

**2020 Accounting Report on Carbon
Emission for International Campus,
Zhejiang University**

January 2021

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1 Preface

Since the 19th century, the global average temperature has risen by 1°C, becoming the hottest period in 120,000 years. In 2018, the Intergovernmental Panel on Climate Change (IPCC) released an authoritative report, which pointed out that to slow down global warming, the use of fossil fuels must be completely stopped and achieve zero carbon emissions by 2050.

In order to actively respond to the action to slow down global warming, China has put forward a “carbon neutral plan”, which aims to peak carbon dioxide emissions before 2030 and achieve carbon neutrality before 2060.

As a practitioner of green campus operation, International Campus, Zhejiang University pays more attention to campus carbon emission, strives to build a “zero-carbon campus”, and build a zero-carbon learning and working circle.

2 Introduction of International Campus, Zhejiang University

International Campus, Zhejiang University (International Campus for short) located in Haining, Zhejiang Province, with covering area of 800,000m² (1200mu) and building area of 399,300m². It was officially opening in November 2016, and by December of 2020, it has 522 faculties and staff and 1973 full-time students (206 international students), including 1413 undergraduate students, 365 graduate students and 195 doctoral students.

3 Report Year & Period

This report is for 2020, from January to December.

4 Accounting Boundaries

Campus carbon emissions accounting is based on two boundaries, organizational boundaries and operational boundaries. The organizational boundaries on International Campus are consistent with its geographical boundaries; the operational boundaries include making estimates to direct or indirect carbon emissions about International Campus. Explanations are as follows:

- Scope 1
It accounts for direct greenhouse gas (GHG) emissions from sources that are owned or controlled by International Campus, principally the result of production of heat by boilers.
- Scope 2
It accounts for indirect GHG emissions associated with generation of purchased electricity

caused by activities such as teaching and academic research.

➤ **Scope 3**

It allows for the treatment of other indirect GHG emissions that are a consequence of activities of International Campus but occur from sources not owned or controlled by the campus, such as materials purchasing, employee commuting, business travel and so on.

This report will not calculate GHG emissions of hydrofluorocarbons (HFCs) of scope 1 and scope 3, because of inadequate equipment and incomplete statistics approaches. GHG emissions identification form is as below:

GHG Emission Sources Identification Form 4-1

Operational Boundaries	Emission Source Types	Main Emission Sources	Energy Consumption	GHG	Accounting
Scope 1: direct GHG emissions	Stationary combustion sources	Boiler	Natural gas	CO ₂ , CH ₄ , N ₂ O	Yes
	Stationary combustion sources	Canteen	Natural gas	CO ₂ , CH ₄ , N ₂ O	Yes
	non-stationary combustion sources	Shuttle Bus	Diesel	CO ₂ , CH ₄ , N ₂ O	Yes
	non-stationary combustion sources	Official vehicle	gasoline	CO ₂ , CH ₄ , N ₂ O	Yes
	Scattered emissions	Air-conditioning and extinguisher	Refrigerant	HFCs	No
Scope 2: indirect GHG emissions	Purchased electricity	Lighting, air-conditioning and related facilities	Power	CO ₂	Yes
Scope 3: other indirect GHG emissions	non-stationary combustion sources	On and off campus commuting transportation excluding shuttle bus and official vehicle	gasoline	CO ₂ , CH ₄ , N ₂ O	No
	non-stationary combustion sources	Airplane, train, bus and ship (business travel)	Gasoline, diesel and power	CO ₂ , CH ₄ , N ₂ O	No

5 Energy Consumption Activity Level Calculation

Calculation range: all buildings of the campus construction.

5.1 Emission Sources and Energy Consumption Activity Level Calculation

2020 International Campus Main Emission Sources Calculation Form 5-1

Operational Boundaries	Main Emission Sources	Types of Energy	Unit	Consumption Amount	Record Approach
Scope 1: direct GHG emissions	Boiler	Natural gas	10kNM ³	14.76	Gauge table
	Canteen	Natural gas	10kNM ³	4.00	Gauge table
	Shuttle bus, official vehicle	Diesel	10kL	1.37	Recorded by the supplier
	Shuttle bus, official vehicle	Gasoline	10kL	3.49	Recorded by the supplier
Scope 2: indirect GHG emissions	Lighting, air-conditioning and related facilities	Power	10k kWh	1262.35	Gauge table

5.2 Main Emission Sources and Energy Consumption in Key Buildings

In this report, we will calculate carbon emissions in detail on the following buildings to provide a strong data gist for the future measures in lowering carbon emissions.

