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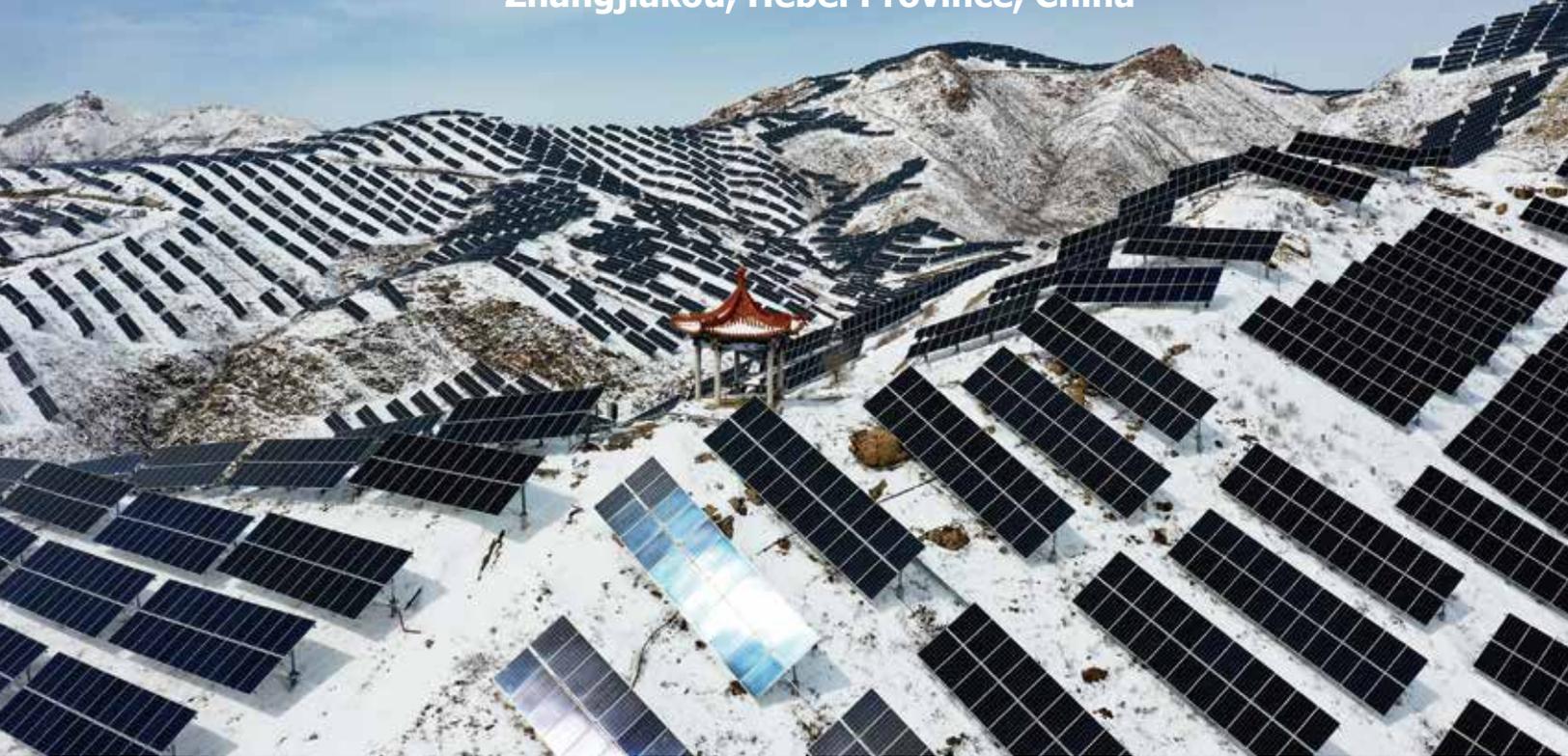
## China's First Winter Olympics

Science and technology security refers to the security of science and technology itself and the technological support for safeguarding the security of related fields. Covering a variety of aspects such as technological personnel, facilities and equipment, scientific and technological activities and outcomes and the application of outcomes, science and technology security serves as a major supporting force and the technological foundation of national security.



