



Low-carbon Management of the Beijing 2022 Games

Pre-Games Report

(2016 - June 2021)

Beijing Organising Committee for the 2022 Olympic and Paralympic Winter Games
January 2022



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Preface



Climate change is a common challenge facing mankind, related to human survival and development. As a responsible country, China has drawn up and implemented a series of policies and measures to actively address climate change.

In the Bidding Report for the Beijing 2022 Winter Olympic and Paralympic Games (the Beijing 2022 Games), the following carbon-related commitments were outlined: “market-oriented carbon emission reduction mechanisms such as carbon emission trading will be implemented; a carbon emissions assessment and management mechanism will be established for the Beijing 2022 Games; and the carbon emissions generated by the Beijing 2022 Games will be fully neutralized.” Carbon management has therefore become a fundamentally important part of hosting a “green Games” and has been comprehensively integrated throughout the entire planning and staging of the Beijing 2022 Games.

On 23 June 2019, The Beijing Organising Committee for the 2022 Olympic and Paralympic Winter Games (Beijing 2022) released the Low-Carbon Management Programme for the Beijing 2022 Games¹, and clearly proposed a number of low-carbon management objectives including 18 carbon emission reduction measures and 4 carbon compensation measures. Beijing 2022, together with the Beijing Municipal Government, the Hebei Host City Government – where the snow competitions will take place – and the venue owners, have actively implemented strong carbon reduction measures during the preparations for the Beijing 2022 Games.

To complement this Pre-Games carbon management report, Beijing 2022 will also compile the Post-Games carbon management report of the Beijing 2022 Games detailing the final carbon footprint emissions of Beijing 2022. The Pre-Games report focuses on the preparation process of the Beijing 2022 Games from 2016 to June 2021, encompassing our carbon footprinting methodology, baseline projections, revised estimations and our carbon compensation projects. The Post-Games report will cover work related to the carbon management during the Beijing 2022 Games from 2016 to June 2022.



¹ Low-Carbon Management Programme for the Olympic and Paralympic Winter Games Beijing 2022



01

Low-carbon Games

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1. Low-carbon Games

1.1 Addressing climate change requiring joint efforts of all mankind

Research results show that the global surface temperature in 2001–2020 was 0.99°C higher than in 1850–1900, and it is expected to increase by 1.0 ~ 5.7°C by the end of the 21st century (2081–2100)². In September 2015, the United Nations defined the initiative of “take urgent action to combat climate change and its impacts” as one of the world’s sustainable development goals for the next 15 years. In the same year, the 21st Conference of Parties (COP21) under the United Nations Framework Convention on Climate Change (UNFCCC) adopted the Paris Agreement – a new comprehensive, inclusive, robust and legally binding agreement on global response to climate change that involves all countries. The initiative mainly defines comprehensive long-term global objectives to address climate change and sets out the principles and actions for countries to achieve these objectives. Hailed as the third milestone in addressing climate change in human history after the 1992 UNFCCC and the 1997 Kyoto Protocol, it has a far-reaching impact worldwide.

1.2 Independent contribution targets and low-carbon development of China

The Chinese government attaches great importance to addressing climate change, and has adopted profound and far-reaching policies and measures to address the related challenges, promote sustainable development and the transition into a low-carbon economy.

On 22 September 2020, President Xi Jinping stated that China will scale up its Intended Nationally Determined Contributions (NDCs) by adopting more vigorous policies and measures, aiming to have CO₂ emissions peak before 2030 and achieve carbon neutrality by 2060.

² Climate Change 2021 The Physical Science Basis

1.3 Low-carbon management of the Beijing 2022 Games

Low-carbon management objectives proposed for the Beijing 2022 Games (Figure 1):

Low-carbon energy:

Develop low-carbon energy projects, establish a trans-regional green electricity trading mechanism in an integrated framework suitable for the Beijing 2022 Games, meet all regular power consumption demand of the Games venues with 100% renewable energy;

Low-carbon transport:

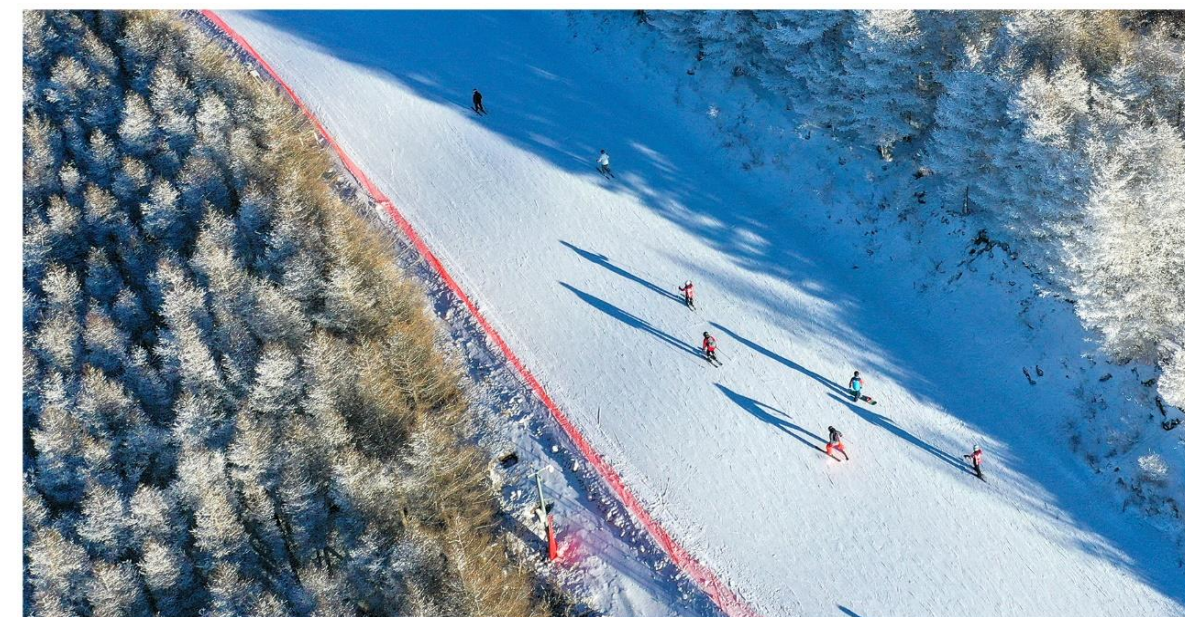
Use clean-energy vehicles (excluding vehicles that cannot be powered by renewable energy) in competition zones during Games-time;

Low-carbon venues:

Build ultra-low-energy projects with a total floor area of no less than 3,000 square metres, and ensure that all newly-built permanent venues meet the national green building Three-Star standards;

Low-carbon standards:

Establish low-carbon management accounting standards for the Beijing 2022 Games and create strong and long-lasting Olympic legacies.



Low Carbon Olympic and Paralympic Winter Games

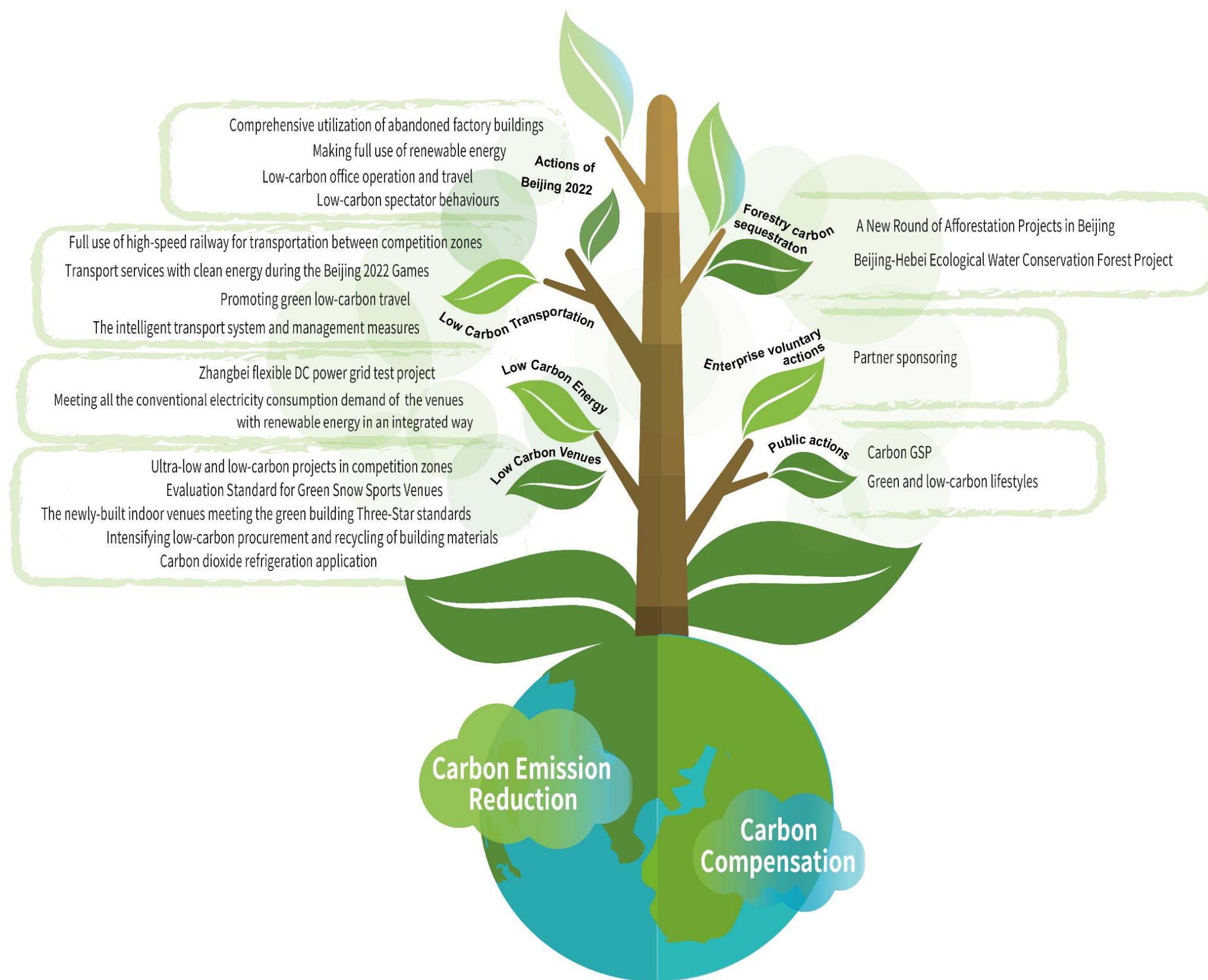


Figure 1 Low-Carbon Management Programme for the Beijing 2022 Games

Featured efforts of the Beijing 2022 Games low-carbon management:

Development of a carbon management methodology to achieve neutrality within the Chinese context.

This methodology encompasses the process of baseline calculations/actual emissions accounting, carbon emission reduction accounting and carbon compensation.

Close cooperation with Host City governments of the Beijing 2022 Games.

The carbon management of the Beijing 2022 Games has been integrated in the overall Games planning work of the Hebei Host City Government in order to achieve the objective of a “green” Games, facilitate the low-carbon transition process with Beijing, and create significant low-carbon legacies.

Establishment of a working mechanism for low-carbon management.

Carbon emissions and the projected impacts of the reduction measures have regularly been calculated and analyzed. In order to improve the validity of this work and the accounting results, Beijing 2022 commissioned a verification agency, qualified as a United Nations Designated Operating Entity (DOE), to conduct third-party evaluations of our carbon management plan.





02

Carbon Management Methodology of the Beijing 2022 Games

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2. Carbon Management Methodology of the Beijing 2022 Games

A carbon management methodology encompassing carbon baseline emissions accounting, emission reduction accounting and compensation evaluation has been developed for the Beijing 2022 Games³.

2.1 GHG emission accounting methodology for the Beijing 2022 Games

A GHG accounting methodology has been developed for the Beijing 2022 Games based on the IOC's carbon footprint methodology for the Olympic Games⁴ and the GHG accounting methodologies used by Beijing and China (in References 7–10). The differences in the GHG accounting methodology for the Beijing 2022 Games are:

- (1) The coverage of greenhouse gases is expanded according to the work progress of the UNFCCC⁵, including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆) and Nitrogen trifluoride (NF₃);
- (2) In baseline emissions and actual emissions accounting, the real physical indexes are used for activity levels;
- (3) GHG emission factors are localized taking into account the energy structure of China and Beijing.

2.1.1 Accounting principles

The main principles of GHG emissions accounting for the Beijing 2022 Games refer to the principles of the Greenhouse Gas Protocol and ISO 14064–1: Relevance, Integrity, Consistency, Accuracy, Transparency and the Avoiding of double counting.

³ Carbon in the report refers to greenhouse gases unless CO₂ is mentioned separately.

⁴ IOC Carbon Footprint Methodology for the Olympic Games.

⁵ Doha amendment to the Kyoto Protocol

2.1.2 Accounting boundaries

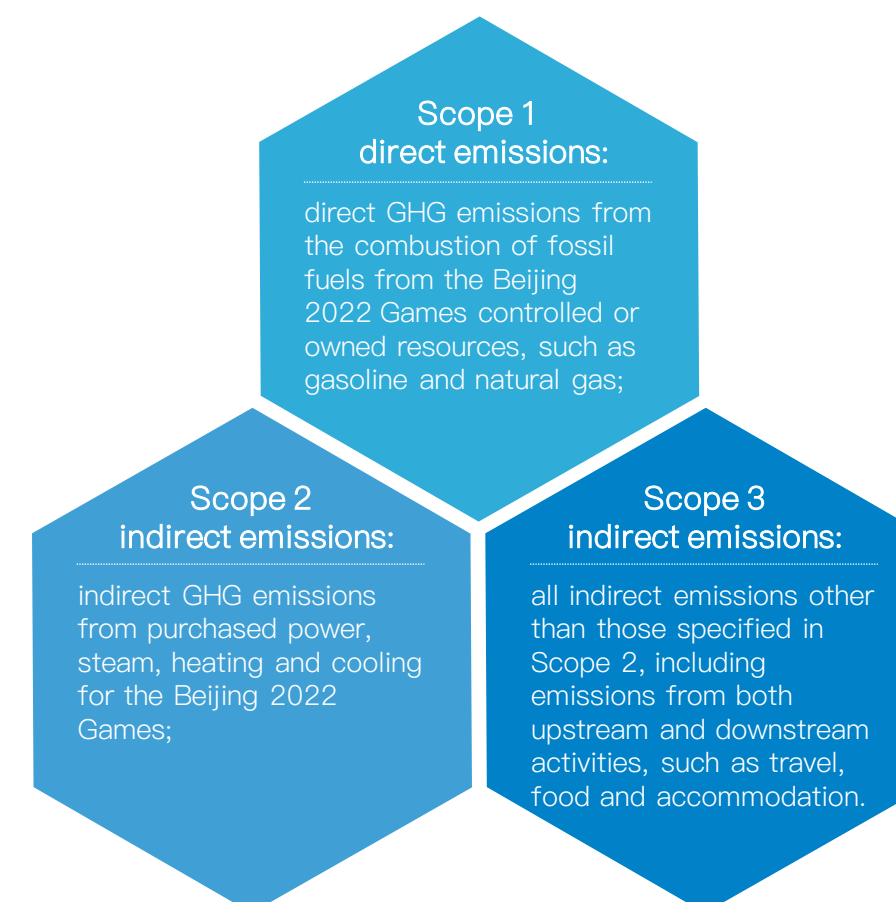
1. Time boundary

The GHG accounting of the Beijing 2022 Games is divided into three stages from 2016⁶ to 30 June 2022: pre–Games preparations, Games–time operations and post–Games dissolution.