2020 International Campus Energy Consumption Activity Level Calculation on Major Functional Buildings Form 5-2

No.	Building	Function	Area (m ²)	Power (kWh/a)	Natural Gas (m ³ /a)
1	No.1 Residential College	Student accommodation	27,408	1,104,400	---
2	Academic Exchange Center	Hotel	25,296	1,179,781	---
3	Gymnasium	Sports	14,669	470,006	3902.28
4	Student Center	Canteen	12,748	1,083,080	73657.76
5	Learning and Teaching Building North B	Teaching	10,750	185,937	28382.58
6	Arts and Science Building	Administration	10,648	117,480	28113.28
7	Learning and Teaching Building North A	Teaching	10,440	305,070	27564.11
8	Library	Library	9,840	235,800	25979.97
9	ZJU-UoE Institute	Science and research	8,174	917,580	---
10	ZJU-UIUC Institute	Science and research	7,238	314,043	---
11	Serviced Apartment	Faculty accommodation	5,824	165,320	---
12	Hospital	Clinic	2,130	56,221	---
13	Laboratory Building	Science and research	19,779	485,315	---
14	No.2 Residential College	Student accommodation	29,127	1,059,078	---
15	Administration Building	Administration	9,379	196,930	---

16	Auditorium	Teaching	11,919	200,004	---
17	Lecture Theatre East & West	Teaching	2,502	84,340	---
18	Multimedia Hall	Conference	2,810	27,470	---
19	Faculty Club	Conference	1,405	27,040	---

6 Emission Factor (EF), Global Warming Potential (GWP), CO₂ Equivalence (CO₂e)

6.1 Emission Factor (EF)

Emission factor is used in greenhouse gas inventories to estimate emissions from materials in a certain measurement, which links the activity level data with GHG emissions. Power EF is based on *Announcement of Emission Factor for China's Regional Power Grid Baseline in 2015* by Climate Change Department subordinated to National Development and Reform Commission; coal EF is based on *Evaluation Guide Rules of Recycle Energy Buildings Model Application Projects*; other EF data are guided by energy heat values from the page 283 of *China Energy Statistical Yearbook of 2008* and calculation values from GHG default emission coefficient of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2.

Typical Emission Factors and Related Introduction Form 6-1

Type	EF			Guideline
	CO ₂	CH ₄	N ₂ O	
Power	81,120 tCO ₂ / (kWh)	--	--	EF value form re Regional Power Grid Power EF in East China in the Page 4 of <i>Announcement of Emission Factor for China's Regional Power Grid Baseline in 2015</i> by Climate Change Department subordinated to National Development and Reform Commission
Coal	2.47 tCO ₂ /t	--	--	<i>Evaluation Guide Rules of Recycle Energy Buildings Model Application Projects</i>
Natural gas	209,000 tCO ₂ /m ³	3.73×10^{-4} tCH ₄ /ten thousand m ³	3.73×10^{-5} tN ₂ O /ten thousand m ³	Chapter 3 of GHG default emission coefficient of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2
Vehicle gasoline	226,000 tCO ₂ /L	8.16×10^{-3} tCH ₄ /ten thousand L	2.61×10^{-3} tN ₂ O /ten thousand L	GHG default emission coefficient of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2

Vehicle diesel	273,000 tCO ₂ /L	1.44×10^{-3} tCH ₄ /ten thousand L	1.44×10^{-3} tN ₂ O /ten thousand L	GHG default emission coefficient of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2
Liquefied petroleum gas (stationary)	175,000 tCO ₂ /L	0.278 tCH ₄ /ten thousand L	0.0278 tN ₂ O /ten thousand L	GHG default emission coefficient of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2
Vehicle	3.641×10^{-5} tCO ₂ /km	--	--	2010 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting: Annex 6 Passenger Transport Conversion Tables:22 of 35,Table 6k
Train	3.641×10^{-5} tCO ₂ /km	--	--	2010 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting: Annex 6 Passenger Transport Conversion Tables:22 of 35,Table 6k
Airplane	2.052×10^{-4} tCO ₂ /km	--	--	2010 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting: Annex 6 Passenger Transport Conversion Tables:22 of 35,Table 6l

6.2 Global Warming Potential (GWP)

Global warming potential (GWP) is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to CO₂. The GWP of CO₂ is 1. The GWP in this report is from *2007 IPCC Guidelines for National Greenhouse Gas Inventories*.