Science and  
Technology  
Security

## A photovoltaic power plant on the north mountain of Caozhuangzi Village in the Xuanhua district of Zhangjiakou, Hebei Province, China



### China's Green Winter Olympics

[1] Climate change is the greatest threat humanity has ever faced and has the potential to destroy life as we know it on Earth. According to experts, we have just under a decade in which to prevent irreversible damage from climate change! If left unchecked, rising temperatures will make more and more places on Earth unlivable for humans while reducing food production and drying up water supplies. And this is just the **tip of the iceberg!** As a result, finding new ways to combat climate change is a priority for many countries (ecological security). Advancements in technology have contributed to the current climate crisis, but at the same time, new technological innovations (science and technology security) may be the key to solving the problem. This might involve finding new ways to repair the damage caused by human pollution, inventing new and more effective forms of clean renewable energy, and developing new technology for capturing carbon

dioxide from the atmosphere. In view of this, China made good use of the 2022 Winter Olympics to safeguard its ecological and science and technology security by investing into renewable energy research and developing green technology and infrastructure.

[2] As you may be aware, winning the bid for an Olympic event is a **monumental** occasion for any country as it presents an excellent opportunity for economic growth via international exposure, increased tourism, rural vitalisation and other economic ventures. China, who hosted the Winter Olympic Games for the first time in 2022, had big ambitions for the event. During their bid for the 2022 Winter Olympics back in 2015, China promised to deliver a Green (carbon-neutral) Olympics, a first in history. Carbon neutrality means having a balance between emitting carbon to and absorbing carbon from the atmosphere in carbon sinks.

**'For the first time in Olympic history, all 26 of the venues used in the 2022 Winter Olympics were powered with 100% renewable energy.'**

#### DID YOU KNOW

Beijing is the first city to ever host both a Summer Olympic Games (in 2008) and Winter Olympic Games (in 2022). This makes it the world's first Dual Olympic city.

## Green Venues

[3] For the first time in Olympic history, all 26 of the venues used in the 2022 Winter Olympics were powered with 100% renewable energy.<sup>2</sup> Only 12 of the 26 venues were used for sporting events (see table 1)<sup>3,4</sup>, the others were used for training, accommodation and press conferences. The venues in Beijing, one of the three competition zones, were completely powered by a flexible direct current (DC) power grid using electricity generated from wind and solar resources. This power grid is in Zhangjiakou and is able to deliver 22.5 billion kWh (kilowatt-hour) of electricity to the Capital each year, which is around one-tenth of the city's total consumption. It also helps to reduce carbon dioxide emissions by 2,040 tonnes and the amount of coal burned by 7.8 million tonnes each year.<sup>5</sup>

[4] China adopted various types of renewable energy sources for its topography to power the Olympics events.<sup>6</sup> A lot of the green energy came from the wind and solar farms around the city of Zhangjiakou. In February 2022, wind and solar energy generating capacity in Zhangjiakou was 16.4 gigawatts (GW) and 7.0 GW respectively. The city has more wind and solar energy than most countries. During the 2022 Olympics, over 60% of its energy came from wind and solar energy. In Hebei Province, only roughly 11% of its power generation was from wind and solar resources. When looking at China as a whole, the country's power generation from wind and solar resources was around 9%. In Beijing, about 98% of its power generation came from gas!

**Table 1: Green Venues Used for Sporting Events**

Zone	Venue	Description
Beijing	National Aquatics Centre (Water/Ice Cube)	The Water Cube hosted events like swimming and diving in 2008. It was transformed into an 'Ice Cube', which hosted the curling competitions in 2022.
	National Indoor Stadium	This stadium is nicknamed 'The Fan' because it looks like a traditional Chinese folding fan. It hosted the ice hockey events.
	Wukesong Arena	This arena is home to the basketball team Beijing Ducks. It was the main venue for the ice hockey events in 2022.
	Capital Indoor Stadium	Built in 1968, this stadium hosted the figure skating and short track speed skating competitions. The famous table tennis match for the Ping-Pong Diplomacy also took place here.
	National Speed Skating Oval	Nicknamed the 'Ice Ribbon', this venue was newly built to host the 2022 speed skating competitions.
	Shougang Ski Jumping Venue	Also called 'Big Air Shougang', this is the world's first permanent 'big air' venue for events like Big Air freestyle skiing and Big Air snowboarding.
Yanqing	National Alpine Ski Centre	The Alpine skiing events took place here. The Centre is made up of 7 different courses. The largest vertical drop is 900 m.
	National Sliding Centre	This is the first ever sliding track in China. It hosted the bobsleigh, skeleton and luge events.
Zhangjiakou	Biathlon Centre	The Biathlon and cross-country skiing events were hosted here.
	National Ski Jumping Centre	The Ski Jumping competitions took place here. It is nicknamed the 'Snow Ruyi' because it looks like a 'Ruyi sceptre', a Chinese symbol for power and good fortune.
	National Cross Country Centre	This venue was host to the cross-country and Nordic combined events (ski jumping and cross country skiing).
	Genting Snow Park	The Snow Park was host to the freestyle skiing and snowboarding events.

