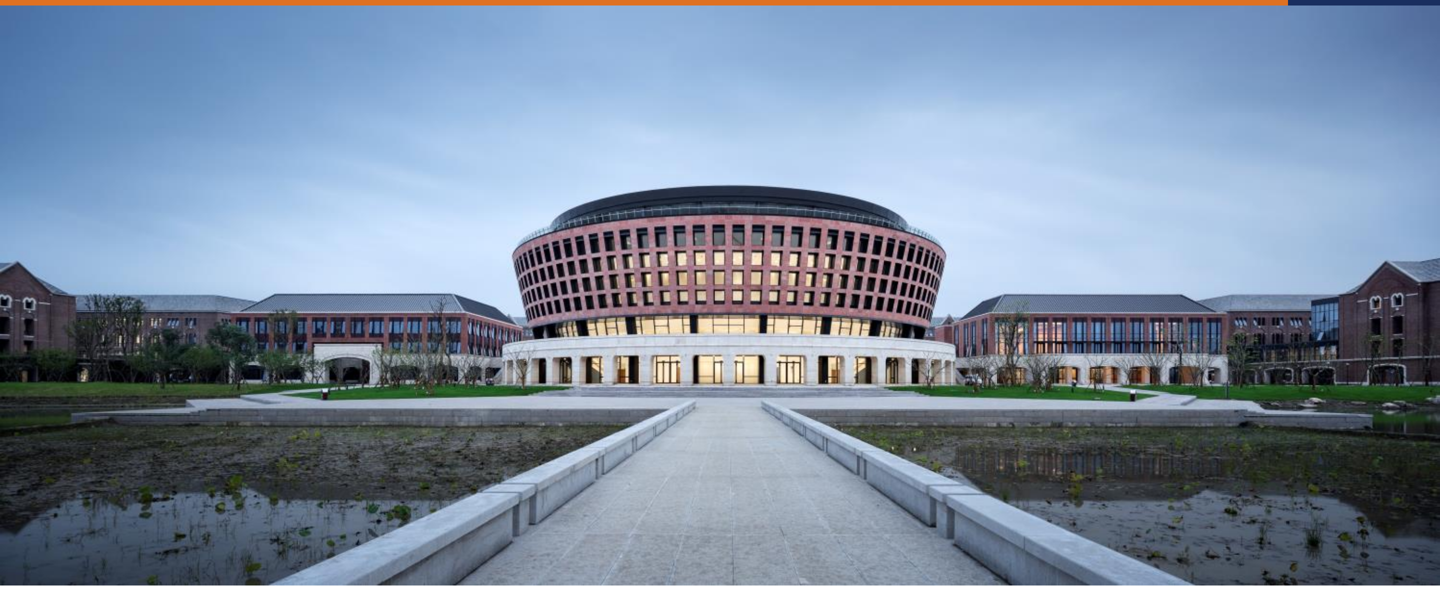
国际联合学院(海宁国际校区)
INTERNATIONAL CAMPUS
ZHEJIANG UNIVERSITY

2021年度
浙江大学国际联合学院（海宁国际校区）
校园碳排放核算报告

2021 Accounting Report on Carbon Emission Consumption for International Campus, Zhejiang University



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The Responsibility

育人者，非但教成，更须养成。言传身教仅是一方面，而日常起居、衣食住行，都是“养成”的重要内容。故此，校园不单是教育场所，其本身也是教材，甚至也是教师。

Teaching by precept and example is part of education, but education should also be embedded in daily life, in clothing, food, accommodation and transportation. Therefore, campus is not just a place for teaching, it is a course book in itself, even a teacher.

——国际联合学院创院院长 宋永华

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Contents

01 Campus Introduction

International Campus, Zhejiang University (International Campus for short) located in Haining, Zhejiang Province, with covering area of 800,000m^2 (1200mu) and building area of 399,300m^2. From the very beginning of its construction, International Campus has adhered to the concept of "people-oriented, low-carbon, and green". The campus planning and construction has taken into full consideration the strategies of site selection, green transportation, renewable energy, low-impact stormwater management, and application of key green building technologies, and has obtained the two-star green building certification. In the operation of the campus, the operation and management level has been continuously improved through international authoritative certifications, and has successively obtained LEED V4.1 O+M ARC System Platinum certification, EcoCampus Platinum certification and ISO14001 certification.

