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# Playing offense to create a sustainable Olympics

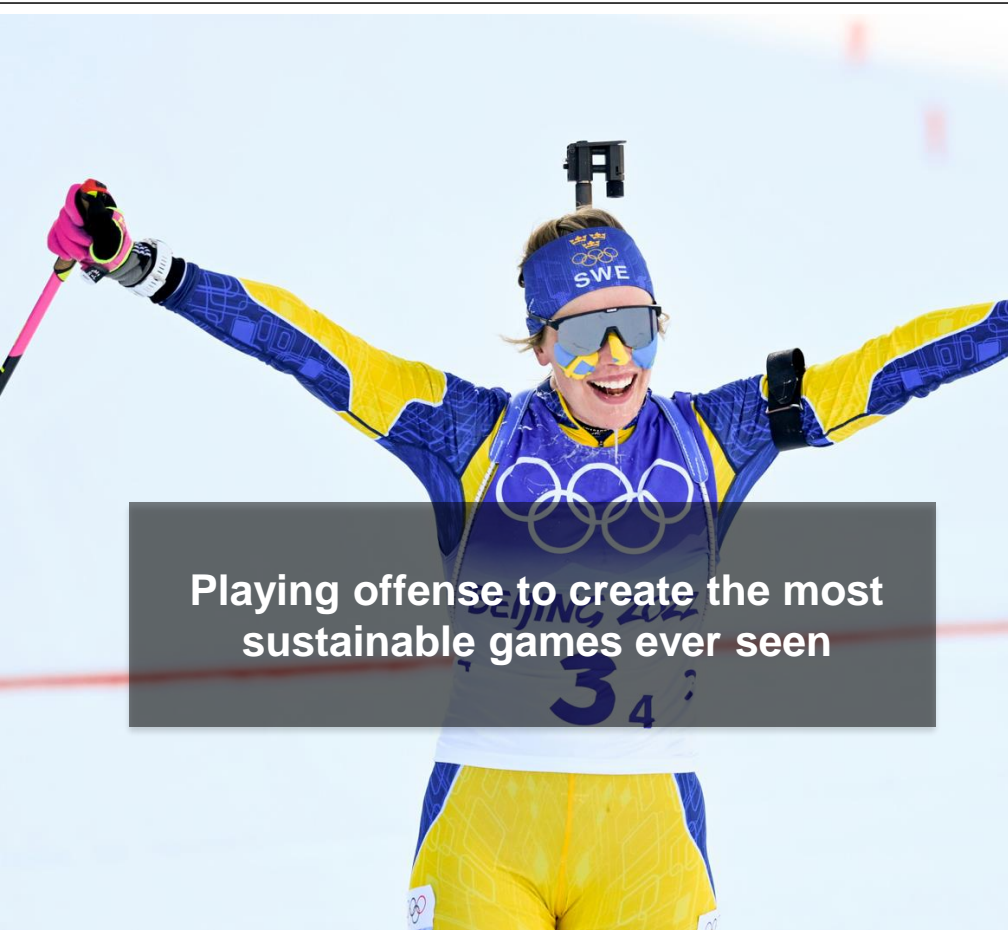
Carbon Footprint of the Swedish Winter Olympics

June 2023



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# Climate ambition for the Swedish Winter Olympics