2. Gases and Scope

All Kyoto Protocol Greenhouse Gases are accounted, including CO₂, CH₄, N₂O, HFCs, PFCs, SF₆ and NF₃, which was added during COP18 of the UNFCCC.

The Beijing 2022 Games carbon footprint encompasses the following scopes:



⁶ Beijing was elected as the 2022 Host in 2015 and emission calculations commenced in 2016.

3. Organizational boundary

According to property rights standards and control standards⁷, the organizational boundaries of GHG emission accounting for the Games were confirmed.

They can be divided into the following three categories:



The detailed determination process pertaining to the three listed categories is shown in Figure 2.

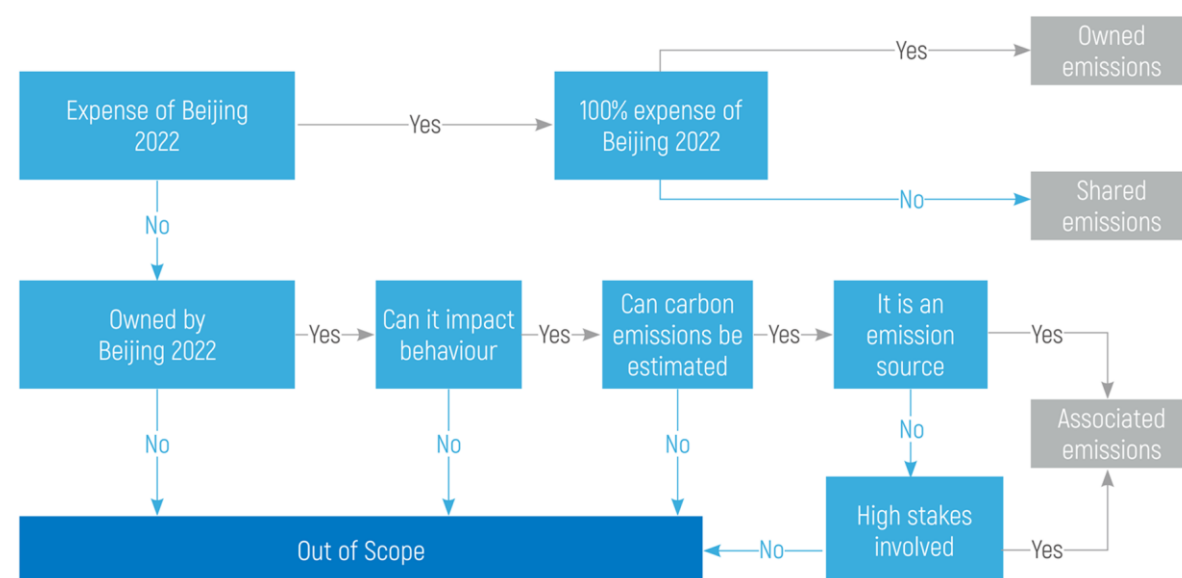


Figure 2 Determination process pertaining to the Beijing 2022 Games carbon emissions

⁷ Property right standards: GHG emission accounting based on property rights ratio.
Control standards: no property rights, but actual control.

4. Space boundary

Space boundary mainly covers GHG emissions from Beijing 2022 Functional Areas, geographical boundaries and activities that can influence the preparations for the Beijing 2022 Games, including permanent and temporary structures, venues, transport infrastructure, venue and general operations and spectators.

2.1.3 Covered emission sources

The GHG accounting of the Beijing 2022 Games covers GHGs from 200 emission sources in 3 primary categories and their sub-categories (Figure 3), generated by Beijing 2022 Games preparations and operations, venue construction and transportation facilities, as well as spectator (international/national) activities.

1. Games preparations and operations:

- 1.1 Beijing 2022 preparations and operations
- 1.2 Services for Olympic Family⁸
- 1.3 Various main event services (Games-time transport, catering and accommodation)
- 1.4 Beijing 2022 owned events
- 1.5 Games-time venue operation
- 1.6 Refrigerants for ice sports venues
- 1.7 Venue support facilities
- 1.8 Waste
- 1.9 Others (medals, licensed merchandise, etc.)

2. Venues and transport infrastructure:

- 2.1 Venue constructions and renovations
- 2.2 Transport infrastructure and event logistics service⁹

3. Spectators

⁸ Emissions generated through the travel, accommodation, catering and on-site transport of Olympic Movement representatives funded by Beijing 2022.

⁹ It is in line with the Bidding Report for the Beijing 2022 Games and its Summary of Operational Data (Version March 2015), List of major tasks of Beijing 2022 and infrastructure project approval documents, and based on the principle of relevance (The Beijing-Zhangjiakou high-speed railway project was approved prior to the election as Beijing as 2022 Host; it is therefore not included in the accounting scope of this report).

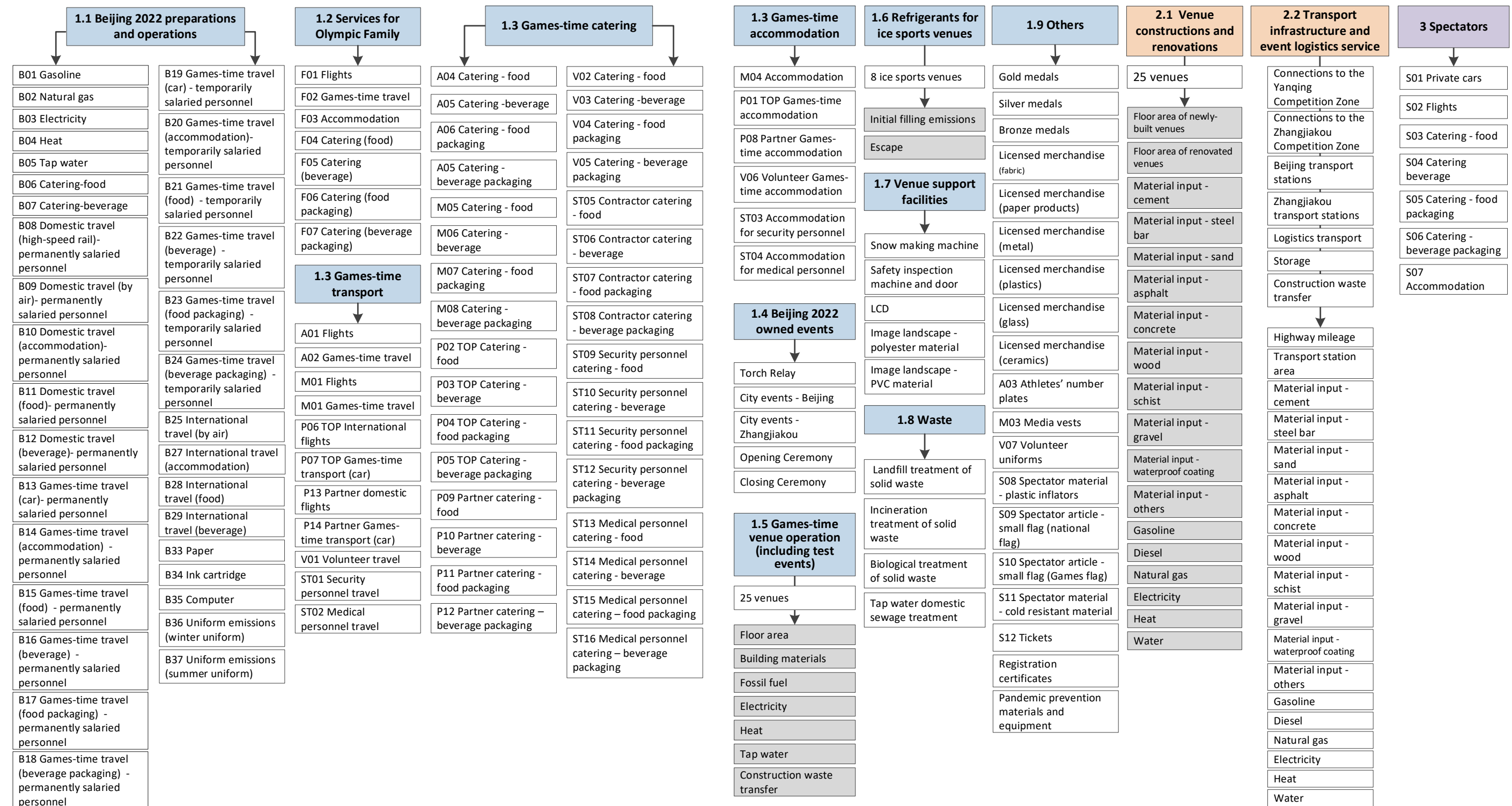


Figure 3 Categories of GHG Emission Sources of Beijing 2022 Games

Note: B – Beijing 2022; F – Olympic Family; A – athletes; M – media; P – partner; V – volunteer; S – spectator; ST – security and medical treatment personnel.

2.1.4 Accounting methodology

GHG emissions from the Beijing 2022 Games are calculated by multiplying the activity levels of various emission sources and the corresponding emission factors.

$$\text{Total carbon emissions} = \sum (\text{activity levels} \times \text{emission factors})$$

Activity level: Data on the magnitude of a human activity resulting in emissions or removals taking place during a given period of time.

Considering that the financial data of activity level is affected by exchange rates, inflation and incomparability, the activity level data of GHG emission sources of the Beijing 2022 Games are all physical quantities. For example, the activity level data of GHG emission sources during the period of venue constructions is the total floor area of the venue (baseline estimation) or material consumption (actual emissions accounting).

Emission factor: A coefficient that quantifies the emissions or removals of gases per unit activity. Emission factors are often based on a sample of measurement data, averaged to develop a representative rate of emission for a given activity level under a given set of operating conditions. The emission factors of GHG accounting of the Beijing 2022 Games were localized according to the actual situation of China and Beijing.

2.2 Carbon emission reduction accounting methodology for the Beijing 2022 Games

With reference to the clean development mechanism (CDM) methodology, the Chinese Certified Emission Reduction (CCER) methodology¹⁰ and the methodology adopted by China in its National Communication on Climate Change, a specific accounting methodology¹¹ for low-carbon measures to reduce emissions was formulated for the Beijing 2022 Games by Beijing 2022.

¹⁰ CCER, China Certified Emission Reduction

¹¹ For the data and parameters of activity level monitoring during the implementation of carbon reduction measures, the related emission factors determined in advance remain unchanged. Accounting of carbon reduction is the difference between the baseline emissions and the monitoring emissions.

2.2.1 Accounting principles

1. Real, measurable and long-term emission reduction benefits can be generated;
2. Emission reduction benefits of activities are additional to the baseline scenario;
3. The whole process is evaluated by a verification agency qualified as a DOE to conduct third-party evaluations.

2.2.2 Accounting boundary and methodology

According to the Beijing 2022 Low-carbon Management Programme, the reduction measures focus on four aspects: low-carbon energy, low-carbon venues, low-carbon transport, and awareness raising actions of Beijing 2022. The carbon emission reduction accounting methodology is developed (Table 1), which considers the Beijing 2022 Games' carbon baseline, monitoring indicators, methodologies and assumptions of different existing emission reduction measures.

Total carbon emission reductions

$$= \sum (\text{BAU emissions of each measure} - \text{actual emissions of each measure})$$

The actual activity level data and emission factors of various emission reduction measures are obtained and used for the actual emissions calculation. The total Carbon emission reductions are calculated as the difference of the BAU emissions and actual emissions of various emission reduction measures. The calculation methods and process have been verified by an independent third party.

Table 1 Accounting Boundary and Method of Emission Reduction for the Beijing 2022 Games