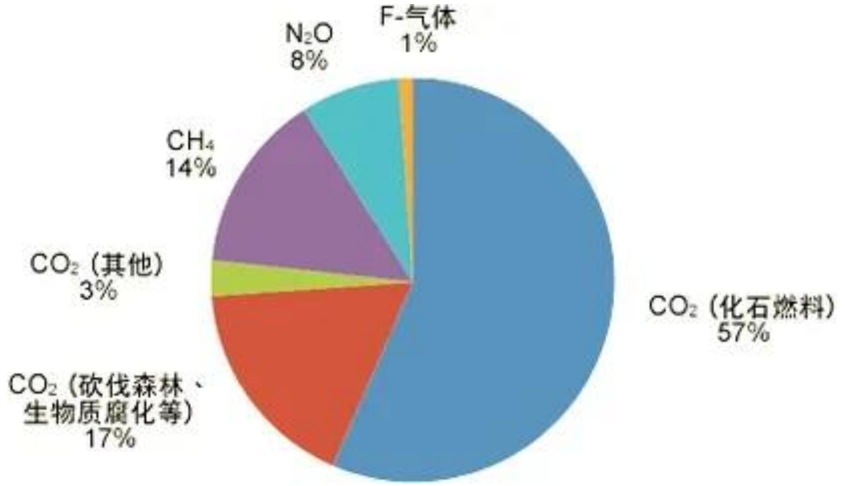
By December 2021, International Campus has a total of 2,099 full time students with 1,294 undergraduates, 599 graduate students and 206 doctoral students, including 262 international students; 705 faculty, staff and service personnel.

02 Carbon Emissions & Carbon neutrality

What is carbon emissions?

Carbon emissions is a general term for greenhouse gas emissions due to human activities such as living, production, and transportation.

Greenhouse gases refer to the natural and anthropogenic gaseous components of the atmosphere that absorb and re-emit infrared radiation, including carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride. The most dominant component of greenhouse gases is carbon dioxide (CO2), hence carbon emissions is also called CO2 emissions.



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02 Carbon Emissions & Carbon neutrality

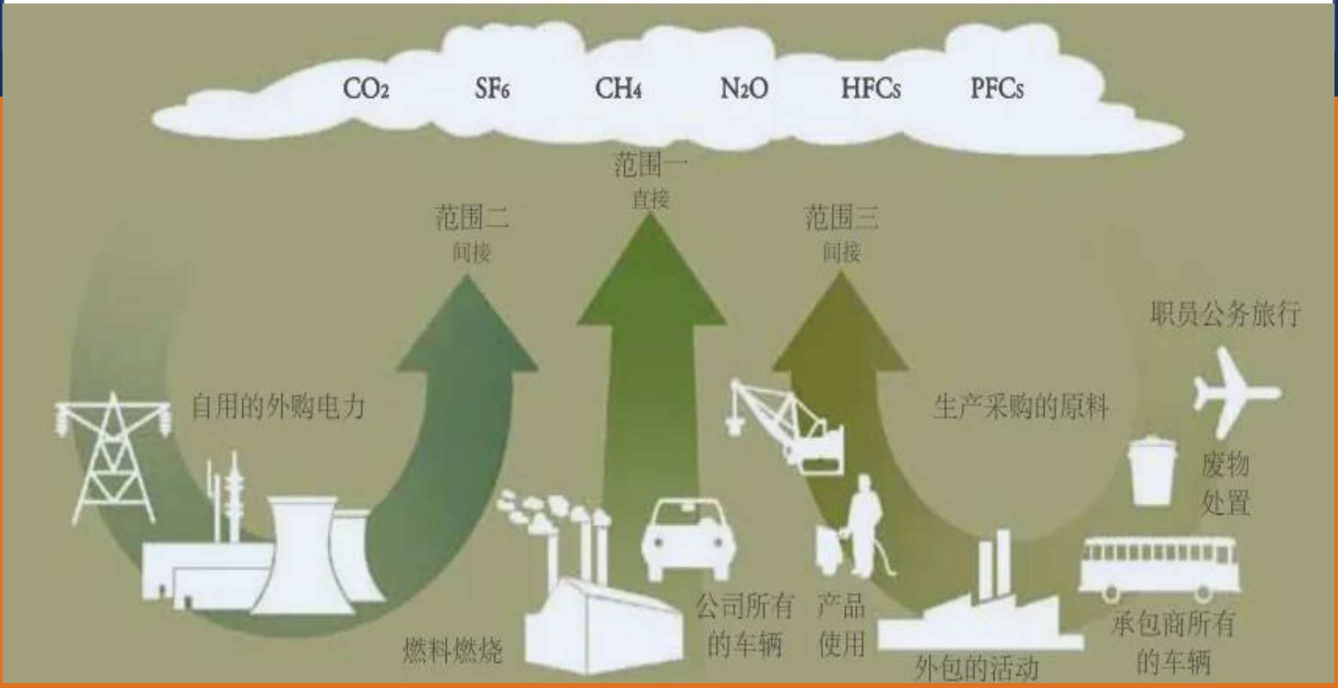
The operational boundaries of carbon emissions