Global Warming Potential Form 6-2

GHG	Molecular Formula	GWP
Carbon dioxide	CO ₂	1
Methane	CH ₄	25
Nitrous oxide	N ₂ O	298

Data from the 4th 2007 IPCC Evaluation Report

6.3 Carbon Dioxide Equivalence (CO₂e)

CO₂e is an abbreviation of 'carbon dioxide equivalence' and is the internationally recognized measure of greenhouse emissions.

International Campus CO₂e equation: $CO_2e = GHG_i \times GWP_i$

GHG_i means the emission amount of greenhouse gas type i and the measurement unit is ton;

GWP_i means the GWP of greenhouse gas type i.

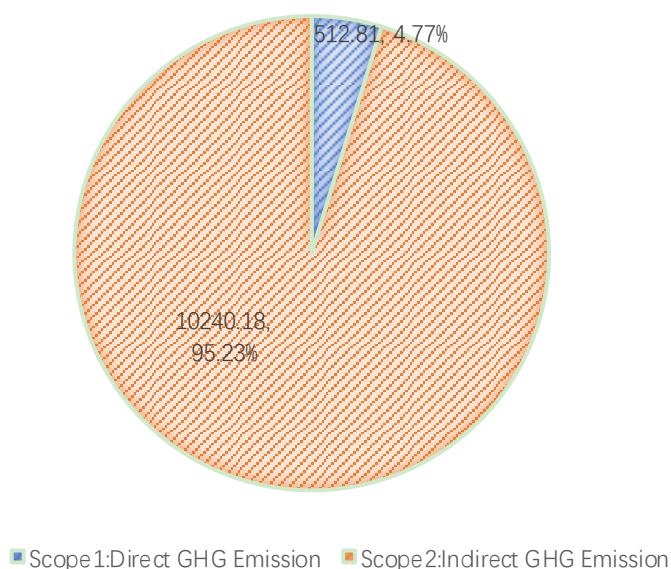
7 Campus Carbon Emissions (Greenhouse Gas Emissions) List

7.1 Campus Carbon Emissions (Greenhouse Gas Emissions) List

1 Total Campus Carbon Emissions (Greenhouse Gas Emissions)

GHG emissions on International Campus in 2020: CO₂ 10,748.54 tons, CH₄ 0.0374 tons, N₂O 0.0118 tons, equivalent to CO₂e 10,752.99 tons. The direct GHG CO₂e is 512.81 tons, including sources such as natural gas of canteen and heat for teaching, learning and academic buildings in winter, diesel of shuttle bus and oil of official vehicles; the indirect GHG CO₂e is mainly from purchased electricity, about 10,240.18 tons.

Details are listed as the below forms:



International Campus GHG Emission Graph 7-1

International Campus GHG Emission Form 7-1

Operational Boundaries	Sources	Type	Unit	Annual Consumption Reported	CO ₂	CH ₄	N ₂ O
Scope 1 Direct GHG Emission	Boiler	Natural gas	10kNM ³	14.76	308.4840	0.0055	0.0006
	Canteen	Natural gas	10kNM ³	4.00	83.6000	0.0015	0.0001
	Shuttle bus, official vehicles	Diesel	10kL	1.37	37.4010	0.0020	0.0020
	Shuttle bus, official vehicles	Oil	10kL	3.49	78.8740	0.0285	0.0091

Scope 2 Indirect GHG Emission	Lighting, air-conditioning and related facilities	Purchased electricity	10k kWh	1262.35	10240.1832	0.0000	0.0000
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International Campus GHG Emission List Form 7-2 (Scope)

Emission Scope	Scope 1 Direct GHG Emission	Scope 2 Indirect GHG Emission	Total Emission
Amount (t)	512.81	10,240.18	10,752.99
Percentage %	4.77	95.23	100

International Campus GHG Emission List Form 7-3

Emission	GHG			Total Emission
	CO ₂	CH ₄	N ₂ O	
Emission (t)	10,748.54	0.04	0.01	--
GWP	1	25	298	--
CO ₂ e (t)	10,748.54	0.94	3.51	10,752.99
Percentage %	99.96	0.01	0.03	100