(Sources: Adapted from China Highlights and National World.)



▲ All Beijing 2022 Winter Olympics venues were powered with 100% renewable energy. Speed skating was one of the events in which China performed exceptionally well and won three gold medals.

## Green Technology & Infrastructure

[5] In a further effort to combat global warming, the Beijing Organising Committee for the 2022 Olympics and Paralympic Winter Games decided to use natural CO<sub>2</sub> refrigeration technology in its speed skating, figure skating and short track speed skating venues.<sup>7</sup> This decision was supported by the International Sports Federations and the International Olympic Committee, which provided guidance and technical expertise on the topic. This was the first time that CO<sub>2</sub> refrigeration systems were used in China and at the Olympics. CO<sub>2</sub> refrigerants are non-toxic, non-flammable and have a global warming potential (GWP) of just 1.<sup>8</sup> GWP measures how much effect a greenhouse gas has on global warming; the lower the GWP, the better it is for the environment. Using natural CO<sub>2</sub> refrigerants in the 2022 Winter Olympics helped to reduce carbon emissions equal to the annual output of approximately 3,900 cars (more than 26 million kilograms); to give a comparison, a similar carbon footprint reduction can also be achieved by planting more than 1.2 million trees. Using this technology at the 'Ice Ribbon', a new ice venue that hosted the speed skating events in Beijing, can improve ice-making efficiency by 30% and save 2 million kilowatts of electricity a year,<sup>9</sup> which helps to make the venue sustainable in the long run.

[6] For its ice hockey and curling events, Beijing 2022 used a refrigerant called R449A, which has a low global warming potential (GWP) of 1282. As a reminder, CO<sub>2</sub> refrigerants have an even lower GWP of just 1. Venues that needed to make ice all year round, such as the National Speed Skating Oval, used CO<sub>2</sub>. Venues that only needed to make ice occasionally, such as the National Aquatics Centre, used R449A. Out of the nine ice rinks used in the 2022 Olympics, five of them used CO<sub>2</sub>, while the other four used R449A. Interestingly, when organisers were planning the event, they first considered using refrigerant R507, which has a GWP of 3985! However, the organising committee finally decided to use greener alternatives.

[7] For its snow events, China relied 100% on **artificial** snow, a step up from the 2018 Winter Olympics in South Korea where 98% of the snow used was man-made. To make this snow, China used a new CO<sub>2</sub> refrigerant that is said to reduce carbon emissions to nearly zero.<sup>10</sup> The artificial snow was made using equipment such as pumping stations, water cooling towers, fan-driven snow generators and snowmaking guns.<sup>11</sup> However, there is a downside to using artificial snow. Creating artificial snow consumes large amounts of water and electricity. An estimated 49 million gallons of water (over 220 million litres) was used to create the snow!

[8] As part of their winning bid for the 2022 Winter Olympics back in 2015, China promised to turn 300 million<sup>12</sup> Chinese citizens into winter sports enthusiasts by the year 2025. Remarkably, just four short years after this promise, China had already achieved half of this target, with around 150 million<sup>13</sup> people across the country participating in ice and snow sports during the winter season of 2019-2020. The infrastructure is already in place to deal with the expected increase in energy usage. The illustration map in Figure 1 shows the renewable flexible DC grid in Zhangjiakou and nearby 2022 Olympics venues.

[9] To accommodate this upsurge in interest, China invested a total of CNY 900 billion (HKD 1.05 trillion) in the winter sports industry between 2017 and 2019. The total number of ski resorts was 770 in 2019, an increase of over 67% when compared to 2014, and the number of skiers had grown to nearly 14 million. According to a Chinese Ice & Snow Tourism Development Report released in 2020, the number of winter tourists is forecast to exceed 500 million and the winter sports industry's revenue is estimated to exceed CNY 1.1 trillion (HKD 1.28 trillion) by the year 2025.<sup>14</sup>

## Promoting Science and Technology Security

[10] The 2022 Olympics presented a good opportunity for China to develop new and innovative green technologies (science and technology security). By going green with the 2022 Olympics, China is also protecting its – and the entire world's – ecological security, which is concerned with protecting the air, land and water. National security domains form an integrated system. By accelerating the growth of its winter tourism sector, China used the opportunity to advance and safeguard its economic security interests. Finally, China also safeguarded its overseas interests security before, during and after the Olympics. In preparation for the event, the organising committee enhanced overseas relations by working closely with the International Sports Federations and International Olympic Committee. During the actual competition, athletes from all over the world competed together with a friendly spirit, which encouraged cultural exchange. China also enhanced its global reputation by showcasing to the

### DID YOU KNOW

Many European ski resorts have already seen a marked increase in visitors from mainland China, many of whom are beginners. During the 2018-2019 winter season, Switzerland saw an increase of 540% in Chinese tourists compared to a decade earlier.