The concept of operational boundaries is introduced in the GHG Accounting System. The establishment of operational boundaries involves identifying GHG emissions and removals associated with an organization's operations and classifying GHG emissions and removals into direct emissions, energy indirect emissions, and other indirect emissions.

Category I: Direct GHG emissions: GHG emissions from sources owned or controlled by the organization.

Category II: Energy Indirect GHG Emissions: GHG emissions from electricity, heat, or steam that are imported and consumed by the organization for production.

Scope III: Other Indirect GHG Emissions: GHG emissions from sources owned or controlled by other organizations or resulting from the organization's activities, excluding energy indirect GHG emissions.



02 Carbon Emissions & Carbon neutrality

Campus carbon emissions 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 is the sum of the departments and facilities related to carbon emissions associated with International Campus operation, which includes three main categories:

- Scope 1
  Refers to direct greenhouse gas (GHG) emissions that occur within the campus boundaries, such as boiler combustion.
- Scope 2
  Refers to indirect GHG emissions associated with generation of purchased electricity caused by activities such as teaching and academic research.
- Scope 3
  refers to other indirect GHG emissions, which means other indirect emissions caused by the university's teaching and research activities but occurring outside the campus, such as carbon emissions from material purchases, transportation of faculty and staff to and from work and business trips, etc. The identification of the main greenhouse gas emission sources of International Campus is shown in Table 1.

Table 1 The identification of the main greenhouse gas emission sources of International Campus

Operational Boundaries	Emission Source Types	Main Emission Source	Energy Consumption	GHG	Accounting
Scope 1: direct GHG emissions	Stationary combustion sources	Boiler	Natural gas	CO_2, CH_4, N_2O	Yes
	Stationary combustion sources	Canteen	Natural gas	CO_2, CH_4, N_2O	Yes
	non-stationary combustion sources	Shuttle Bus	Diesel	CO_2, CH_4, N_2O	Yes
	non-stationary combustion sources	Official vehicle	gasoline	CO_2, CH_4, N_2O	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_2O	No
	non-stationary combustion sources	Airplane, train, bus and ship (business travel)	Gasoline, diesel and power	CO_2, CH_4, N_2O	No