Focus area	Measure	Additional details	Baseline of Emission Reduction (or Qualitative description/reference standard)	Pre-Games			Games-time	
				2016-2018	2019	2020	2021	2022
Promoting low-carbon energy technology projects	Realize continuous use of Zhangbei flexible DC power grid project	Construction of the world's first ±500 kV flexible DC power grid with a four-terminal ring structure.	Construction progress	✓	✓			
	Renewable energy will be used for Games-time conventional electricity consumption in all venues	Photovoltaic power generation, wind-solar complementation, green electricity procurement.	National power grid generation level in 2015		✓	✓	✓	✓
Strengthening the construction and management of low-carbon venues	Develop ultra-low energy consumption and low-carbon projects in each competition zone	Wukesong Ice Hockey Training Hall, Polyclinic of the Beijing Olympic Village, apartment cluster in the Yanqing Zone	Showcasing area		✓	✓	✓	
	Implement National Green Building Standards for new indoor venues	Meet the 3-star standard (highest rating) of Green Building Evaluation Standards	Number of indoor venues that meet the 3-star standards of Green Building Evaluation Standards	✓	✓	✓		
	Develop Evaluation Standards for Green Snow Sports Venues	All snow sports venues meet this standard	Number of snow sports venues that meet the 3-star standards of Green Building Evaluation Standards	✓	✓	✓		
	Promote low-carbon and energy-saving construction and transformation of venues	Existing venues are encouraged to meet the 2-star standard of the Evaluation Standards for Green Renovation of Existing Buildings	Number of venues that have been renovated and met the 2-star standards of the Evaluation Standards for Green Renovation of Existing Buildings	✓	✓	✓		
	Implement low-carbon venue design and promote the recycling of construction materials during the pre-Games period	1) The consumption of building materials was reduced by optimization design (cement, glass, steel, asphalt (ground use))	1) Estimated material consumption before design optimization;	✓	✓	✓		
		2) The recycling rate of building materials is higher than 20%.	2) Building materials without recycling					
	Use renewable/recyclable materials, detachable parts in the construction of temporary venues and facilities	Temporary facilities will be fully re-used after removal	Re-use rate of temporary facilities					✓
	Monitor energy consumption in venue operations	Monitor in real time the electricity, gas, water, heat and renewable energy consumption, air-conditioning, heating, elevator, lighting and other building energy consumption for segmented, zoning metering control	Number of venues with building energy consumption control centres				✓	✓
	Improve the efficiency of ice and snow making	1) Rational use of reclaimed water and rainwater;	1) Municipal water sources are used to make artificial snow;				✓	✓
		2) Use of CO ₂ refrigeration in appropriate ice venues	2) Refrigerant: R507 filling amount					
Strengthen waste recycling management	Develop plans for waste removal management, and arrangements for garbage classification, general cleaning, snow and ice removal etc.	Waste treatment situation in Beijing in 2016	✓	✓	✓	✓	✓	
Build a low-carbon transport system	Low-carbon transport	The Beijing-Zhangjiakou High-speed Railway will operate for the Games-time transport among the three competition zones	Emissions from traditional vehicle travel					✓
	Intelligent transport	Use of intelligent transport systems and management measures, such as transport resource management system	Traditional vehicle travel					✓
	Low-carbon travel	Continue to encourage spectators to participate in low-carbon travel models	Traditional vehicle travel model	✓	✓	✓	✓	✓
	Low-carbon engineering technology is used in transport infrastructure construction projects	1) Warm-mixing asphalt technology (lower energy consumption for production)	1) Conventional asphalt;					
		2) Recycling of old road materials	2) Material consumption level of old road materials that are not recycled	✓	✓	✓		
3) Type of construction machinery used		3) Emission levels of diesel machinery						
Awareness raising action of Beijing 2022	Make full use of renewable energy in office area of Beijing 2022	1) Solar water heating	1) Natural gas water heating	✓	✓	✓	✓	✓
		2) Thermo-compressor heating	2) Municipal thermal heating					
	Implement low-carbon office procedures	1) Energy-saving light source;	1) The target value of light efficiency of LED lamps is to be no less than 80 lm/W in Architectural Lighting Design Standards (GB50034-2013) and Electrical Design Code for Sports Buildings JGJ354-2014;	✓	✓	✓	✓	✓
		2) Water-saving equipment;	2) Conventional water efficiency grade;					
3) Save office supplies, such as paper and ink cartridges		3) Emissions from office supplies						
	Advocate for low-carbon spectator behaviour	Low-carbon spectator activities, such as Low-carbon travel, electronic tickets, home stay, material recycling and other low-carbon spectating activities	Sampling questionnaire survey					✓

2.3 Carbon compensation methodology for the Beijing 2022 Games

2.3.1 Principles of carbon compensation methodology

1. Clear responsibilities for carbon emissions

Beijing 2022 will work with qualified third-party carbon verification agencies to verify the carbon emissions accounting. All residual emissions will be compensated to achieve carbon neutrality.

2. Compliance with international standards

High-quality carbon compensation products/projects that meet international standards (2.3.2) will be selected for the Beijing 2022 Games. All products/projects will be verified by qualified third-party verification agencies and comprehensive verification reports will be issued.

3. Transparency

The carbon emissions, carbon emission reduction and carbon compensation amount of the Beijing 2022 Games will be officially publicized and transparent, and the specific categories and quantities of compensation products selected will be fully disclosed in the Beijing 2022 Post-Games Sustainability Report and available on the website of Beijing 2022.

4. Additionality

Additionality refers to the additional carbon sequestration or emission reduction generated by the project relative to the business-as-usual scenario (i.e. in the absence of the Beijing 2022 Games). The benefit of the project is the amount of carbon sequestration increased or greenhouse gas emissions reduced compared to the business-as-usual scenario.

5. Multi-party participation

Games-related partners and enterprises are encouraged to take relevant low-carbon actions and sponsor high-quality carbon compensation products to Beijing 2022. Through a carbon generalized system of preferences (carbon GSP), general public are encouraged to participate in voluntary actions of emission reduction through, for example, low-carbon travel options and low-carbon life.

2.3.2 Carbon compensation product evaluation indicators

Evaluation criteria for carbon compensation have been established for the Beijing 2022 Games: “CORSIA¹² criteria + general applicability”, which include 9 evaluation indicators for compensation products.

Integrity evaluation criteria of carbon compensation products:

- Emission reduction is additional.
- The baseline is practical and reliable.
- Emission reduction can be quantified, monitored, reported and verified.
- The supervisory process is clear and transparent.
- Emission reduction is permanent.
- No carbon leakage is caused.
- Repetitive calculation, repetitive issuance, repetitive use and repetitive calculation are to be avoided.
- There is no violation of relevant laws and regulations.
- General applicability is required.

¹² CORSIA is an internationally recognized evaluation criteria for emission reduction products in ICAO (International Civil Aviation Organization).

Sources: <https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx>



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GHG Emissions from the Beijing 2022 Games

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3. GHG Emissions from the Beijing 2022 Games

In this chapter, the Beijing 2022 initial baseline emissions, revised baseline emissions and actual emissions for the period 2016 – June 2021 are presented.

3.1 GHG baseline emissions

$$\text{GHG baseline emissions} = \sum (\text{baseline activity levels} \times \text{emission factors})$$

● Activity level.

For the calculation of GHG baseline emissions, the main sources of data used to estimate activity levels were as follows:

- Data from the Bidding Report of the Beijing 2022 Olympic Winter Games Bid Committee and its Summary of Operation Data (Version of March 2015);
- Planning documentation pertaining to the planning and staging of the Beijing 2022 Games compiled and provided by national and regional governments;
- Data obtained from researching, such as survey data of hotels;
- Actual physical data collected from some emission sources included in the reporting perimeter.

● Emission factor.

In view of the actual energy structures of China and Beijing, for the selection of emission factors, local emission factors were prioritised, followed by national emission factors, and finally international emission factors.

● Baseline emissions.

In 2018, the total GHG baseline emissions covering the three phases of the Beijing 2022 Games were calculated at 1.637 million tonnes of CO₂ equivalent (t– CO₂ e). The top three sources of emissions were spectators (49.6% of the total baseline emissions), venue construction, renovation to existing permanent venues, temporary overlay infrastructure (21.4%), and new transport infrastructure constructions (6.2%)(Table 2).

Emissions between 2016 and 2019	Emissions between 2020 and 2021	Emissions between January and June 2022
were primarily from venue construction and transport infrastructure;	originated mainly from venue construction and testing operations;	will be generated through Games–time operations, temporary infrastructure and overlay, increased short–term staff numbers and spectators.

Within the Beijing 2022 Games’ baseline calculations, owned emissions accounted for 18.2%, shared emissions (based on the apportionment by venue investment) accounted for 21.4%, and associated emissions is the largest overall proportion (60.4%).

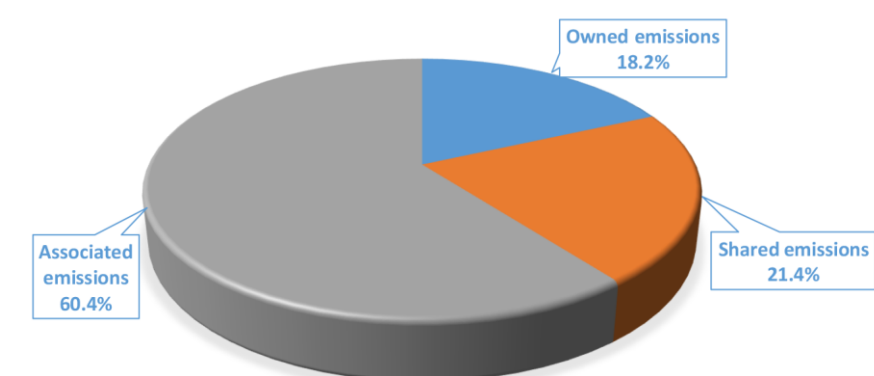


Figure 4 Baseline breakdown of owned, shared and associated emissions

Table 2 Baseline and Revised Baseline GHG Emissions¹³

Accounting Category	Activity Category	Emission Sources Category	Pre-Games (incl. Test events)	Games-time	Post Games	GHG Emissions (10,000 t-CO ₂ e)	
						Accounting in 2018	Revised in 2021
Preparations and operations	1. Beijing 2022 preparations and operations	Energy, food and beverages, business travels, accommodation and catering on business trips, office supplies (paper, ink cartridge, computers, etc.), and uniforms	✓	✓	✓	7.9	7.9
	2.Services for Olympic Movement (excluding athletes and media)	Services (transportation, accommodation and catering) provided for the Olympic Movement at the expense of Beijing 2022	✓	✓	✓	2.3	2.3
	3.Various main event services	Transport, accommodation and catering services provided to various stakeholders (athletes and delegation officials, media, broadcasters, contractors, volunteers, healthcare professionals, security personnel and marketing partners) during the Games		✓		7.4	7.4
	4. Beijing 2022 owned events	Including the Countdown Celebrations, Torch Relay, city activities, Opening and Closing Ceremonies.	✓	✓		1.8	1.8
	5.Venue operations (including test events)	Energy consumption	✓	✓		9.3	7.3
	6.Refrigerants for ice sports venues	Escape of refrigerants	✓	✓		0.5	0.5
	7.Venue support facilities	Snow-making machines, security facilities, LCD screens, and look of the Games	✓	✓		0.3	0.3
	8.Waste	Solid waste treatment and domestic sewage treatment in office areas and competition venues	✓	✓	✓	1.0	1.0
	9.Other	Including medals, licensed commodities, athletes' bibs, spectator supplies, tickets and certificates	✓	✓		6.8	6.8
Venues, transport infrastructure construction and services	10.Venue constructions and renovations	Energy consumption, and use of materials	✓			35.0	39.5
	11.Transport infrastructure and logistics	Energy, use of materials, and logistics (warehousing and transport)	✓	✓	✓	10.2	25.8
Spectators	12.Spectators (international /national)	Transport, accommodation, and Food & Beverage		✓		81.2	30
Total						163.7	130.6

¹³ Notes:

Energy includes gasoline, diesel, natural gas, electricity, heating and tap water;
FNB includes food, beverages, food packaging and beverage packaging;
Transport includes flights, railways, coaches, cars, public buses and subways;
Materials refer to cement, steel, sand, concrete, glass and other building materials.

3.2 Revision of GHG baseline emissions

In June 2021, Beijing 2022 revised its GHG baseline emissions based on more advanced planning and knowledge pertaining to the staging of the Beijing 2022 Games and the actual activity level of venue construction. The revised figures, alongside the baseline figures are presented in Figure 5. The main changes are as follows:

- **Transport and venue infrastructure plans amended.**

During the construction period of the Yanqing competition zone, some planned surface roads were transformed into elevated roads (bridges). This increased and changed construction materials, and the overall increase was approximately 156,000 tonnes of CO₂ equivalent (t-CO₂e). During the construction period of the Beijing competition zone, one significant construction change was implemented which also impacted on carbon emissions. The Main Media Centre was initially planned to be housed within the existing China National Convention Centre. The decision was made to move it to the newly-built China National Convention Centre. This resulted in an overall increase of approximately 45,000 t-CO₂e.

- **Number of Beijing 2022 Test Events revised.**

In line with the Covid-19 prevention and control policies implemented by Beijing 2022, the Test Event Operational Plan was significantly modified. The initial venue number of 22 Test Events¹⁴ was reduced to only 12. The GHG emissions therefore decreased by 20,000 t-CO₂e.

- **Beijing 2022 Games-time spectator plan changed.**

Because of the Covid-19 situation, Beijing 2022 took the decision in 2021 to revise its Games-time spectator plan to reduce the risk of infection. Spectator capacity for the Olympic Games has been reduced from 2.29 million to 1.58 million (national spectators only). Spectator capacity for the Paralympic Games will remain at 639,000 (national spectators only). It has been estimated that the GHG emissions will decrease by 512,000 t-CO₂e.

¹⁴ Test Events are sporting competitions held prior to an Olympic Games. They often take place a year in advance of the Olympic competition to give enough time for the hosts to check and sort any issues with the playing conditions and infrastructure readiness.

As indicated, the GHG baseline emissions were calculated at 1.637 million t-CO₂e. Taking the above into consideration, the revised baseline emissions were reduced by 331,000 t-CO₂e to 1.306 million t-CO₂e. (Figure 5).

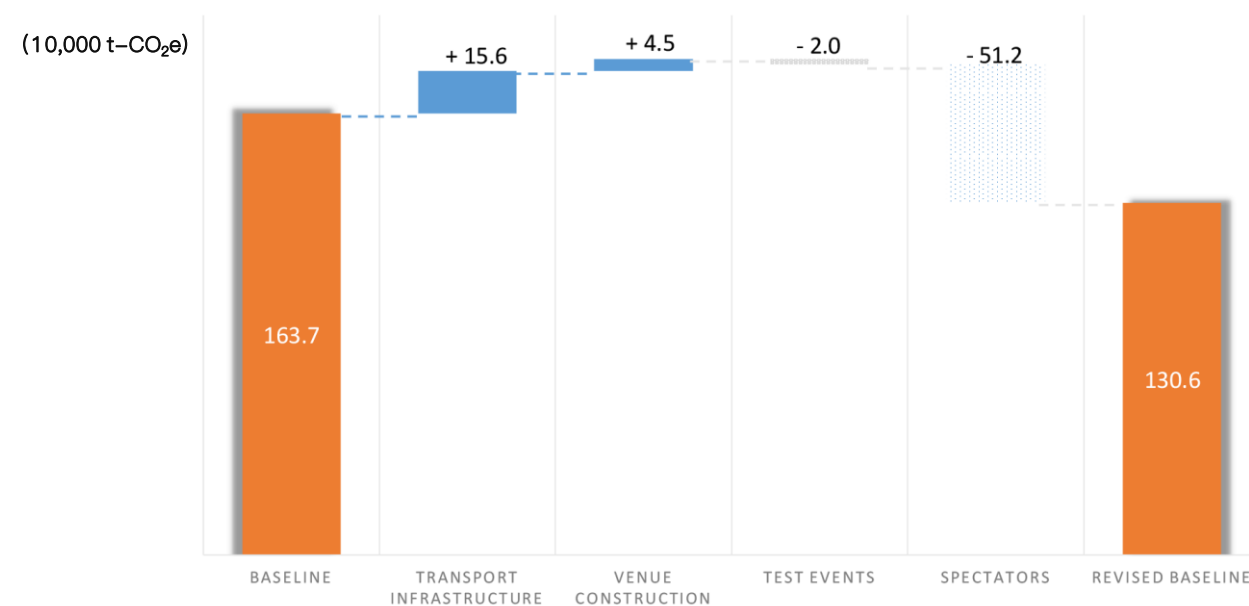


Figure 5 Revisions to GHG Baseline Emissions of the Beijing 2022 Games

3.3 Actual GHG emissions as of 2021

As of June 2021, the 2016–2021 GHG emissions of the Beijing 2022 Games were calculated to be 489,000 t-CO₂e. The emissions in each year accounted for 1.1%, 1.6%, 25.3%, 42.4%, 18.0% and 11.5% respectively. The top three sources of emissions were the transport infrastructure (50.0%), the venue constructions and renovations of existing venues (41.3%) and Beijing 2022 preparations and operations (7.5%) (Figure 6).