Playing offense to create the most sustainable games ever seen



Reduce emissions by  
**80–90%**



**100%** fossil-free ground  
transport



**80%** less new-built venues  
and infrastructure

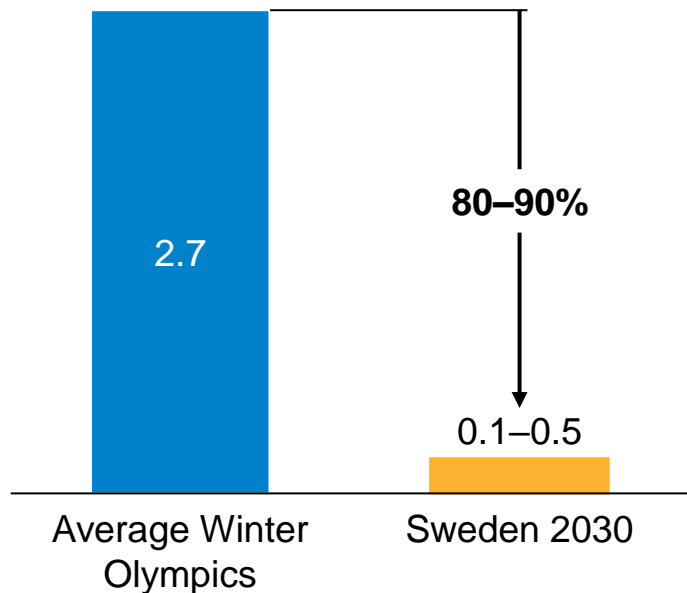


# Ambition to reduce emissions by 80–90%

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## Climate ambition

Million tonnes of CO<sub>2</sub>



### Construction

**90%** green materials

**80%** less new-built than average



### Transport

**100%** fossil-free ground transport

**50%** of aviation powered by biofuels



### Electricity

**100%** green electricity and heating

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- Baseline
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- Additional analysis
- Appendix



# Executive summary

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## The Swedish Olympic Committee (SOC) aims to host the Winter Olympics in 2030, striving to make it the most sustainable games ever seen

- 1. Hosting the Olympics in Sweden could reduce CO<sub>2</sub> emissions by up to 95%** compared to the average Winter Olympics in an ambitious scenario. Even in a more conservative scenario, emissions could be reduced by ~80%
- 2. The SOC could set a climate target of 80–90% reduction compared to the average Winter Olympics to have some leeway in achieving the target.** The remaining emissions should also be compensated in line with the IOC's commitment to compensate more than 100% of emissions
  - The Winter Olympics has a history of being labelled green and sustainable. To set a new standard, the Swedish Olympics must set ambitious and concrete targets
  - Setting a 90% reduction target (in line with science-based net-zero targets) would make this event genuinely green, achieving what is required by 2050 already in 2030
- 3. Leading green Swedish companies could help make this a reality** and would help showcase their green products and ambitions to the world

Hosting the Olympics presents an exciting opportunity for Sweden and Swedish companies to leverage the green transition and set a global standard for sustainability, one that may fill Sweden with pride for years to come

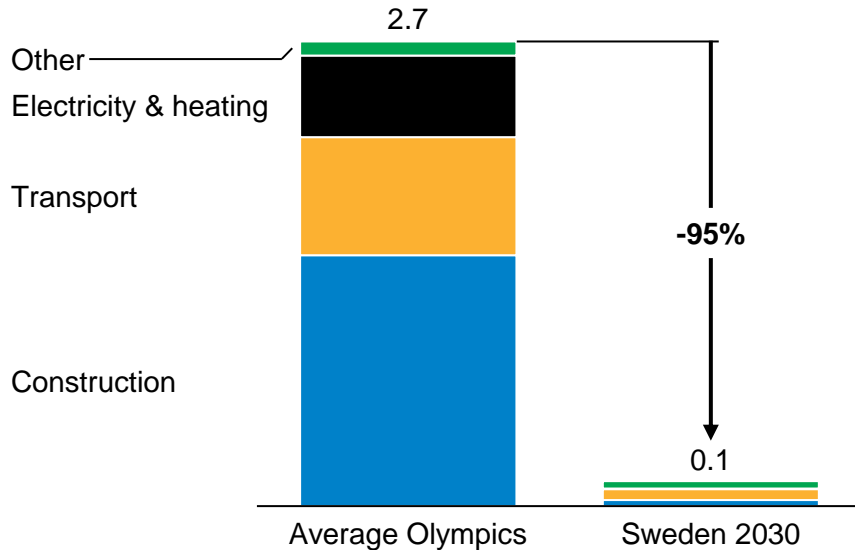


# Hosting the Olympics in Sweden could reduce emissions by up to 95% compared to the average Winter Olympics

Estimate      Ambitious scenario

## Emissions from average Winter Olympics relative to Sweden's 2030 bid, without carbon offsets

Million tonnes of CO<sub>2</sub> emissions, excluding international travel



## Key assumptions

**Construction emissions could be cut by ~98%** by only having 10% new-built (80% less than average) and using materials with ~88% lower carbon footprint (e.g., recycled steel and green cement)

**Transport emissions could be reduced by ~90%** through 100% fossil-free ground transport (vehicles using 100% renewable electricity or sustainable biofuels), and by curbing aviation emissions (e.g., 75% shift to ground transport and using 50% biofuels)