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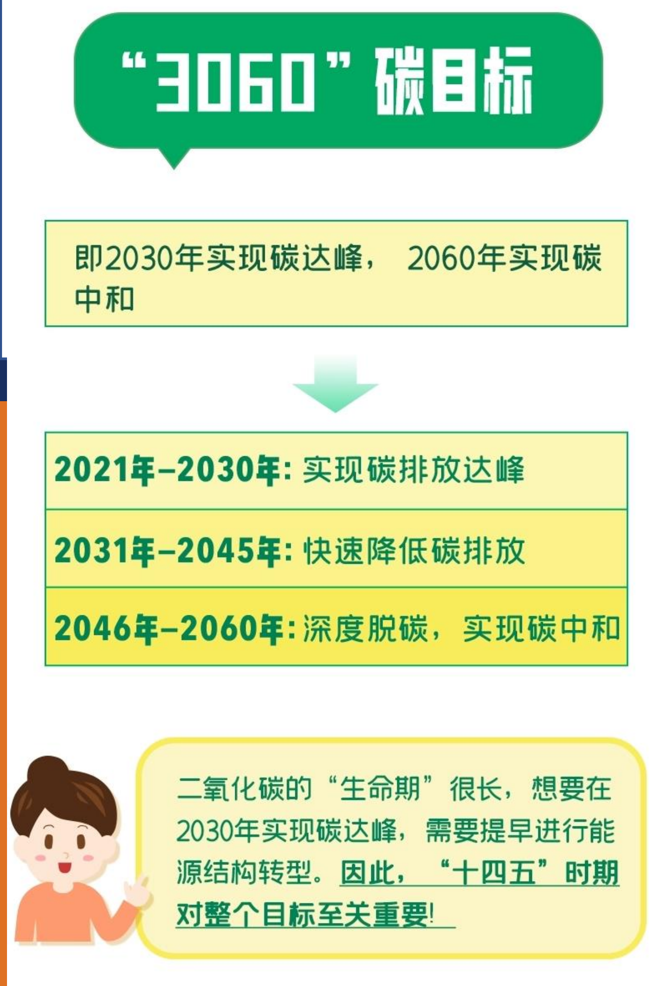
02 Carbon Emissions & Carbon neutrality

Carbon Neutral Target

Carbon neutrality refers to the total amount of carbon dioxide or greenhouse gas emissions produced directly or indirectly by a country, enterprise, product, activity or individual within a certain period of time, and offset the carbon dioxide or greenhouse gas emissions produced by itself in the form of afforestation, energy conservation and emission reduction to achieve positive and negative offset, and achieve relative "zero emissions".

In order to respond positively to global warming mitigation actions, China has proposed the "Carbon Neutrality Plan", striving to reach the peak of carbon emissions by 2030 and achieving carbon neutrality by 2060.



03 The Model of Green Campus

Sponge Campus

With conducting bioretention zone and down-lying green space design, the use of permeable paving materials, water system drainage capacity control, rainwater collection system and the use of non-traditional water sources, the utilization rate of non-traditional water sources up to 15% and about 100,000 tons water resources can be saved per year.

Renewable Energy

According to different building function types, renewable energy application systems are set up in a targeted manner. Renewable energy systems including solar photovoltaic system, solar thermal system, ground source heat pump system and air source heat pump and their combinations are adopted. The amount of renewable energy application reaches 6.69 million kWh/year.

03 The Model of Green Campus

Education

- Organized the student group "Green Campus Ambassadors" to participate in the Asia Pacific Green Campus Alliance conference and received the "Outstanding Student Team Award".
- Supported student participation in garbage sorting management and the full implementation of garbage sorting on campus.
- Building a sustainable campus website, guiding students to participate in monthly building energy consumption disclosure, organizing students to design plant signs, and supporting student group ECO CLUB related projects.
- Organize a series of training sessions in the "Sustainable Campus Learning Corner" to provide basic data support for research projects, build a smooth communication channel, and spread the concept of sustainable environmental protection.

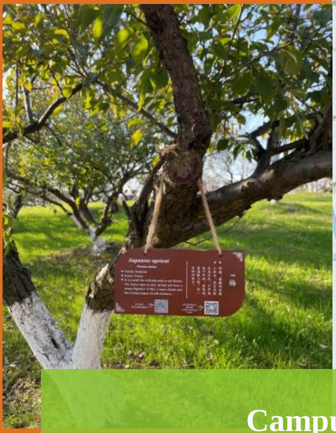
Campus carbon accounting and preparation of annual reports

Garbage classification in Residential College

International communication for green

Buildings energy consumption accounting and release

ECO CLUB



Campus Green Map

03 The Model of Green Campus

Facility Services

The campus has built intelligent systems such as public energy resource supervision system, centralized control system for air conditioning energy saving, and intelligent security system to centrally monitor facilities and energy consumption, unify management of access control and monitoring, guarantee energy-saving operation, conduct real-time monitoring, realizing the implementation of space and equipment linkage, improving the efficiency of campus facilities use, reducing resource waste, and enhancing the experience of teachers and students.