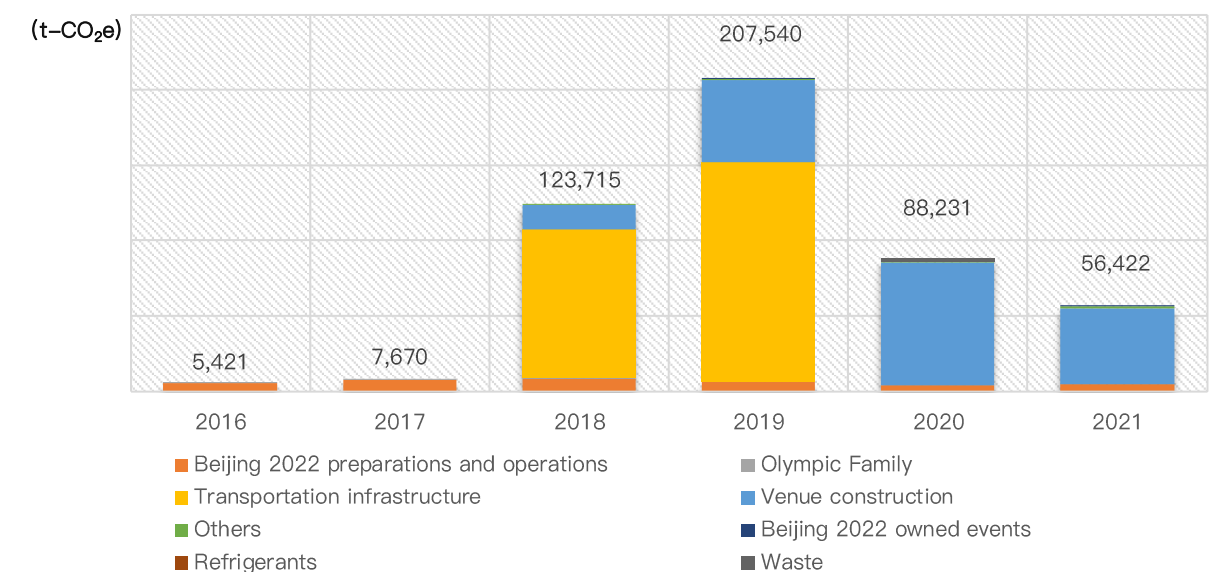


Figure 6 Actual Emissions from 2016 to June 2021

The relationship among the initial GHG baseline emissions, the revised baseline emissions and the actual carbon emissions (as of 2021) is shown in Figure 7. The actual total GHG emissions from 2016 to 2021 were 489,000 t-CO₂e, and the total GHG emissions during the Beijing 2022 Games and the post-Games phase are estimated to be 539,000 t-CO₂e¹⁵. The actual GHG emissions of the Beijing 2022 Games from 2016 to 2022 are estimated to be 1.028 million t-CO₂e.

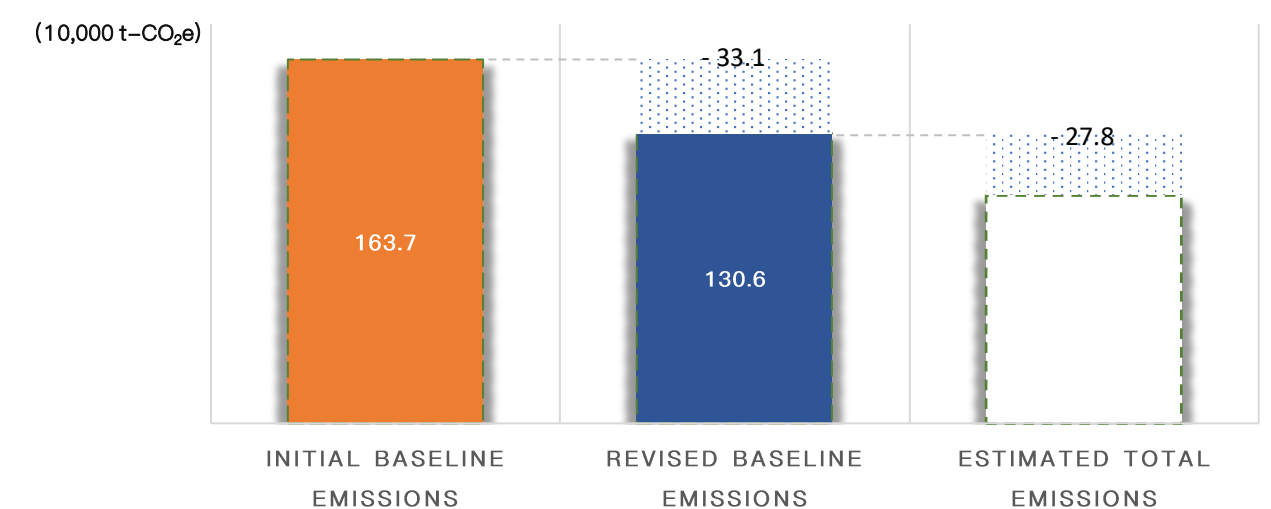


Figure 7 Baseline GHG Emissions and Actual Emissions

¹⁵ This number is mainly comprised of Games-time operations (transport, accommodations and catering) temporary infrastructure, overlay and spectators.

3.3.1 Venue construction and renovation

The GHG emission accounting for the Beijing 2022 Games covers 25 competition and non-competition venues (Table 3).

Table 3 Competition and non-competition venues of the Beijing 2022 Games

No.	Name	Competition Event	Construction status
1	National Speed Skating Oval	Speed Skating	Newly built
2	Yanqing National Alpine Skiing Centre	Alpine Skiing	Newly built
3	Yanqing National Sliding Centre	Bobsleigh, Skeleton, Luge	Newly built
4	Zhangjiakou National Biathlon Centre	Biathlon, Para Biathlon	Newly built
5	Zhangjiakou National Cross-Country Skiing Centre	Cross Country Skiing, Nordic Combined	Newly built
6	Zhangjiakou National Ski Jumping Centre	Ski Jumping, Nordic Combined	Newly built
7	CTS Short Track Speed Skating Training Hall	Short Track Speed Skating	Newly built
8	Beijing Olympic Village/Beijing Paralympic Village	Beijing Olympic (Paralympic Village)	Newly built
9	Yanqing Olympic Village/Yanqing Paralympic Village	Beijing Olympic (Paralympic Village)	Newly built
10	Zhangjiakou Olympic Village/Zhangjiakou Paralympic Village	Beijing Olympic (Paralympic Village)	Newly built
11	Big Air Shougang	Snowboard	Newly built
12	Wukesong Ice Hockey Training Centre	Ice Hockey	Newly built
13	National Aquatics Centre	Curling	Renovated
14	Wukesong Sports Centre	Ice Hockey	Renovated
15	National Indoor Stadium	Ice Hockey	Renovated
16	Capital Indoor Stadium	Short Track Speed Skating, Figure Skating	Transformed
17	Zhangjiakou Genting Snow Park	Parallel Giant Slalom and Chase with Obstacles, Half-pipe Snowboard and Slope Obstacles, Snowboard Aerial Skiing, Moguls	Renovated
18	CTS Figure Skating Training Hall	Figure Skating	Renovated
19	National Stadium	Opening and Closing Ceremonies	Renovated
20	Main Media Centre	Media operation and broadcasting services	Newly built
21	Zhangjiakou Mountain Broadcast Centre	Broadcasting services	Temporarily built
22	Beijing Medals Plaza	Medal presentation	Temporarily built
23	Yanqing Paralympic Games Medals Plaza	Medal presentation	Temporarily built
24	Zhangjiakou Medals Plaza	Medal presentation	Temporarily built
25	Zhangjiakou Mountain Press Centre	Media operation	Temporarily built

(1) Venue-related activity levels and emission factors

Venue related activity levels include the consumption of natural gas, gasoline and diesel oil, electricity, heat and tap water, and building materials during the construction and renovation phase and the transfer of construction waste. The carbon data pertaining to the sites listed in Table 3 has been provided to Beijing 2022 from the venue constructors, venue owners/operators and infrastructure providers during the 2018 – 2021 period. Any missing data has been estimated by Beijing 2022.

The emission factors related to venue construction and renovation materials are determined according to the Building Carbon Emission Calculation Standard of China (published in Chinese only). The construction materials include cement, steel, gravel, sand, concrete, building mortar and plate glass.

(2) Venue-related accounting results

The total actual GHG emissions from 2018 to 2021 were 202,000 t-CO₂e, and the annual emissions accounted for 8.1%, 27.0%, 40.2% and 24.8% respectively.

3.3.2 Transport infrastructure

The total actual transport infrastructure of the Beijing 2022 Games mainly includes the surface road connections and bridges in the Yanqing Competition Zone, which were built from 2018 to 2019 and put into use in 2020.

(1) Transport-related activity level data and emission factors

Emission factors include GHG emissions generated by the consumption of fossil energy such as gasoline, diesel and natural gas, and construction materials such as cement and steel, as well as the indirect emissions generated by the use of electricity and heat. The activity level is based on the actual survey monitoring data provided by the constructors and providers throughout 2018 – 2019. The emission factors are adjusted according to the Building Carbon Emission Calculation Standard of China (published in Chinese only).

(2) Transport-related accounting results

The total actual GHG emissions generated by the construction of the surface road connections and bridges were 244,500 t-CO₂e. The emissions in 2018 and 2019 accounted for 40.3% and 59.7% respectively.

3.3.3 Beijing 2022 Games preparations

(1) Beijing 2022 office operations

The office spaces of Beijing 2022 include Shougang Office Area and the Yanqing and Zhangjiakou Operation Centres. Beijing 2022 operations are comprised of energy, food and beverages, business travels, accommodation and catering on business trips, office supplies.

The total actual emissions generated by Beijing 2022 operations from 2016 to 2021 were 36,000 t-CO₂e. The annual emissions accounted for 14.6%, 20.7%, 23.2%, 17.3%, 10.6% and 13.4% respectively.

(2) Olympic Family

Olympic Family includes International Sports Federations (“IFs”), National Olympic Committees (“NOCs”), Organizing Committees for the Olympic Games (“OCOGs”). Beijing 2022 provides and funds the Olympic Family with Games-time services, and in defined cases, pre-Games services as well e.g. meetings with Beijing 2022, site visits, test events.

The total actual emissions generated by the Olympic Family from 2016 to 2021 were 300 t-CO₂e. The annual emissions accounted for 16.4%, 20.8%, 28.8%, 14.4%, 9.8% and 9.8%, respectively.

(3) Beijing 2022 owned events

Beijing 2022 owned events cover activities and celebrations such as “100 days to go”, “Countdown to the Beijing 2022 500-day Great Wall Cultural Activities” and the “Beijing 2022 Outstanding Music Works Release”. Events and celebrations have taken place in both the Beijing and Zhanjiakou zones.

The majority of events were conducted between 2019 and 2021. According to Beijing 2022 carbon accounting, the total actual emissions generated by Beijing 2022 owned events were 7.28 t-CO₂e. The emissions in these years accounted for 92.1%, 4.9% and 3.1% respectively.

(4) Others

Other Beijing 2022 Games GHG emissions from 2016 to 2021 include, for example, licensed merchandise and refrigerants.

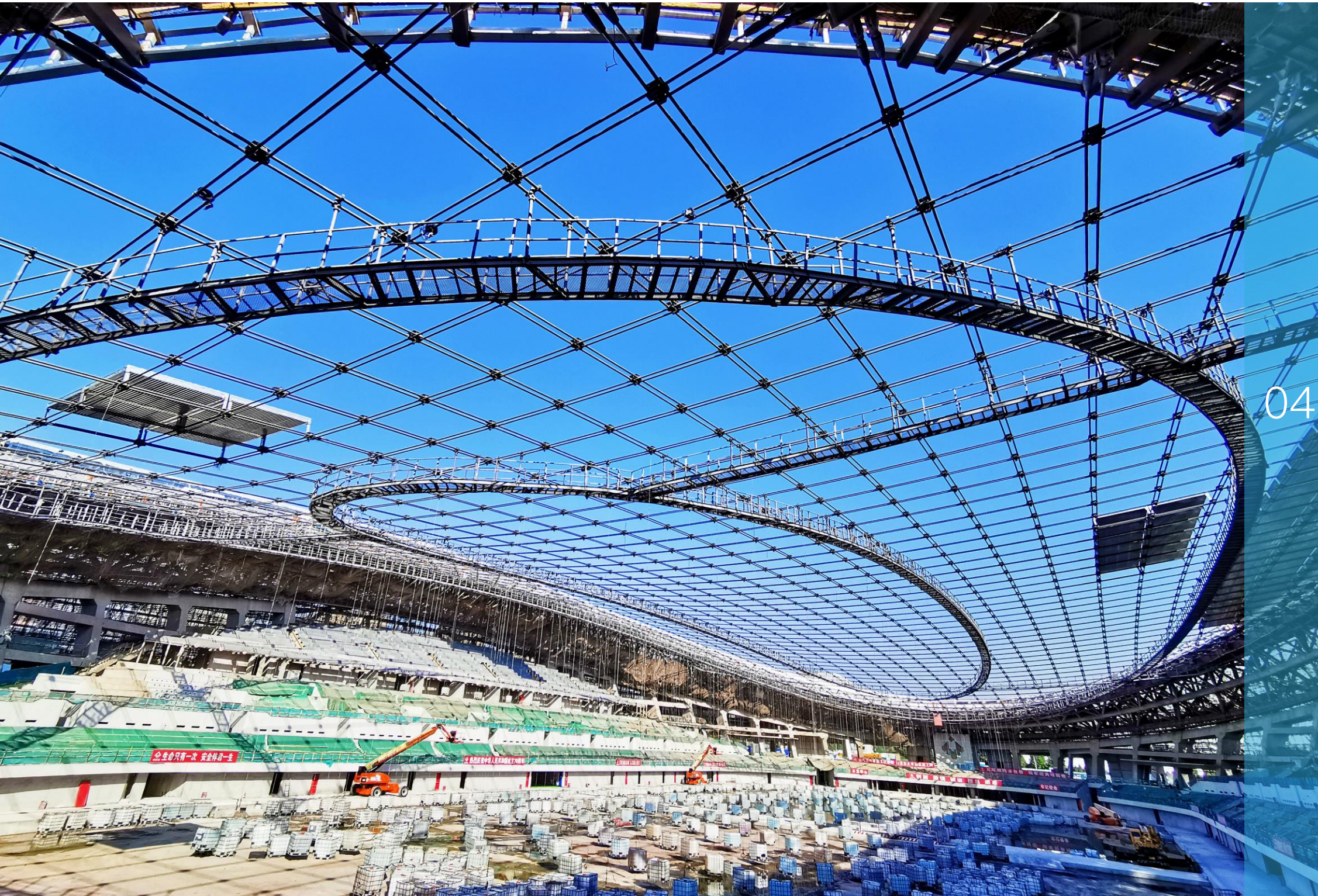
Beijing 2022 licensed merchandise

Licensed merchandise includes a variety of materials such as fabric, paper, metal, plastics, glass and ceramics. According to the Beijing 2022 carbon accounting, the total actual emissions from licensed merchandise from 2018 to 2021 were 0.33 million t-CO₂e.