**Emissions from electricity and heating could be eliminated by ~99%** as Sweden has clean production of electricity and district heating

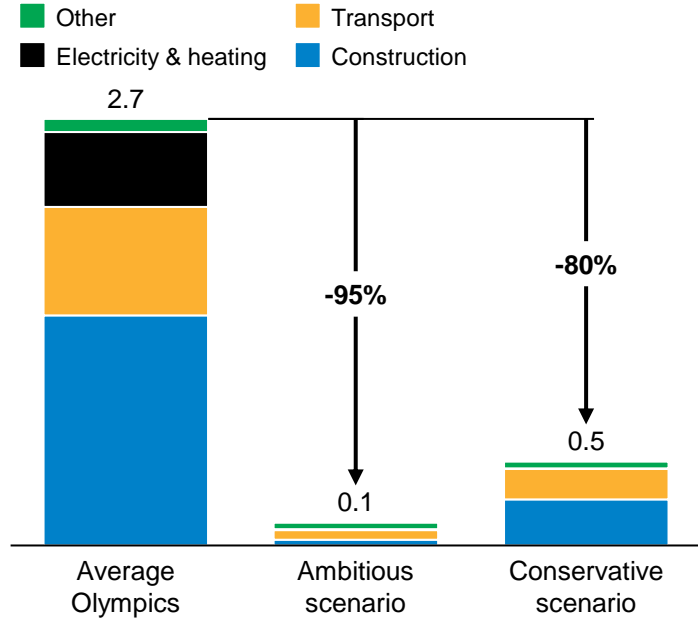
**Other emissions could roughly be cut in half** by using e.g., biogas for the Olympic flame, recycled textiles, and reducing waste