Environmental symbiosis

The campus insists on using non-toxic pesticides and manual weeding to reduce the impact of chemicals on the natural environment; using plant leaves for composting to reduce the use of chemical fertilizers; selecting local green species to build a reasonable ecological chain and protect biodiversity; building environmental protection stations to ensure reasonable separation of domestic waste and safe storage of dangerous chemicals; and managing a smoke-free campus to build a harmonious and symbiotic Campus environment.

04 Carbon Emissions Accounting

Emission Sources and Energy Consumption Activity Level Calculation

The accounting cycle of this report is from January to December 2021, and considering that the statistical methods and tools are not yet complete, Scope 3: Other indirect GHG emissions and fugitive emissions of HFCs from air conditioners and fire extinguishers included in Scope 1 are not included in the scope of statistics for the time being.

Table 2 2021 International Campus Main Emission Sources Calculation

Operational Boundaries	Main Emission Sources	Types of Energy	Unit	Consumption Amount	Record Approach
Scope 1: direct GHG emissions	Boiler	Natural gas	10kNM^3	21.2	Gauge table
	Canteen	Natural gas	10kNM^3	5.7	Gauge table
	Shuttle bus, official vehicle	Diesel	10kL	1.3	Recorded by the supplier
	Shuttle bus, official vehicle	Gasoline	10kL	3.9	Recorded by the supplier
Scope 2: indirect GHG emissions	Lighting, air-conditioning and related facilities	Power	10k kWh	1853.3	Gauge table

Emission Sources and Energy Consumption Activity Level Calculation

Table 3 2021 International Campus Energy Consumption Activity Level Calculation on Major Functional Buildings

No.	Building	Function	Area (m^2)	Power (kWh/a)	Natural Gas (m^3/a)
1	No.2 Residential College	Student accommodation	29127	1742278.4	——
2	No.1 Residential College	Student accommodation	27408	1393114.5	——
3	Academic Exchange Center	Hotel	25296	1399674.0	——
4	Laboratory Building	Science and research	19779	693906.0	——
5	Gymnasium	Sports	14669	938954.3	3902.3
6	Student Center	Canteen	12748	1318532.9	73657.8
7	Auditorium	Teaching	11919	235179.6	——
8	Learning and Teaching Building North B	Teaching	10750	198474.3	28382.6
9	Arts and Science Building	Administration	10648	125640.0	28113.3
10	Learning and Teaching Building North A	Teaching	10440	345827.0	27564.1
11	Library	Library	9840	365183.0	25980.0
12	Administration Building	Administration	9379	207845.0	——
13	ZJU-UoE Institute	Science and research	8174	1179765.0	——
14	ZJU-UIUC Institute	Science and research	7238	657753.4	——
15	Serviced Apartment	Faculty accommodation	5824	189288.0	——
16	Multimedia Hall	Conference	2810	40304.9	——
17	Lecture Theatre East & West	Teaching	2502	98564.0	——
18	Hospital	Clinic	2130	67953.5	——
19	Animal Laboratory Center	Science and research	1698	1158153.8	
20	Faculty Club	Conference	1405	36160.0	——

04 Carbon Emissions Accounting

Total Campus Carbon Emissions (Greenhouse Gas Emissions)

GHG emissions on International Campus in 2021: CO_2 15,720.6 tons, CH_4 1.1 tons, N_2O 3.9 tons, equivalent to CO_2e 15,725.6 tons. The direct GHG CO_2e is 691.9 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 CO_2e is mainly from purchased electricity, about 15,033.7 tons.