Refrigerant

The GHG emissions from the refrigerants escaping from the 8 relevant ice venues of the Beijing 2022 Games are specifically calculated based on the CO₂ refrigerant used in 5 ice surfaces of 4 venues, i.e. the National Speed Skating Oval, the Capital Indoor Stadium, the Short Track Speed Skating Training Hall and the Wukesong Ice Hockey Training Hall. R449a refrigerant is used in 3 venues, i.e. the National Aquatics Centre, the Wukesong Sports Centre and the National Indoor Stadium, and R22 refrigerant is used in the Figure Skating Training Hall. According to the methodology detailed in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories¹⁶, the refrigeration system packing and emissions released a total of 230 t-CO₂e before June 2021.

¹⁶ <https://www.ipcc.ch/report/2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/>



04

Low-carbon measures undertaken for the Beijing 2022 Games

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4. Low-carbon Measures for the Beijing 2022 Games

The period from 2016 to 2021 was the main preparation phase of the Beijing 2022 Games, and carbon emissions were mainly reduced through the adoption of low-carbon energy as well as low-carbon venues and supporting facilities. The carbon reduction measures for low-carbon transport and venue operations will be mainly reflected during the Games. All relevant information will be published in the Post-Games Sustainability Report.

4.1 GHG emissions avoided through existing venue transformation

The existing National Aquatics Centre, the National Indoor Stadium, the Wukesong Sports Centre, the Capital Indoor Stadium, the National Stadium — all built for the Beijing 2008 Olympic Games have been creatively transformed into ice venues for the Beijing 2022 Games by “‘water – ice conversion’ and ‘land – ice conversion’ infrastructure and technology”. According to preliminary calculations made by Beijing 2022, the carbon emissions generated by the transformation of these five venues have been estimated to reduce GHG emissions by approximately 30,000 t-CO₂e compared to building new venues.

¹⁷ Ultra-low energy consumption buildings refer to buildings with a comprehensive selection of energy saving technologies across areas such as; exterior coating, lighting, energy and equipment systems; and whose energy consumption levels are significantly lower than that of conventional buildings. They are powered by renewable energy.

¹⁸ This standard is revised by China Building Research Institute and Shanghai Building Research Institute (Group) Co., Ltd. together with relevant units on the basis of the original national standard “Green Building Evaluation Standard” GB/T 50378–2006 according to the requirements of the Circular on Printing and Distribution (Construction Standard [2011] No. 17) of the Ministry of Housing and Urban-Rural Development.

¹⁹ Evaluation Standard for Green Snow Sports Venues (Beijing).
Evaluation Standard for Green Snow Sports Venues (Hebei).

Table 4 Low-carbon measures for the Beijing 2022 Games¹⁷

Focus area	Measure	Objective	Completion	Details
Low-carbon energy	Develop low-carbon energy projects	Zhangbei flexible Direct Current (DC) power grid test project.	100%	Flexible DC power grid with ±500 kV four-terminal ring structure became operational in 2020, and large-scale grid connection project of renewable energy on land was implemented with flexible DC technology, providing green electricity for Olympic venues.
	Establish a trans-regional green electricity trading mechanism suitable for the Beijing 2022 Games	Realize 100% renewable energy to meet the regular electricity consumption demand of the Beijing 2022 competition and non-competition venues	100%	Renewable energy will be provided to the competition and non-competition venues. By the end of 2020, 12 venues, including the Big Air Shougang and the Zhangjiakou Competition Zone were powered by renewable electricity through the green electricity trading platform, using a total of 71.79 million kWh and reducing CO ₂ emissions by 43,800 tonnes.
Low-carbon venues	Low-carbon projects such as ultra-low energy consumption	Build a site with a total construction area of not less than 3,000 square metres	Total area: 50,271 square metres	The Polyclinic of the Beijing Olympic Village, the Wukesong Ice Hockey Training Hall and the D6 area of the Yanqing Olympic Village. <ul style="list-style-type: none"> ● The Wukesong Ice Hockey Training Hall contains an area of 38,400 square metres of ultra-low-energy public buildings; ● The D6 area of the Yanqing Olympic Village contains an area of 10,731 square metres of ultra-low energy buildings; ● The Polyclinic of the Beijing Olympic Village contains an area of approximately 1,140 square metres of ultra-low energy.
	New venues	All the new indoor venues meet 3-star green building standards ¹⁸	Number of new venues to achieve 3-star green building standards: 6	For example, the National Speed Skating Center, the Main Media Center, the Wukesong Ice Hockey Training Center.
	New/renovated sports venues	Meet the requirements of the Evaluation Standard for Green Snow Sports Venues ¹⁹ (Beijing/Hebei)	Number of green snow sports venues meeting the 3-star standards : 7	The 7 venues (including the transformed venues), such as the Big Air Shougang, the National Alpine Skiing Centre, the National Sliding Centre, the National Cross-country Skiing Centre, the National Ski Jumping Centre, the National Biathlon Centre and the Genting Snow Park, have been awarded the 3-star green snow sports venue logo, which helps energy-saving.
	Existing venues	They are encouraged to meet 2-star green building standards (There are three levels of national standards, where 3-star is the highest)	Number of existing venues renovated to achieve 2-star green building standards: 5	The National Aquatics Centre, the National Indoor Stadium and the Capital Indoor Stadium cluster achieved certification of 2-star green building design logo.
	Material-saving optimization design	The venues are optimized to save building materials	All the new venues have been optimized to save materials	For example, the National Speed Skating Hall, the Beijing Olympic Village and other venues
	Implementation of low-carbon refrigerant	Reduce emissions from traditional refrigerants	Number of venues using CO ₂ refrigerant: 4	The CO ₂ trans-critical direct refrigeration technology is used in four ice sport venues, the National Speed Skating Oval, the Capital Indoor Stadium, the Short Track Speed Skating Training Hall and the Wukesong Ice Hockey Training Hall
	Distributed renewable energy utilization	Photovoltaic power generation, wind-solar complementary lighting system, solar hot water utilization	Number of venues with distributed RE: 3	The National Speed Skating Oval, the Beijing Olympic Village, the Main Media Centre
	Smart snow-making and non-municipal water use	Improve snow-making efficiency to reduce electricity consumption	Number of venues with more efficient snow-making technology: 7	Snow sports venues (as above)
	Energy control centre	Management of venue operations to reduce energy consumption	Number of venues with energy control centres: 3	The National Speed Skating Oval, the Beijing Olympic Village, the National Indoor Stadium
Low-carbon transport	Maximum use of clean energy vehicles across the 3 competition zones (Beijing, Yanqing, Zhangjiakou)	Guaranteed provision of clean energy vehicles	Low-carbon vehicles account for 84.9% of the total vehicles	Low-carbon vehicles account for 100% of the passenger cars

4.2 Carbon reduction measures implemented for the Beijing 2022 Games

Various measures in the low-carbon management programme have been implemented for the Beijing 2022 Games and by the end of December 2021, significant progress has been made in the areas of low-carbon energy, low-carbon venues, low-carbon transport and in the awareness raising action of Beijing 2022, reducing carbon dioxide by an estimated total of 158,300 t-CO₂e, including the reduction of low-carbon energy measures 99,300 t-CO₂e, the reduction of low-carbon venues measures 58,700 t-CO₂e, and the reduction of Beijing 2022 initiatives 300 t-CO₂e.

Table 5 outlines Beijing 2022’s low-carbon focus areas, their key objectives and the achievements as of December 2021.

Table 5 Summary of carbon emission reduction measures for the Beijing 2022 Games

Carbon reduction measures	Carbon emission reductions (10,000 t-CO ₂ e)
Low-carbon energy	9.93
Low-carbon venues	5.87
Low-carbon transport	/(to be disclosed in the Post-Games carbon management report)
Actions of Beijing 2022	0.03
Total	15.83



4.2 Carbon reduction measures implemented for the Beijing 2022 Games

4.2.1 Low-carbon energy projects

1. Zhangbei renewable energy flexible Direct Current (DC) grid

The Zhangbei renewable energy flexible DC grid project will play an important role in providing renewable energy to all Beijing 2022 competition and non-competition venues in the Beijing, Yanqing and Zhangjiakou competition zones. It is the world's first four-terminal flexible DC power grid to transport large-scale wind and solar power. The project is estimated to transmit about 14.1 billion kWh of clean energy to Beijing annually, equivalent to approximately 10% of the electricity consumption of Beijing. The project fully meets the conventional electricity demands of the Games venues, significantly increases the proportion of the consumption of electricity generated from clean sources in Beijing, and contributes to the low-carbon transformation and development in Beijing.



Figure 8 Zhangbei flexible DC power grid demonstration project

Construction of the Zhangbei flexible DC grid project started in February 2018 and was operational in June 2020. From 2019 to 30 June, 2021, the 21 competition and non-competition Beijing 2022 venues, together with Beijing 2022's Shougang office area, have all been powered by renewable energy provided by the Zhangbei flexible DC power grid project. The renewable energy transaction settlement volume was 162.78 million kWh²⁰.

²⁰ The amount of green electricity used within the emission accounting boundary

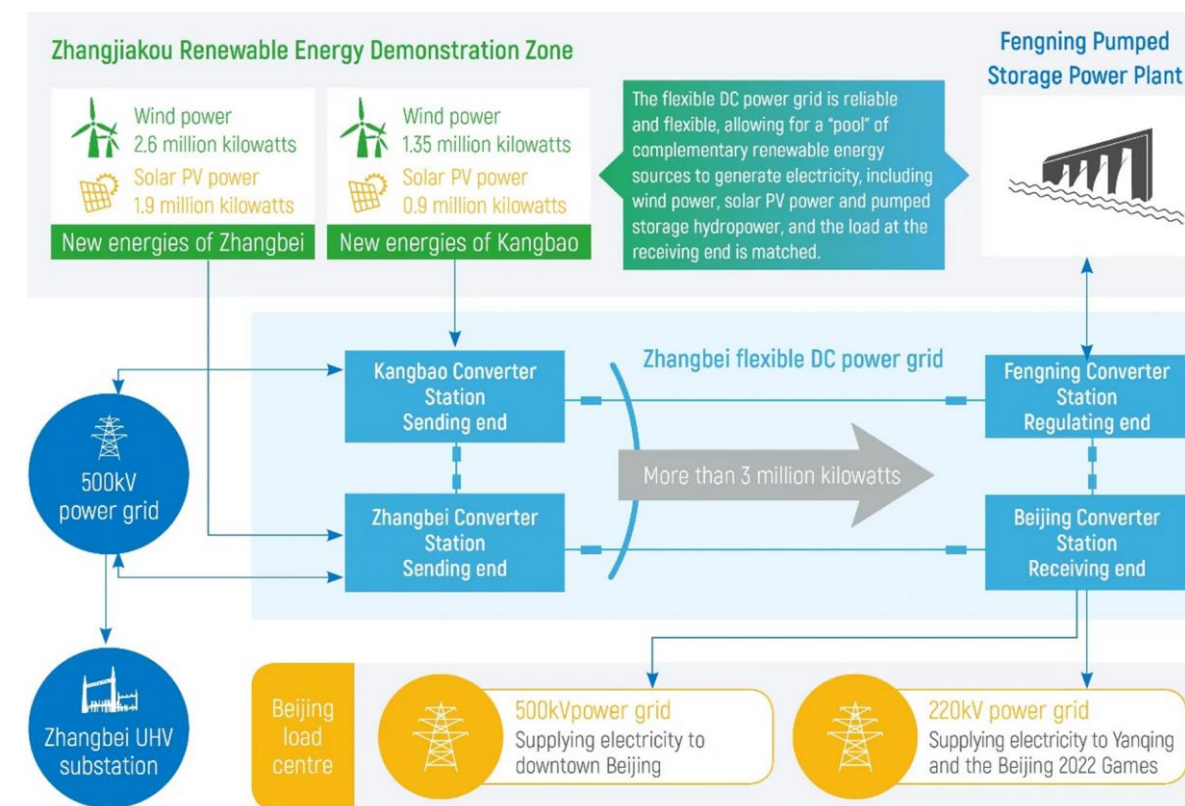


Figure 9 Schematic Diagram of the Zhangbei Flexible DC Power Grid Project

2. A new Green Energy Trading Mechanism

In 2018, Beijing 2022 created a working group with the host city governments of the Beijing 2022 Games, energy companies and trading centres, and other relevant entities to conduct research on the operational process, implementation plan and safeguarding measures of renewable electricity trading. The working group developed an implementation plan for purchasing renewable energy by the owners/operators of the Beijing 2022 venues and related supporting facilities. The trans-regional renewable energy purchasing mechanism has been established and implemented for the Beijing 2022 Games, making it possible that all venues will be 100% powered by renewable energy.