**Figure 1: Zhangjiakou's DC power grid and nearby 2022 Olympics venues**



An illustration map showing the flexible DC power grid in Zhangjiakou and the locations of the converter stations, wind and solar farms, storage plants and Olympics venues.

world its technological prowess and commitment towards a greener, more sustainable future. Successfully hosting the 2022 Winter Olympics could have very well **paved the way for** future international cooperation opportunities, especially in matters related to technology and renewable energy research.

**‘A booming winter sports industry opens up many career opportunities. You could be a ski coach, sell winter sports equipment or even run a ski resort!’**

▼ A wind farm in the county of Zhangbei in Zhangjiakou, Hebei province, China



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**Questions (14 marks)**

a. Which of the following sporting events were held in Beijing venues during the 2022 Winter Olympics? (1 mark)

- (1) Ski jumping
- (2) Figure skating
- (3) Bobsleigh
- (4) Curling

- A. (1) and (2) only
- B. (1) and (4) only
- C. (2) and (3) only
- D. (2) and (4) only

A	B	C	D
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b. According to the article, which of the following statements are correct? (1 mark)

- (1) Zhangjiakou got more than 60% of its power from solar and wind during the Olympics.
- (2) All of the 26 green venues were used for sporting events during the Olympics.
- (3) The number of ski resorts in China had an increase of more than 67% from 2014 to 2019.
- (4) Beijing is the first city to host both the Summer Olympic Games and the Winter Olympic Games.

- A. (1) and (4) only
- B. (1), (2) and (3) only
- C. (1), (3) and (4) only
- D. (2), (3) and (4) only

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c. Based on the article, identify one feature about the 2022 Winter Olympics held in China. (2 marks)

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## Essential Concepts and Terms

### 1. Science and technology security 科技安全

**Definition** It refers to the security of science and technology itself and the technological support for safeguarding the security of related fields. Covering a variety of aspects such as technological personnel, facilities and equipment, scientific and technological activities and outcomes and the application of outcomes, science and technology security serves as a major supporting force and the technological foundation of national security.

### 2. Winter Olympic Games 冬季奧運會

**Definition** It is a major international sports event that is held every four years in places usually covered with snow and ice. Common sports events include ski jumping, freestyle skiing, ice hockey, snowboarding, speed skating, figure skating, bobsleigh and curling.

## English Corner

### 1. tip of the iceberg (idiom) 冰山一角

**Meaning** a small part of a much larger problem

e.g. These complaints from consumers are just the **tip of the iceberg**.

### 2. monumental (adjective) 巨大的

**Meaning** very big or great

e.g. His book is of **monumental** significance.

### 3. artificial (adjective) 人工的，人造的

**Meaning** made by humans, not natural

e.g. Some ski resorts use **artificial** snow rather than real snow.

### 4. pave the way for (idiom) 為... 做好準備

**Meaning** to make it easier for something to happen or for someone to do something

e.g. Good education **paves the way for** a successful future.

# Glossary

accommodate 為...提供空間	international cooperation 國際合作
artificial snow 人造雪	international exposure 國際曝光
atmosphere 大氣層	irreversible damage 不可逆轉的損害
Beijing 北京	monumental 留存於歷史上的
carbon emission 碳排放	non-flammable 不易燃的的
carbon footprint 碳足跡	non-toxic 無毒的
carbon neutrality 碳中和	prowess 高超的技能
climate change 氣候變化	refrigerant 製冷劑
CO <sub>2</sub> refrigeration 二氧化碳製冷	renewable energy 可再生能源
commitment 承諾	rural vitalisation 鄉村振興
cultural exchange 文化交流	science and technology security 科技安全
curling 冰壺運動	short track speed skating 短道速滑
direct current (DC) power grid 直流電網	solar farm 太陽能發電場
figure skating 花式溜冰	speed skating 速度滑冰
global warming potential (GWP) 全球變暖潛能	sustainable 可持續的
global warming 全球暖化	topography 地貌
greenhouse gas 溫室氣體	tourism 旅遊業
Hebei Province 河北省	upsurge 急劇上升
humanity 人類	water supply 供水
ice hockey 冰上曲棍球	wind farm 風力發電場
infrastructure 基礎建設	winter sports enthusiast 冬季運動愛好者
integrated 融合的	Zhangjiakou 張家口