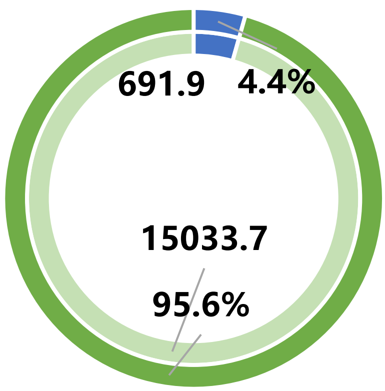


Figure 1 International Campus GHG Emission Unit：t

Table 4 International Campus GHG Emission List

Emissions GHG	CO_2	CH_4	N_2O	Total Emission
CO_2e Emission (t)	15720.6	0.04	0.01	--
Student's average CO_2e (t)	1.0	25.0	298.0	--
CO_2e (t) on faculty, staff and students	15720.6	1.1	3.9	15725.6
CO_2e (t) /m^2 of campus construction	99.97%	0.01%	0.02%	100.00%

04 Carbon Emissions Accounting

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Carbon Emission Intensity

In 2021, the average CO_2e is 7.49t accounted on students, 5.61t on faculty, staff and students, 39.38kg per square meter of campus construction and 18.37kg per square meter of floor area.

Table 5 International Campus GHG Emission List

Emissions	CO_2	CH_4	N_2O	Total Emission
CO_2e Emission (t)	15720.6	1.1	3.9	15725.6
Student's average CO_2e (t)	7.5	0.0000	0.0000	7.5
CO_2e (t) on faculty, staff and students	5.6	0.0000	0.0000	5.6
CO_2e (t) /m² of campus construction	39.4	0.0027	0.0098	39.4
CO_2e /m² of floor area	18.4	0.0013	0.0046	18.4