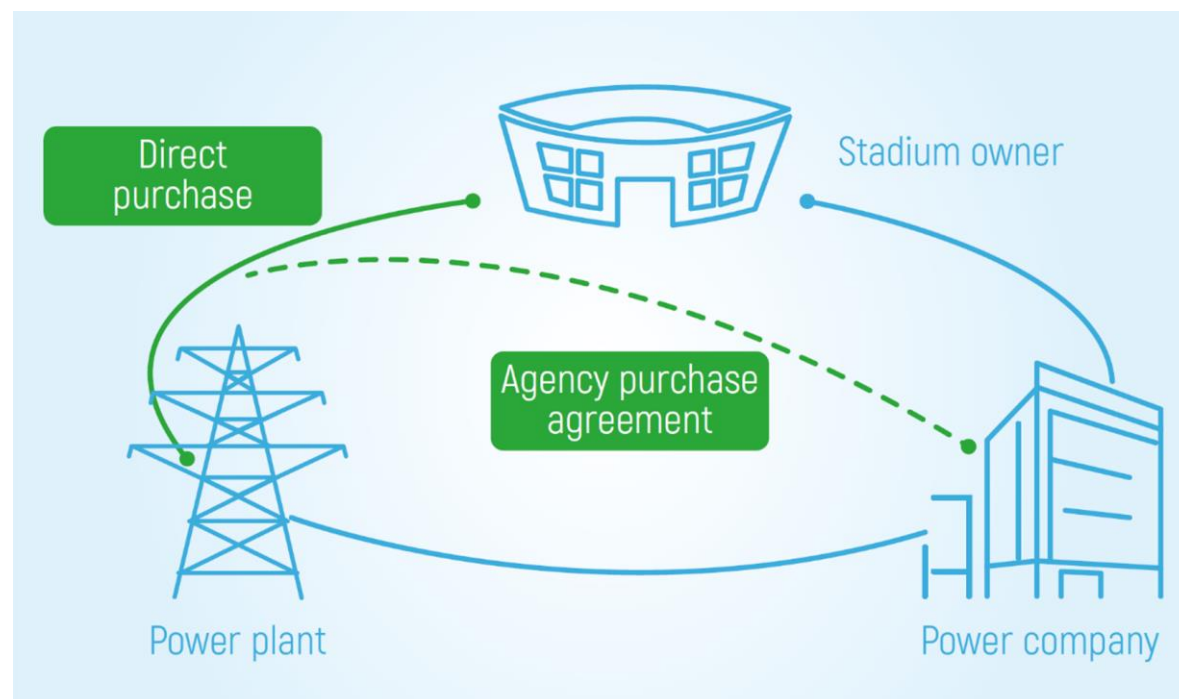


Figure 10 Zhangbei renewable energy flexible DC grid

4.2.2 Building low-carbon venues

The construction of new venues and the transformation of existing ones were completed in 2016. A series of low-carbon initiatives were implemented during the planning and construction stages of each venue.

1. Meeting China Assessment Standard for Green Building

By end of June 2021, six indoor venues, the National Speed Skating Oval, the Main Media Centre, the Wukesong Ice Hockey Training Hall, the Beijing Olympic Village, the Yanqing Olympic Village and the Zhangjiakou Olympic Village have been certified as 3-star green buildings – the highest rating – according to the China Assessment Standard for Green Building (GB/T 50378-2019). The following six outdoor venues were also awarded 3-star green building certification: the Big Air Shougang, the National Skiing Centre, the National Sliding Centre, the National Cross-Country Skiing Centre, the National Ski Jumping Centre, the National Biathlon Centre and the Genting

Snow Park. The existing National Aquatics Centre, the National Indoor Stadium and the Capital Indoor Stadium venues have been certified as 2-star green buildings.

2. Compilation of the Evaluation Standard for Green Snow Sports Venues (Beijing/Hebei)

Evaluation Standards for Green Snow Sports Venues

In response to the lack of domestic and international green building standards for snow sports venues, Beijing 2022 compiled the Evaluation Standard for Green Snow Sports Venues (DB11/T 1606-2018) to promote the construction of green snow sports venues of the Beijing 2022 Games. It was published and put into effect on 1 January 2019 as a local standard jointly recognized and followed by Beijing, Tianjin and Hebei Province. According to the Standards, the green snow sports venues are rated with one-star, two-star or three-star ratings – three star being the highest. The implementation of the Standards improved the green construction of the snow sports venues of the Beijing 2022 Games. It addresses areas such as land saving, energy reduction, water use, material management and indoor air quality into venue design and construction.

Seven snow sport venues, including the Big Air Shougang, the National Alpine Skiing Centre, the National Sliding Centre, the National Cross-Country Skiing Centre, the National Ski Jumping Centre, the National Biathlon Centre and the Genting Snow Park are all built according to the 3-star standard of the Evaluation Standards for Green Snow Sports Venues.

The key low-carbon construction initiatives adopted by the snow sport venues are:

- Adopting an energy saving design – the energy saving rate is 11.3% relative to the energy consumption per unit area of the building; 100% use of renewable energy through the Zhangbei flexible DC grid project;
- Utilizing earth and stone from local constructions to build structures such as retaining walls and tree surrounds, 310,000 m² of local waste stone was reused in the Yanqing Competition Zone;
- Adopting detachable prefabricated steel frames, recyclable structures, building materials/products with green certification and local materials for temporary facilities.

3. Building ultra-low energy consumption projects

The Polyclinic of the Beijing Olympic and Paralympic Village, the D6 (building number) area of the Yanqing Olympic and Paralympic Village and the Wukesong Ice Sports Centre are 3 ultra-low-energy projects, which minimize the heating and cooling needs of the buildings, are powered by renewable energy sources, and achieve significant energy savings and consumption reductions. The buildings cover 1,358 m², 10,856 m²

and 38,960 m² respectively. These ultra-low energy projects apply energy-efficient designs and new technologies to make buildings operate more efficiently.

Wukesong Ice Hockey Training Hall:

- The solution dehumidification system is adopted in ice rinks, and saving energy at a rate of up to 77.1% compared with the traditional electric rotary wheel dehumidification system;
- High-performance glass curtain wall with heat transfer coefficient lower than 1.0 is used in large areas;
- Re-insulation design is conducted for the ice rink area.



Figure 11 Wukesong Ice Hockey Training Hall

4. Focusing on low-carbon design and recycling of building materials

During the design phase, a material-saving optimization design was adopted for all Beijing 2022 venues, and priority was given to the use of renewable/recyclable building materials. Besides, concrete and other building materials were recycled, and extensive research was conducted on recycled materials prior to selection and usage in order to ensure their quality and durability.

For the **National Speed Skating Oval**, attention was paid to material-saving and optimization design:

- It has a saddle-shaped cable mesh roof using high Vanadium carbon steel cables. Through computer-aided simulations of the cable tension construction process, the stress state of the cable network in the construction process is precisely controlled to optimize the extent of tension. This method achieves 20,000 m² of column-free space, and uses only about a quarter of the steel used for a traditional steel roof.
- Waste building materials were fully recycled. 654 pile heads collected from the construction site were crushed, screened, cleaned, processed and made into concrete grandstand boards to achieve self-enclosed recycling. The total amount of recycled concrete used for the grandstand boards is about 750 m³. Furthermore, recycled rock-fill concrete was used to backfill the foundation groove, thereby reducing the use of concrete and the hydration heat of concrete and improving the quality of the backfill.
- Air source heat pump
- Wind-solar complementary lighting system



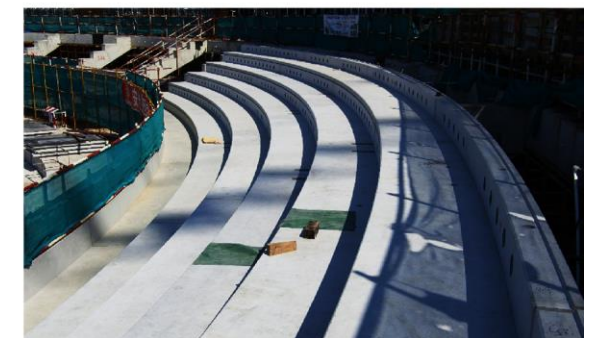
a) Cable Mesh Roof



b) Air Sourced Heat Pump



c) Wind-Solar Complementary Lighting System



d) Crushed and Recycled Concrete Pile Heads

Figure 12 Low-carbon measures implemented at the National Speed Skating Oval

5. CO₂ ice cooling system to reduce carbon footprint

The lowest-carbon CO₂ trans-critical direct refrigeration technology has been installed at five ice surfaces in four of the ice sport venues, namely the National Speed Skating Oval, the Capital Indoor Stadium, the Short Track Speed Skating Training Hall and the Wukesong Ice Hockey Training Hall. CO₂ refrigerant's Ozone Depletion Potential (ODP) is 0 and its Global Warming Potential (GWP) is 1. Refrigerant R449, which has a low GWP, will be used in the ice hockey and curling venues. Compared with the traditional refrigeration technology, CO₂ refrigeration can significantly reduce the power need of the refrigeration system, thereby saving energy and achieving higher quality ice surfaces.

Table 6 Ice Surface Refrigeration System of the Beijing 2022 Games

Venue	Ice Surface used for the Games	Refrigerant
National Speed Skating Oval	1 piece (permanent/new)	CO ₂
National Aquatics Centre	1 piece (temporary/new)	R449A
National Indoor Stadium	2 pieces (permanent/new)	R449A
Wukesong Ice Hockey Training Hall	2 pieces (permanent/new)	CO ₂
Wukesong Sports Centre	1 piece (permanent/rebuilt)	R449A
Capital Indoor Stadium	1 piece (permanent/new)	CO ₂
Short Track Speed Skating Training Hall	1 piece (permanent/new)	CO ₂

6. Smart snow making

The snow venues of the Beijing 2022 Games have adopted smart snow making technology to control the amount of snow needed and improve energy efficiency of snow making. Compared with the traditional technology, it can save up to 20% of water by realizing optimal allocation and accurate delivery of water resources. Meanwhile, mobile snow making can be more targeted and can flexibly supplement snow in different competition locations so as to significantly reduce water usage and water waste. Oil-free compressors are adopted as the core component of the snow making machines to achieve highly efficient snow making without oil discharged into the air, thus minimizing adverse environmental impacts.

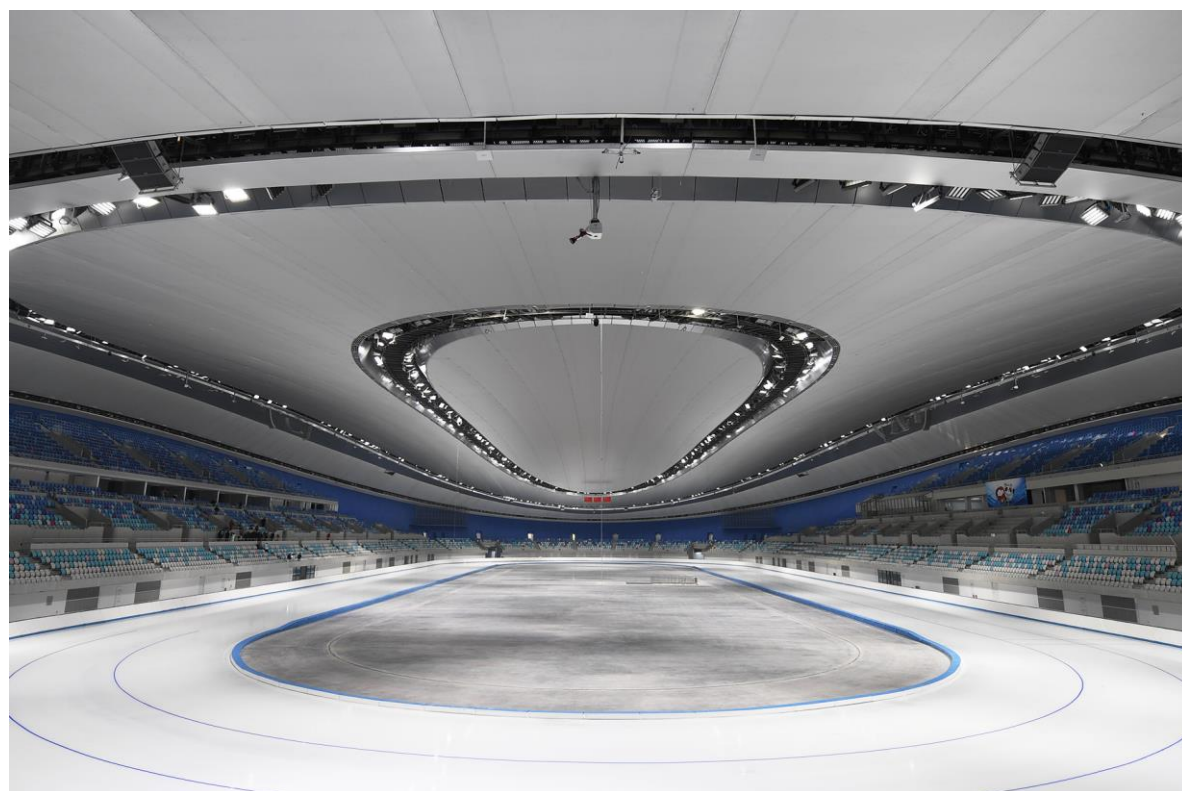


Figure 13 12,000 m² Ice Surface of the National Speed Skating Oval



Figure 14 Mobile Snow Making Machine of the Zhangjiakou Guyangshu Venue

Other water-saving approaches²¹ that were applied during construction include using water-saving equipment and giving priority to non-traditional water resources. In the National Speed Skating Oval, the main Media Center (MMC) in Beijing, and other venues, rainwater was collected by concave green space and collection pools and then used for irrigation and landscape water features. In Yanqing and Zhangjiakou competition sites, the exposed ground was covered with soil and vegetation so that surface water, rainwater and snowmelt can permeate the ground, thereby reducing soil erosion.

The “sponge” design with “infiltration, retention, storage, purification, utilization, and drainage” as the core idea has been implemented in the three competition sites to achieve efficient use of water resources. A well considered sponge city design will reduce the frequency and severity of floods, improve water quality and reduce water waste while also improving air quality and reducing the urban heat island effect.



Figure 15 Guyangshu Cluster reservoir in the Zhangjiakou Zone

4.2.3 Building a low-carbon transport system

1. Implementing the clean-energy vehicle service plan

During the Beijing 2022 Games, according to our objective that “the transport within the Beijing Zone will mainly rely on pure electric and natural-gas-based vehicles, while hydrogen fuel cell vehicles will be deployed in the Yanqing and Zhangjiakou zones”, the areas covered by vehicle movements will be assessed comprehensively, such as the three competition zones, long distances, low temperatures, mountain roads and slippery surfaces on snowy days. On the premise of safety, fuel efficient and clean-energy vehicles will be used as much as possible to reduce carbon emissions.

A total of 4,090 vehicles will be used during the Beijing 2022 Games, including 2,205 vehicles provided by Worldwide TOP Partner, Toyota. In total there are 816 hydrogen-based vehicles, 370 pure electric vehicles, 478 natural gas-based vehicles, 1,807 hybrid vehicles and 619 conventional-energy vehicles. Fuel efficient and clean-energy vehicles will account for 100% of all passenger cars and 84.9% of all vehicles.

2. Improving the efficiency of transport operations

The Beijing 2022 Games has developed a comprehensive plan to provide efficient transport services. The plan will strongly rely on the large-scale event experience of professional transport enterprises to carry out scientific scheduling and reasonable transport capacity allocation, thus improving the operational efficiency. Additionally, special Olympic lanes will be secured around all competition and non-competition venues to reduce travel times. In the Beijing Competition Zone, the Olympic lanes and urban bus transit lanes will be secured in the relevant areas and road sections; in the Yanqing and Zhangjiakou zones, some Olympic lanes will be merged with the bus transit lanes. Finally, the low-carbon bus fleet and high-speed rail will be used by all Beijing 2022 staff, volunteers, and ticketed spectators.

