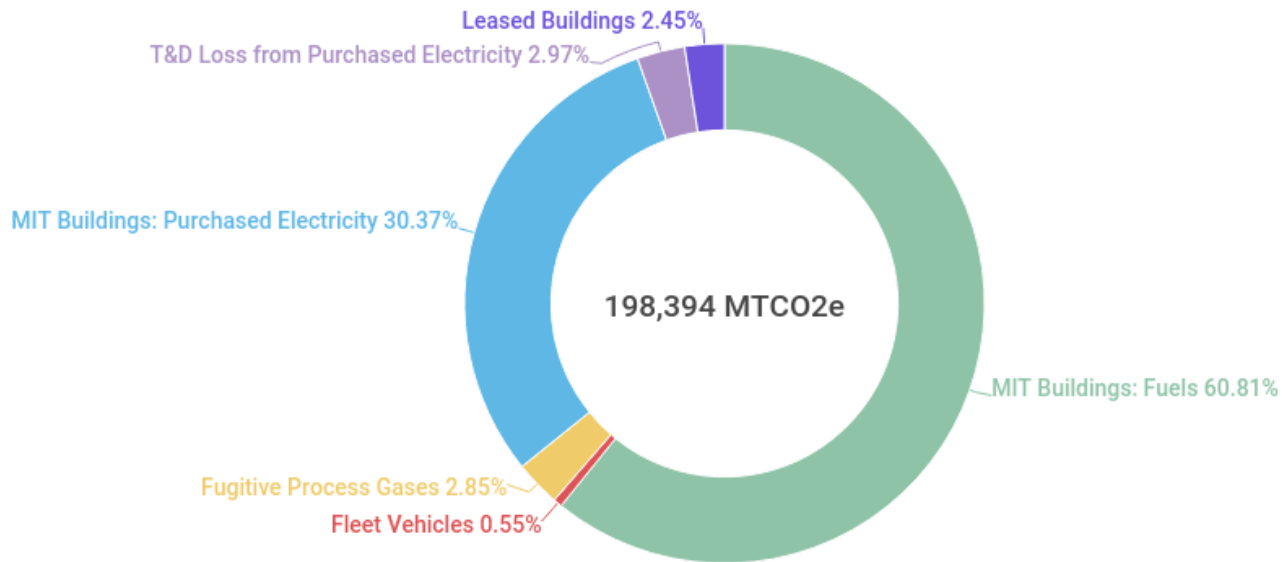
The total change in emissions from 2015 was a reduction of 2,982 MTCO₂e, or 1.5%.

The total change in emissions from 2014 was a reduction of 15,390 MTCO₂e, or 7%.



MIT GREENHOUSE GAS EMISIONS INVENTORY

2017 MAIN CATEGORIES



GHG Inventory FY17 Inventory

The 2017 inventory was audited by the MIT Office of Treasury and represents the third year of comprehensive inventory assessment for the Institute.

The total change in on-campus emissions from 2016 was a reduction of 356 MTCO_{2e}, or 0.18% 515,856, not accounting for MIT's solar power purchase in 2017.

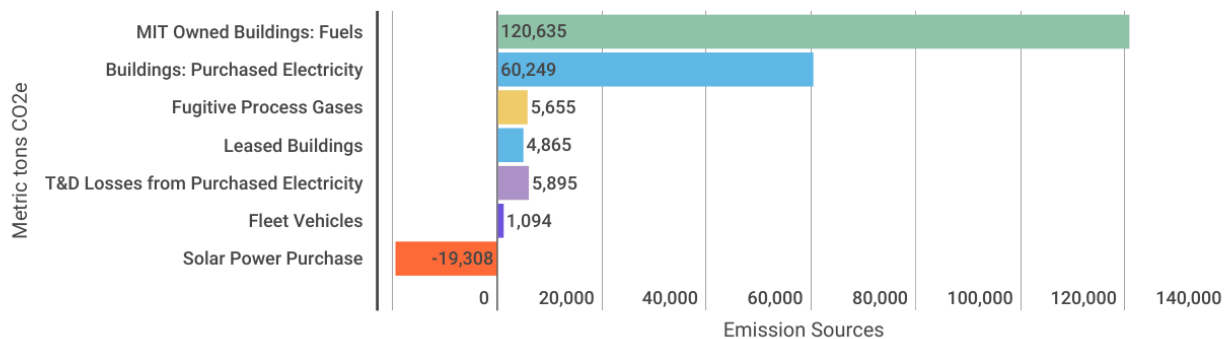
The total change in emissions from 2014 was a reduction of 15,034 MTCO_{2e}, or 7%.

Role of Solar Power Purchase

Fiscal year 2017 marked the first year MIT began to account for the impact of their large Summit Farm solar energy purchase.