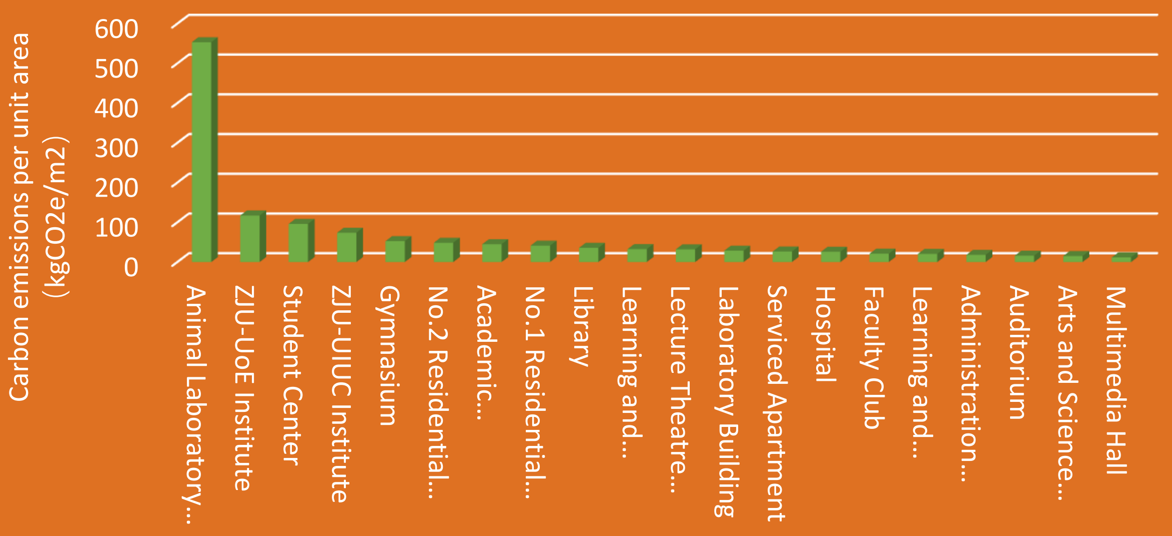

Figure 2 Key Buildings' Average Carbon Emission Bar

04 Carbon Emissions Accounting

Carbon Emission Intensity

Table 6 2021 Carbon Emission List of Key Buildings on International Campus

No.	Building	Construction Area (m^2)	Power (kWh/a)	Natural gas (m3/a)	Total CO_2 Emission (t)	Per Construction Area (kg CO_{2e}/m^2)
1	Animal Laboratory Center	1698	1158153.8		939.5	553.3
2	ZJU-UoE Institute	8174	1179765.0		957.0	117.1
3	Student Center	12748	1318532.9	73657.8	1223.5	96.0
4	ZJU-UIUC Institute	7238	657753.4		533.6	73.7
5	Gymnasium	14669	938954.3	3902.3	769.8	52.5
6	No.2 Residential College	29127	1742278.4		1413.3	48.5
7	Academic Exchange Center	25296	1399674.0		1135.4	44.9
8	No.1 Residential College	27408	1393114.5		1130.1	41.2
9	Library	9840	365183.0	25980.0	350.5	35.6
10	Learning and Teaching Building North A	10440	345827.0	27564.1	338.1	32.4
11	Lecture Theatre East & West	2502	98564.0		80.0	32.0
12	Laboratory Building	19779	693906.0		562.9	28.5
13	Serviced Apartment	5824	189288.0		153.6	26.4
14	Hospital	2130	67953.5		55.1	25.9
15	Faculty Club	1405	36160.0		29.3	20.9
16	Learning and Teaching Building North B	10750	198474.3	28382.6	220.3	20.5
17	Administration Building	9379	207845.0		168.6	18.0
18	Auditorium	11919	235179.6		190.8	16.0
19	Arts and Science Building	10648	125640.0	28113.3	160.7	15.1
20	Multimedia Hall	2810	40304.9		32.7	11.6
	Total	223784	12392551.5	187600.0	10444.9	46.7

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04 carbon emission accounting

Analysis of carbon emission data in recent three years

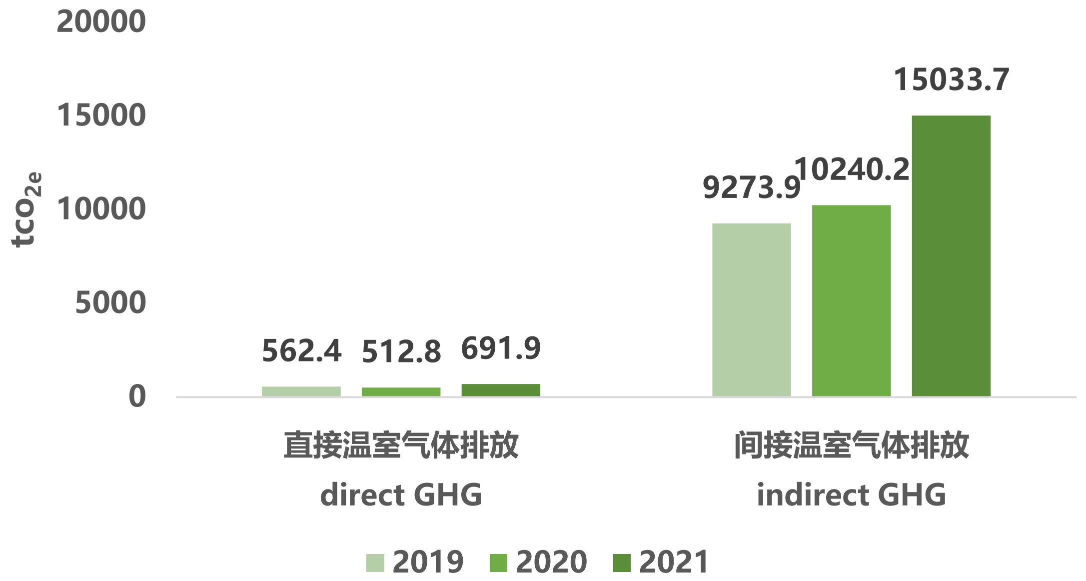

Figure 3 GHG trends of the International Campus in 2019-2021

In recent three years, GHG (Greenhouse Gas) emissions on International Campus continues to increase and the direct GHG emission includs natural gas consumed by the canteen and teaching and research buildings, as well as diesel and gasoline consumed by shuttle buses and official vehicles. The indirect GHG mainly for electricity consumption.