²¹ Which is in scope 3 of emission accounting methodology

3. Full application of intelligent transport systems and management measures

Transport policies will be implemented during Games-time to ensure Beijing 2022 staff, volunteers and ticketed spectators have priority access on rail, bus and subway transportation. In addition, a “transport resource management system” will be set up in the Beijing 2022 Games Transport Operations Command Centre to:

<p>1</p> <p>Achieve real-time monitoring, vehicle scheduling, data analysis and other related functions of transport services and the utilized vehicles to optimize the overall scheduling during Games-time;</p>	<p>2</p> <p>Improve emergency rescue efficiency and accelerate traffic dispersion;</p>	<p>3</p> <p>Release transport service information in a timely manner so that the registered personnel know the arrival and departure times of the shuttle buses in advance, and make travel route planning in advance, thus improving the accuracy of transport services.</p>
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4.2.4 Actions of Beijing 2022

1. Creating a new landmark of urban regeneration in the Shougang Area

Due to the staging of Beijing 2008 and the effort to reduce pollution while promoting socio-economic development, the steel plant of Shougang Group in Beijing was shut down and relocated.

In 2016, Beijing 2022 moved into Shougang Park. In 2018, Shougang Group signed the agreement with Beijing 2022 to become the Official Partner of Urban-renewal Services of the Beijing 2022 Games.

Shougang seized the strategic opportunity to combine: the creation of a new landmark in Beijing, as part of the drive of urban renewal; the regeneration of the old industrial park; the development of the company toward energy-saving and pollution-free business; and the staging of the Beijing 2022 Games.

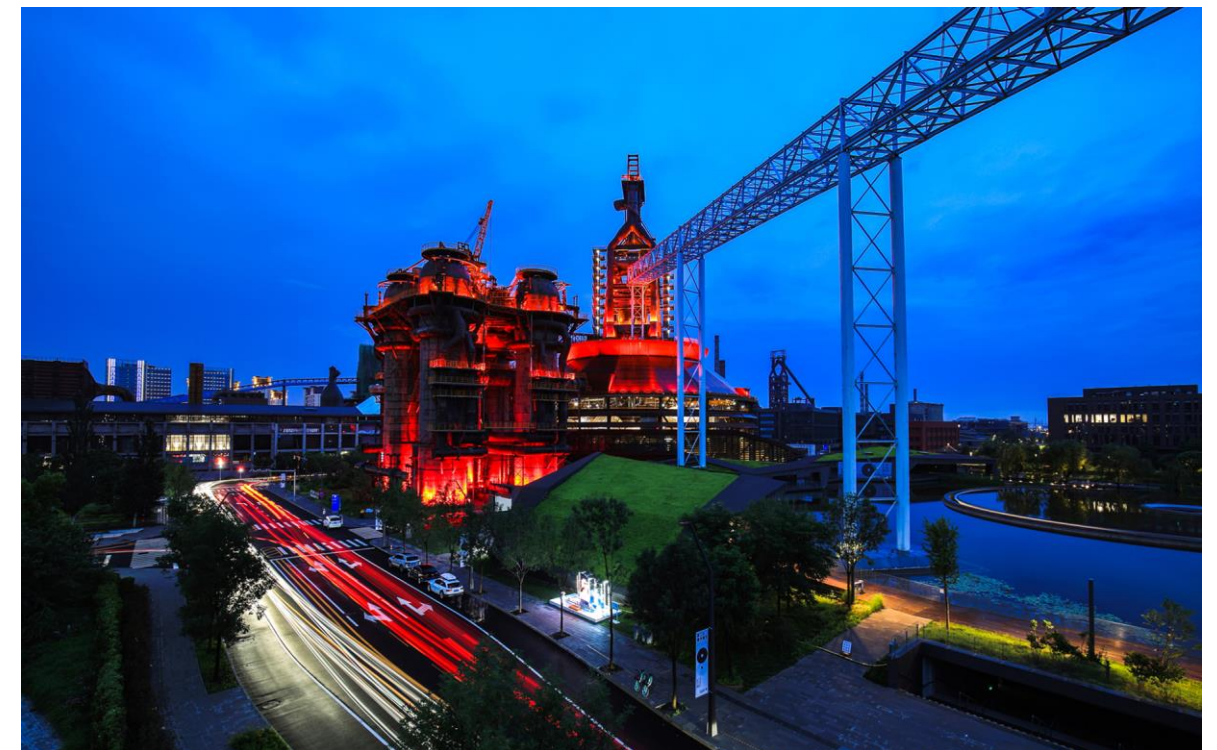


Figure 16 New Shougang Park

2. Maximum use of renewable energy

Since 2017, the gas water heaters in the restaurants and office buildings of Beijing 2022 have been supplied by solar energy and natural gas. The implementation of this measure contributes to natural gas saving by 1/3 and carbon emissions reduction by about 30 tonnes every year.

Meanwhile, a distributed grid-connected photovoltaic project has been installed in the silos of the Beijing 2022 office area. It is estimated that more than 4,000 kWh of grid-connected electricity can be realized each month. The exhibition hall and conference building of Beijing 2022 are equipped with energy storage devices to effectively improve the reliability of power supply and realize the economic power consumption strategy of peak-load periods. Furthermore, by the end of September 2021, a total of 22.26 million kWh of renewable energy had been purchased for the office area of Beijing 2022.

3. Classifying waste in the office area of Beijing 2022

Beijing 2022 separates all office waste and sends waste that can be recycled to a waste treatment plant for processing. It achieves zero landfill treatment of conventional waste, and the proportion of garbage incineration has reached 70%²².

4. Establishing a comprehensive monitoring and reporting mechanism

A comprehensive monitoring and reporting mechanism for GHG emission data of the Beijing 2022 Games has been established, and this mechanism determines accounting boundaries, emission sources and accounting methods for the Beijing 2022 Games. It also provides the GHG emission monitoring and reporting form for all relevant entities to report their carbon emission accounting work including all related emission sources. Each reporting entity is required to monitor and regularly log relevant statistics on the level of activities related to their emission sources each year and report to the General Planning Department of Beijing 2022.

Olympic and Paralympic Winter Games Beijing 2022
Carbon Management Plan

Source: Beijing 2022

24/06/2019 11:00



Figure 17 Low-Carbon Management Programme for the Beijing 2022 Games

²² Energy Saving, Consumption Reduction and Climate Change Plan of Beijing during the “13th Five-Year” Plan Period.

5. Sharing knowledge on low-carbon management

Beijing 2022 has actively organized educational activities in and around Beijing to share information on climate change and details on the low-carbon management plan of the Beijing 2022 Games. Beijing 2022 has also participated in international climate-related events such as UNFCCC COP25 in order to learn and to share its learnings.

2018

National Low-carbon Day in China(13th June)

Beijing 2022—together with the Ministry of Ecology and Environment, and the Beijing Municipal People’s Government—organized a public event, in which Beijing 2022 official partners signed the “Beijing 2022 Low-carbon Games Initiative” to raise awareness of climate change to promote and implement low-carbon initiatives.

2019

International Olympic Day (23th June)

Beijing 2022 officially published the Low-Carbon Management Programme for the Beijing 2022 Games. The programme is an important commitment to addressing climate change and an important measure to “stage a green Games”. It formulates 18 measures, defining the overall objectives and measures for the low-carbon management of the Beijing 2022 Games.

2020

National Low-carbon Day in China (2nd July)

Beijing 2022 officially launched the WeChat mini-programme “Low-carbon Beijing 2022 Games” to raise climate awareness and create action.

2021

26th May

Beijing 2022 held a low-carbon Games press conference to national and international media to share progress on the implementation of the Beijing 2022 low-carbon management programme.

4.3 Implementing carbon compensation measures

Carbon compensation for the Beijing 2022 Games focused on afforestation projects and Partner donations. During the bidding phase of the Beijing 2022 Games, it was decided that afforestation projects would be implemented in the competition zones as the primary compensation measure. The carbon sequestration periods for the Zhangjiakou and Beijing afforestation projects were January 2016 – November 2021 and January 2018 – August 2021 respectively. The carbon credits have been measured and certified by a third-party entity and provided to Beijing 2022.

Table 7 Implementing carbon compensation measures

Compensation measures	Expected Emissions (t-CO ₂ e)
Beijing Afforestation and Greening Project	530,000
Beijing-Hebei Afforestation Project for Ecological Water Source Protection	570,000
Partner sponsoring	600,000
Total	1,700,000

4.3.1 A New Round of Afforestation Projects in Beijing

Based on the new afforestation projects (the Carbon Neutralization and Sustainable Ecological Improvement Project in Beijing in Support of the Beijing 2022 Games) from 2018 to 2020, approximately 530,000 tonnes of forestry carbon sequestration have been provided to Beijing 2022 to compensate its residual carbon emissions and achieve its objective of carbon neutral Games.

According to the annual statistics of the implementation plan of the Beijing afforestation projects, the following figures were recorded:

- 2018: 14,721.51 hectares planted;
- 2019: 19,669.75 hectares planted;
- 2020: 12,946.68 hectares planted.

This totals an amount of 47,337.94 hectares.

The details of the Beijing afforestation projects are listed in Table 8 and Figure 18.

The Beijing afforestation projects include 17 tree species, such as white birch, platycladus orientalis, locust tree, oak, poplar and ginkgo.

Table 8 Summary of Afforestation Area of Each District and County in Beijing

District/County	Area of Forest Land (hectares)	District/County	Area of Forest Land (hectares)
Changping	7,689.77	Mentougou	3,441.96
Chaoyang	6,088.72	Miyun	3,295.72
Daxing	5,390.13	Pinggu	2,791.77
Fangshan	4,262.14	Shijingshan	1,627.03
Fengtai	4,089.85	Shunyi	673.68
Haidian	3,916.16	Tongzhou	236.70
Huairou	3,611.94	Yanqing	222.38
Total	47,337.94		

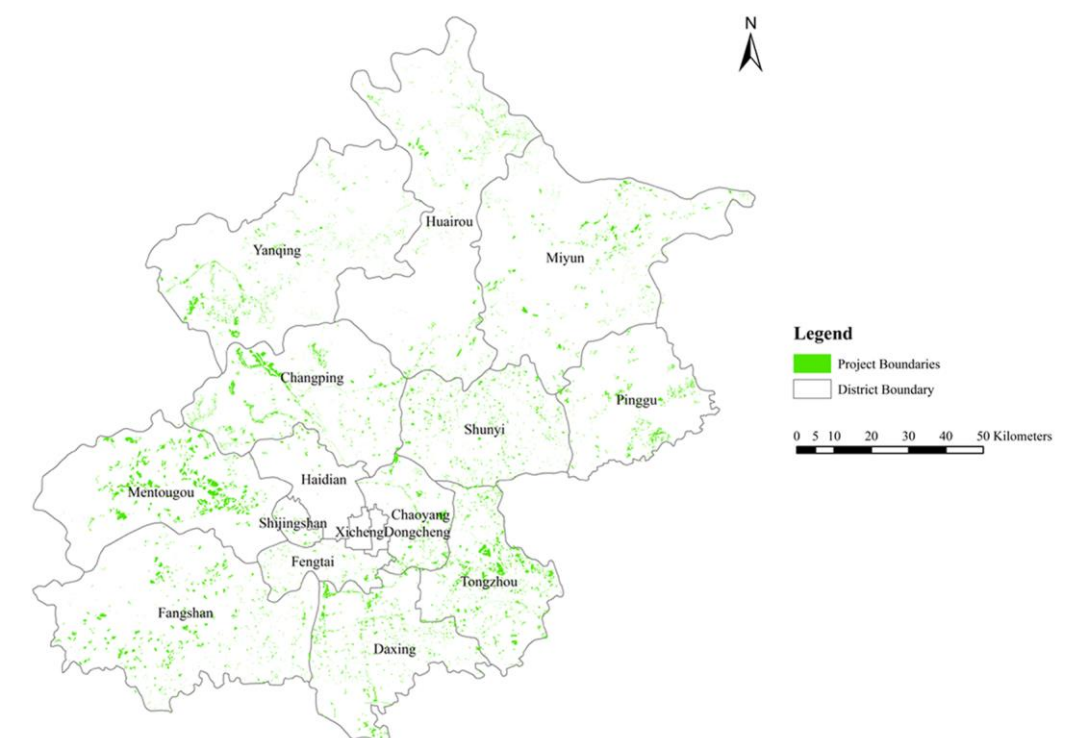


Figure 18 Geographical locations of the afforestation projects in Beijing

4.3.2 Beijing–Hebei Ecological Water Conservation Forest Project

Zhangjiakou City is responsible for implementing the Beijing–Hebei Ecological Water Conservation Forest Project (Table 9 and Figure 19). Zhangjiakou City authorities have measured, monitored and certified the carbon sequestration generated by the 33,396.36 hectares of forest from 2016 to 2021, approximately 570,000 tonnes of forestry carbon sequestration have been provided to Beijing 2022 to compensate its residual carbon emissions and achieve its objective of carbon neutral Games.