Since the solar-generated electricity is considered to be carbon-free, the net impact is a reduction of greenhouse gas emissions associated with MIT's greenhouse gas inventory. The solar power purchase had a net impact of reducing our total emissions by 19,308 metric tons of CO₂ equivalents.

GHG SOURCE DETAIL

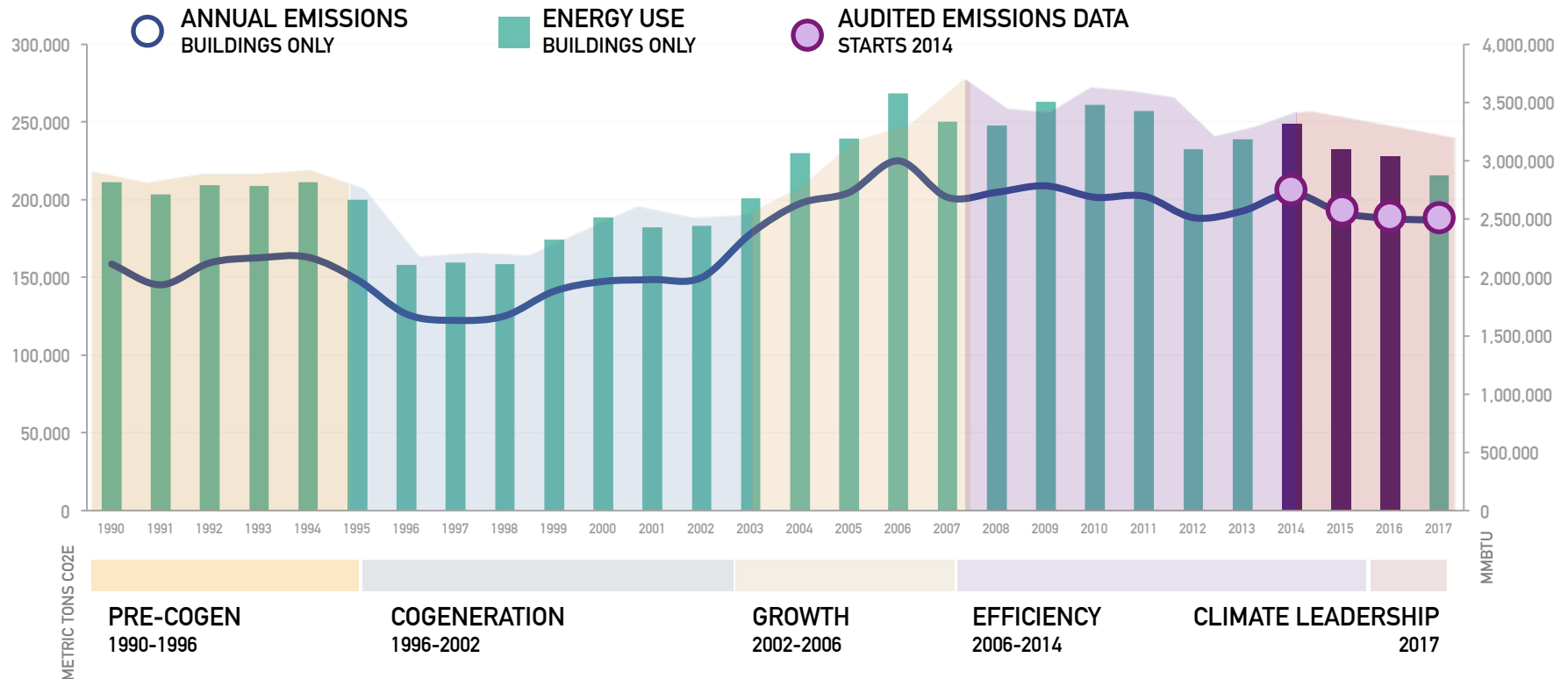


MIT GREENHOUSE GAS EMISSIONS INVENTORY

HISTORICAL EMISSIONS FROM MIT BUILDINGS ONLY



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MIT has non-audited greenhouse gas data for buildings dating back to 1990. From this data, emissions can be roughly categorized into four phases of development from 1990 to the present: *Pre-Cogeneration*, *Cogeneration*, *Campus Growth*, and *Efficiency*. The next phase of MIT's greenhouse gas management is *Climate Leadership*, beginning with the first Institutional GHG reduction goal of at least 32% by 2030 below 2014 levels being set in 2015, and the release of the first comprehensive and audited institutional GHG inventories for 2014-2017.

Note that this graphic shows trends only for emissions from MIT owned academic buildings, and does not include MIT's solar power purchase in 2017. Beginning in 2014, MIT also measures emissions from fugitive gases and campus vehicle use which are omitted from this figure.



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