2 International Campus Carbon Emission Intensity

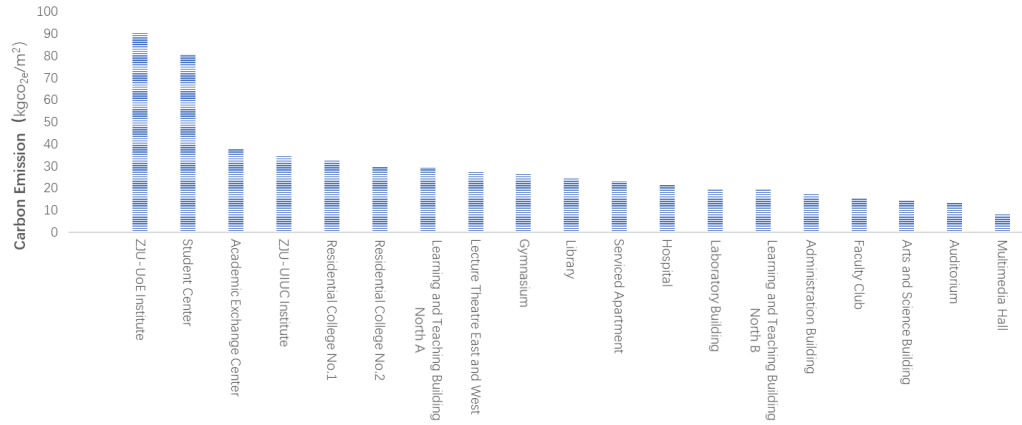
In 2020, the average CO₂e is 5.45t accounted on students, 4.30t on faculty, staff and students, 26.92kg per square meter of campus construction and 12.56kg per square meter of floor area. Details are as below:

International Campus GHG Emission List Form 7-4 (per unit)

Emission	GHG			Total Emission
	CO ₂	CH ₄	N ₂ O	
CO ₂ e Emission (t)	10,748.5422	0.9362	3.5109	10752.99
Student's average CO ₂ e (t)	5.4478	0.0000	0.0000	5.45
CO ₂ e (t) on faculty, staff and students	4.3029	0.0000	0.0000	4.30
CO ₂ e (t) /m ² of campus construction	26.9185	0.0023	0.0088	26.93
CO ₂ e /m ² of floor area	12.5568	0.0011	0.0041	12.56

7.2 Greenhouse Gas Emissions List of Key Buildings

Buildings contributed most to total energy consumption and average carbon emission of campus construction has been reported. Key accounting construction area is 222,086 m², which includes 55.62% of construction area that put in use and 65.65% of total carbon emission. The maximum average carbon emission intensity of campus construction is from ZJU-UoE Institute, about 91.06kg CO₂e/m². Detail forms are as below:



Key Buildings' Average Carbon Emission Bar Graph 7-2

2020 Carbon Emission List of Key Buildings on International Campus Form 7-5

No.	Building	Construction Area (m ²)	Power (kWh/a)	Natural gas (m ³ /a)	Total CO ₂ Emission (t)	Per Construction Area (kg CO _{2e} /m ²)
1	ZJU-UoE Institute	8,174	917,580	---	744.34	91.06
2	Student Center	12,748	1,083,080	73,657.76	1,032.54	81.00
3	Academic Exchange Center	25,296	1,179,781	---	957.04	37.83
4	ZJU-UIUC Institute	7,238	314,043	---	254.75	35.20
5	No.1 Residential College	27,408	1,104,400	---	895.89	32.69
6	No.2 Residential College	29,127	1,059,078.3	---	859.12	29.50
7	Learning and Teaching Building North A	10,440	305,070	27,564.11	305.08	29.22
8	Lecture Theatre East & West	2,502	8,4340	---	68.42	27.34
9	Gymnasium	14,669	470,006	3,902.28	389.42	26.55
10	Library	9,840	235,800	25,979.97	245.58	24.96
11	Serviced Apartment	5,824	165,320	---	134.11	23.03
12	Hospital	2,130	56,221	---	45.61	21.41
13	Laboratory Building	19,779	485,315	---	393.69	19.90
14	Learning and Teaching Building North B	10,750	185,937	28,382.58	210.15	19.55
15	Administration Building	9,379	196,930	---	159.75	17.03
16	Faculty Club	1,405	27,040	---	21.93	15.61
17	Arts and Science Building	1,0648	117,480	28,113.28	154.06	14.47
18	Auditorium	11,919	200,004	---	162.24	13.61
19	Multimedia Hall	2,810	27,470	---	22.28	7.93
	Total	222,086	8,214,895	---	7,056.01	567.89