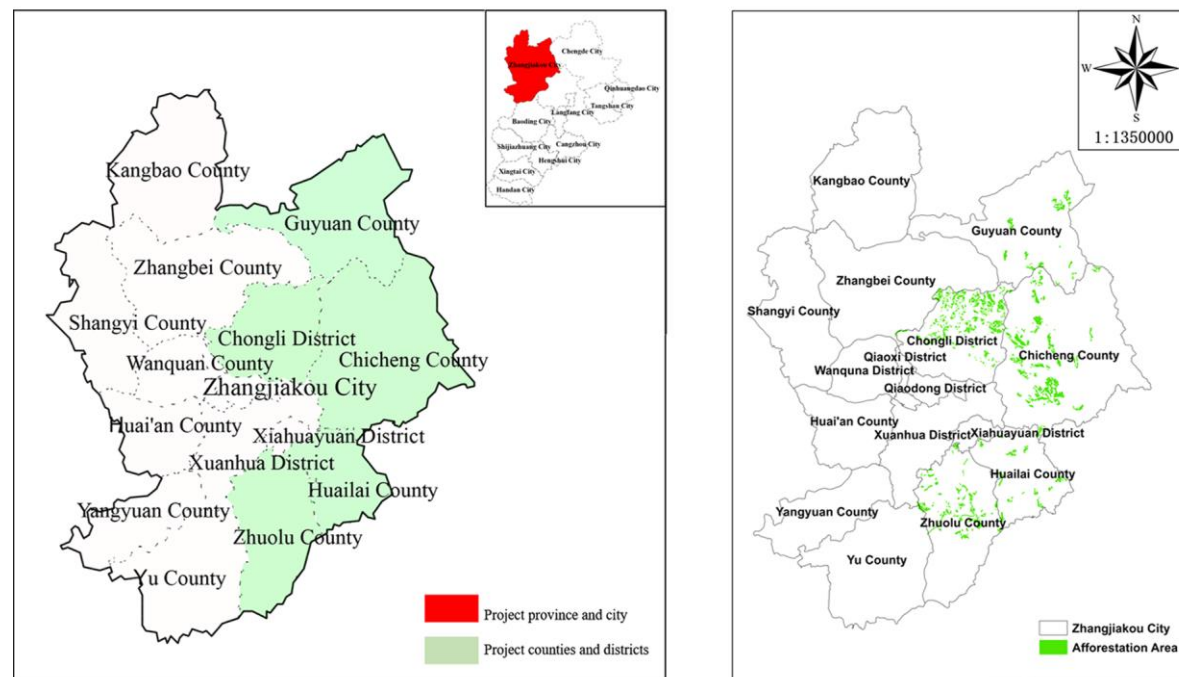


Figure 19 Afforestation Locations in Zhangjiakou, Hebei

Table 9 Summary of each district and county in Zhangjiakou, Hebei

County/District	Forest Area (hm ²)
Chongli District	10,277.31
Chicheng County	10,280.53
Guyuan County	3,252.87
Huailai County	3,248.94
Zhuolu County	6,636.72
Total	33,396.36

The afforestation projects in Zhangjiakou include tree species such as Chinese pine, larch, pinus sylvestris, platycladus orientalis, birch, Mongolian oak, golden elm, spruce, apricot, acer monoos.

4.3.3 The Beijing 2022 Games afforestation carbon sequestration certification and sponsorship process

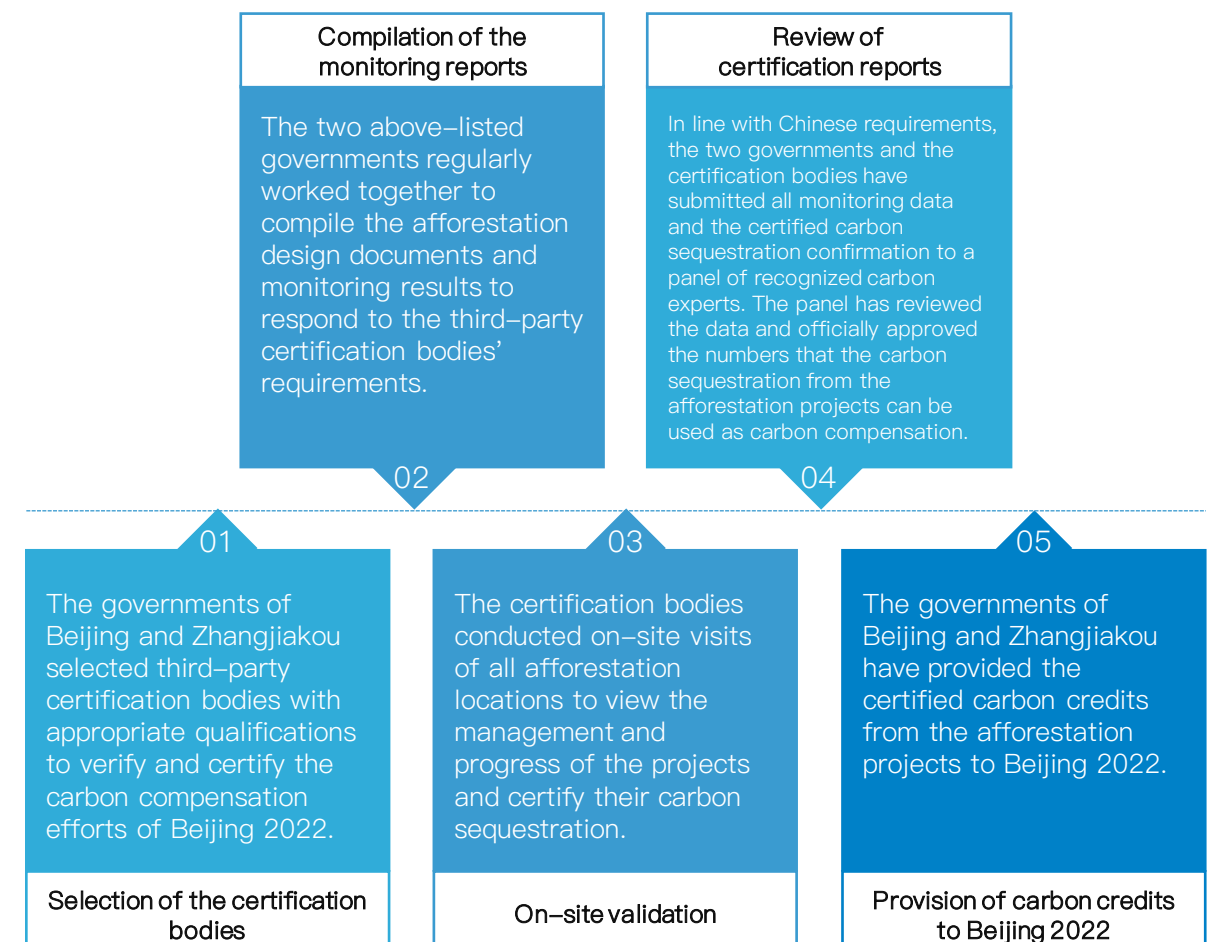


Figure 20 Beijing–Hebei Ecological Water Conservation Forest Project

4.3.4 Carbon credit sponsoring by Beijing 2022 Partners

Three national partners of the Beijing 2022 Games, PetroChina, the State Grid Corporation of China and the China Three Gorges Corporation, have sponsored compensation products (CCERs/CERs) to Beijing 2022 in an effort to assist in the realization of the carbon neutrality goal of the Beijing 2022 Games.

PetroChina purchased 200,000 CCERs (equivalent to 200,000 t-CO₂e) through open delisting and sponsored them to Beijing 2022; the State Grid Corporation of China actively explored technological innovation, took the initiative to develop emission reduction projects, and sponsored 200,000 CCERs (equivalent to 200,000 t-CO₂e) to Beijing 2022. The China Three Gorges Corporation sponsored 200,000 CERs (equivalent to 200,000 t-CO₂e) to Beijing 2022.

4.3.5 Advancing steadily the innovation in the carbon GSP system

In July 2020, Beijing 2022 officially launched the WeChat mini-programme “Low-carbon Beijing 2022 Games”. In August 2021, the mini-programme 2.0 was officially launched in both Chinese and English. It records the user’s low-carbon behaviour trajectory and helps to encourage and guide the general public to pursue a low-carbon life. As of December 2021, 110,324 people had registered for the mini-programme.

This Greenhouse Gas Verification Statement is provided by China Environmental United Certification Center Co., Ltd., who conducted an independent verification on the Beijing 2022 carbon methodology, calculations and compensation.

Greenhouse Gas Verification Statement

No: CEC-2021-CN-E-0010

Scope and Principles of Verification:

China Environmental United Certification Center Co., Ltd. (hereinafter referred to as "CEC") was entrusted by the Beijing Organising Committee for the 2022 Olympic and Paralympic Winter Games (hereinafter referred to as "Beijing Organising Committee") to conduct independent verification on the low-carbon management report of Beijing 2022 Olympic and Paralympic Winter Games (hereinafter referred to as "Beijing 2022"). Scope of verification: The scientificity of accounting method adopted by the Carbon Management of Beijing 2022; baseline of greenhouse gas emission and the completeness, accuracy and rationality of emissions; authenticity and accuracy of emission reduction; the prudent and reasonable compensation measures and the uniqueness and authenticity of the compensation amount.

CEC has carried out inspections based on internationally recognized standards and guidelines, including ISO14064-1 *Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals*, ISO14064-2 *Specification with Guidance at the Project Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals*, IOC *Carbon Footprint Methodology For The Olympic Games*, LONDON 2012 *Carbon Footprint Study-Methodology and Reference Footprint* and relevant Chinese laws and regulations.

Declaration of Independence and Competence:


CEC is a professional third-party certification organization approved by the Certification and Accreditation Administration of The People's Republic of China. Based on recognized quality and integrity, CEC provides global assessment and certification services in the field of climate change and eco-environmental governance. CEC declares that it has no conflict of interest with the Beijing Organising Committee or its interested parties.

Verification Opinions:



Based on the above verification basis, CEC confirmed that the Olympic Low-carbon Management Report comprehensively and truly elaborated the Olympic carbon management plan and specific measures, and the information and data related to baseline emissions, actual emissions and emission reduction contained in the report were true, accurate and complete.

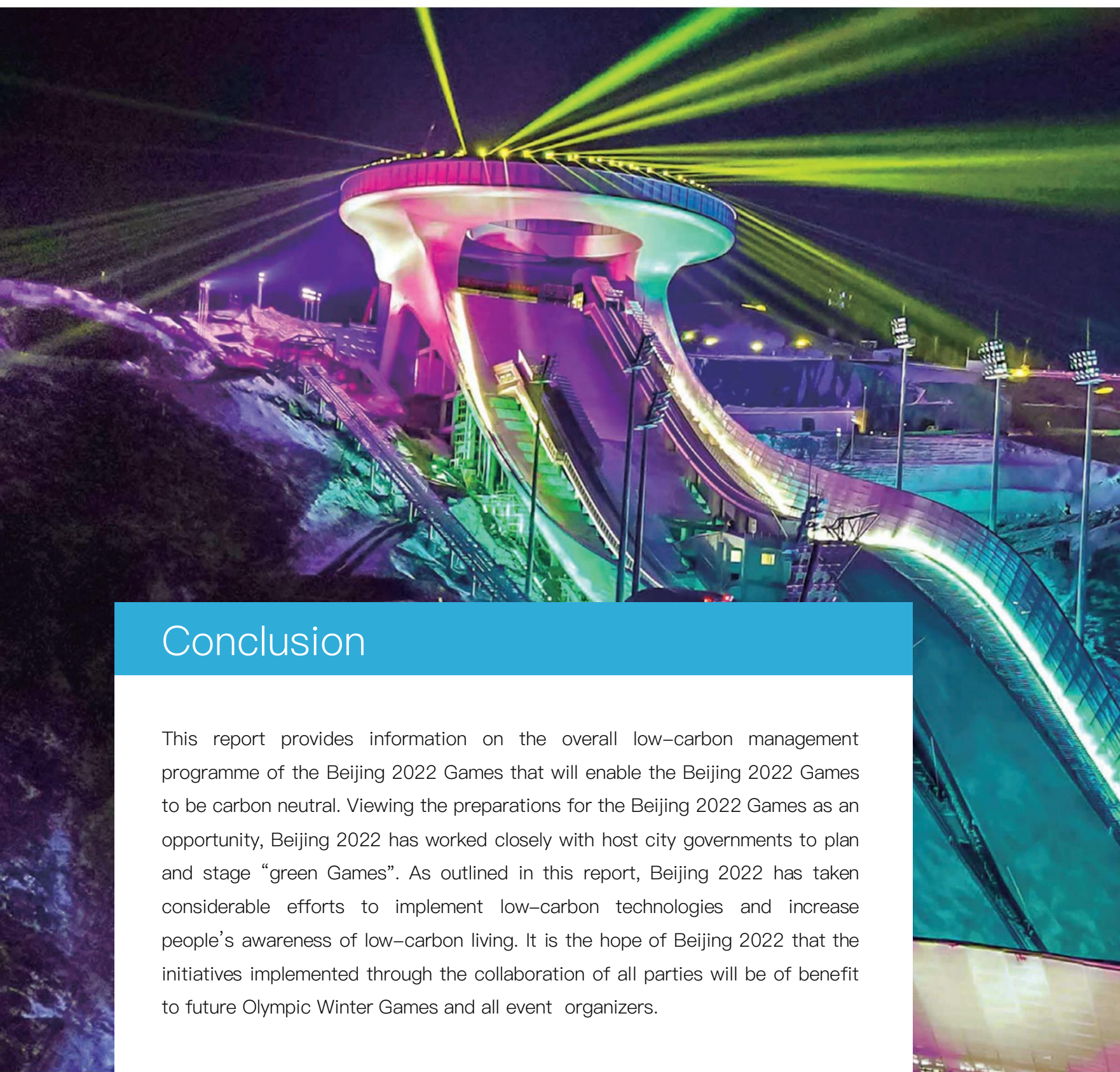
- Carbon Emission Accounting Method: The carbon emission accounting method of Beijing 2022 is scientific and reasonable, which can ensure a true, accurate and complete accounting of baseline emissions, emission reduction and actual emissions.
- Emissions: The main emission sources involved in Beijing 2022 include the office activities of the Organizing Committee, travels of international Olympic community (expensed by Beijing 2022), venue construction and operation, transportation infrastructures and audiences. The baseline emission estimate is reasonable, the data of activity level used to calculate the actual emissions are all of physical quantity, some localization factors was adopt, and calculations of emissions are true, accurate and complete.
- Emission Reduction Actions: The Beijing 2022 has issued the *Olympic and Paralympic Winter Games Beijing 2022 Carbon Management Plan*, which specifies the low-carbon emission reduction actions that each department can take, and calculates the actual emission reduction after comparing the emission reduction measures already implemented with the set benchmark. CEC confirms that low-carbon measures have been effectively implemented and the quantitative results of emission reduction are accurate and reasonable.
- Carbon Offsetting Measures: The Beijing 2022 has formulated the *Carbon Neutrality Implementation Plan*, which clarified the responsibilities and guarantee mechanism of relevant departments in Beijing and Zhangjiakou (Hebei) to implement the carbon neutrality plan. The afforestation carbon sinks donated by the two host cities of Beijing and Zhangjiakou (Hebei), as well as the voluntary carbon credits from sponsors, will help the Beijing 2022 offset inevitable carbon emissions and become carbon neutrality after efforts to reduce emissions.

China Environmental United Certification Center Co., Ltd.

General Manager  31/12/2021

China Environmental United Certification Center Co., Ltd. <http://www.meecec.com>



Conclusion

This report provides information on the overall low-carbon management programme of the Beijing 2022 Games that will enable the Beijing 2022 Games to be carbon neutral. Viewing the preparations for the Beijing 2022 Games as an opportunity, Beijing 2022 has worked closely with host city governments to plan and stage “green Games”. As outlined in this report, Beijing 2022 has taken considerable efforts to implement low-carbon technologies and increase people’s awareness of low-carbon living. It is the hope of Beijing 2022 that the initiatives implemented through the collaboration of all parties will be of benefit to future Olympic Winter Games and all event organizers.

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