The significant increase in GHG emissions in 2021 is mainly due to the increase in the number of teachers and students on campus, the arrival of scientific research platforms and the opening of large laboratories.

04 carbon emission accounting

Analysis of carbon emission data in recent three years

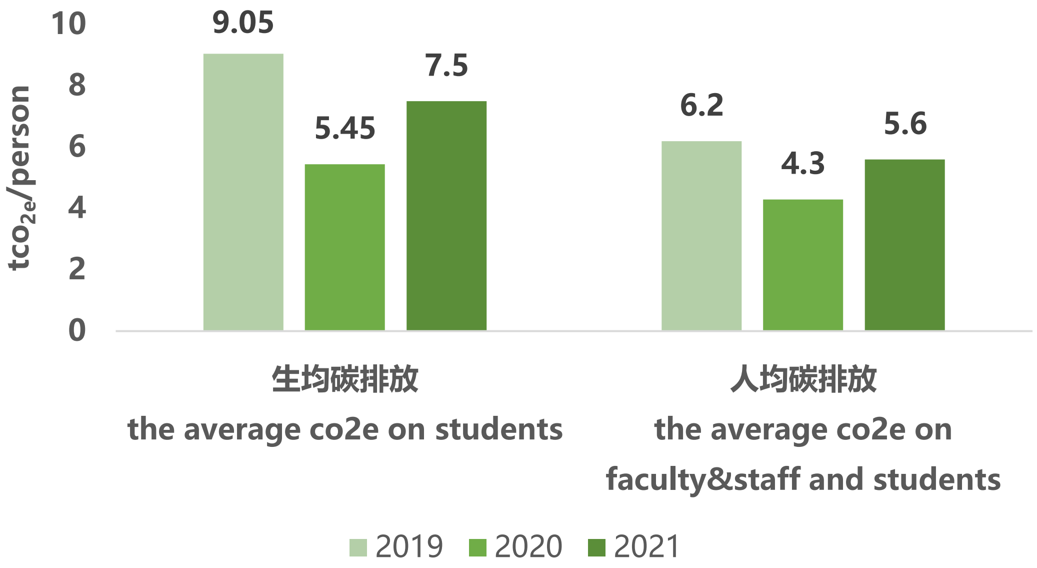

Figure 4 Carbon emissions per student and per capita of the International Campus in 2019-2021

From 2019 to 2021, the average student and per capita carbon emissions on campus showed a declining trend. In 2020, due to the impact of COVID-19, some teachers and students conducted online office work and teaching at the beginning of the year, which significantly reduced the average carbon emissions per student and per capita. In 2021, the campus the campus began operating normally. By using Public resources and energy platforms to carry out effective energy saving management for lighting, air conditioning, water heater and other equipment, energy saving measures to continuously reduce carbon emissions per student and per capita were further promoted.

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05 Appendix

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 Reginal 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.

Table 7 Typical Emission Factors and Related Introduction

Type	EF			Guideline
	CO_2	CH_4	N_2O	
Power	81,120 tCO_2/（kWh）	--	--	EF value form re Reginal Power Grid Power EF in East China in the Page 4 of *Announcement of Emission Factor for China's Reginal Power Grid Baseline in 2015* by Climate Change Department subordinated to National Development and Reform Commission
Natural gas	209,000 tCO_2/m^3	3.73 tCH_4/m^3	0.373 tN_2O/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	81.6 tCH_4/L	26.1 tN_2O/L	GHG default emission coefficient of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2
Vehicle Diesel	273,000 tCO_2/L	14.4 tCH_4/L	14.4 tN_2O/L	GHG default emission coefficient of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2

05 Appendix

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 CO_2. The GWP of CO_2 is 1. The GWP in this report is from *2007 IPCC Guidelines for National Greenhouse Gas Inventories*.

Table 8 Global Warming Potential

GHG	Molecular Formula	GWP
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298

Carbon Dioxide Equivalence (CO2e)

CO_2e is an abbreviation of 'carbon dioxide equivalence' and is the internationally recognized measure of greenhouse emissions.
International Campus CO_2e 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.