# Even in a more conservative scenario, emissions could be reduced by ~80%

Estimate

## Reduction potential in ambitious vs. conservative scenario for Sweden Olympics 2030

Million tonnes CO<sub>2</sub> emissions, excl. international travel

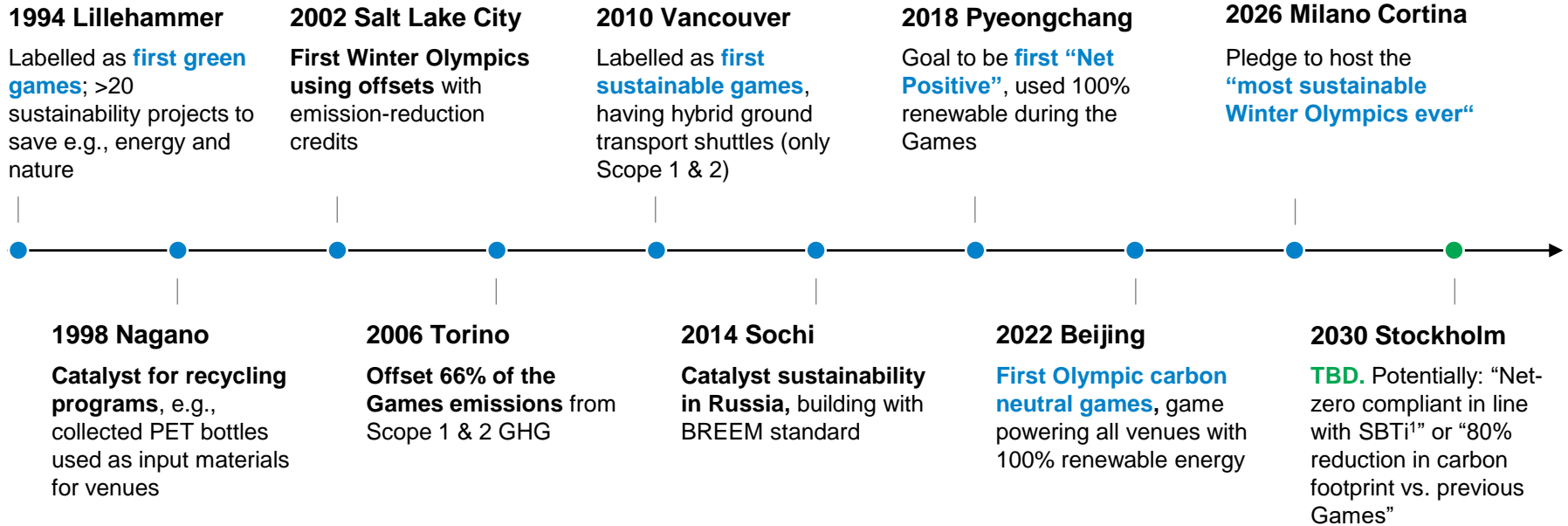


Key factors	Ambitious scenario	Conservative scenario
 <b>Construction materials</b>	88% lower CO <sub>2</sub> than average Olympics	50% lower CO <sub>2</sub> than average Olympics
 <b>New-build construction</b>	10% new-built (80% less than average)	20% new-built (60% less than average)
 <b>Aviation travel</b>	75% shift to ground transport vs. average	50% shift to ground transport vs. average
 <b>Biofuels for aviation</b>	50% biofuels in domestic aviation	25% biofuels in domestic aviation
 <b>Ground transport</b>	100% fossil-free ground transport	80% fossil-free ground transport

# Sweden must set ambitious and concrete targets to be the most sustainable Games ever seen

The Winter Olympics has a history of being labelled green and sustainable

## Timeline of sustainability ambitions for the Winter Olympics



1. Science-Based Target initiative

Source: International Olympic committee (2023);



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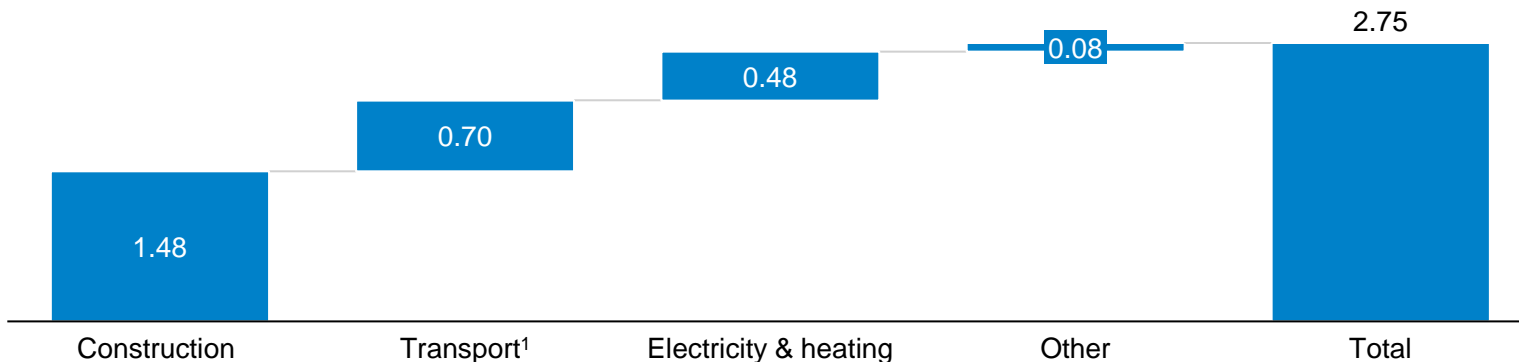
# The average Winter Olympics generate ~2.7 million tonnes of CO<sub>2</sub> emissions primarily from construction and transport

## Rough estimate

### Average emissions for hosting Winter Olympics assuming no carbon offsets

Million tonnes of CO<sub>2</sub> emissions

Emissions have been estimated based on best available data (primarily from Pyeongchang and Beijing). Data for each Olympics is limited, with varying quality and visibility of assumptions and scope



### Assumptions

Based on estimated emissions for construction and infrastructure

Based on ground transport (car, bus, taxi, train) and domestic aviation

Based on data from Sochi, Pyeongchang and Beijing for heating and energy

Emissions from e.g., waste, food, Olympic flame and apparel

1. Excludes emissions from international aviation, which is roughly 0.5 million tonnes of CO<sub>2</sub> per Olympics

Source: Olympics World Library (2023); Carbon Responsible Games 2018 PyeongChang (2015); Beijing Post-Games Sustainability Report (2022); Beijing Pre-Games Sustainability Report (2022); Sustainability report Vancouver (2010); S&P Global (2022) "Winter Olympics 2022 is the 'carbon neutral template' for future global events"; Sojti (2014), Sustainable Future Dow

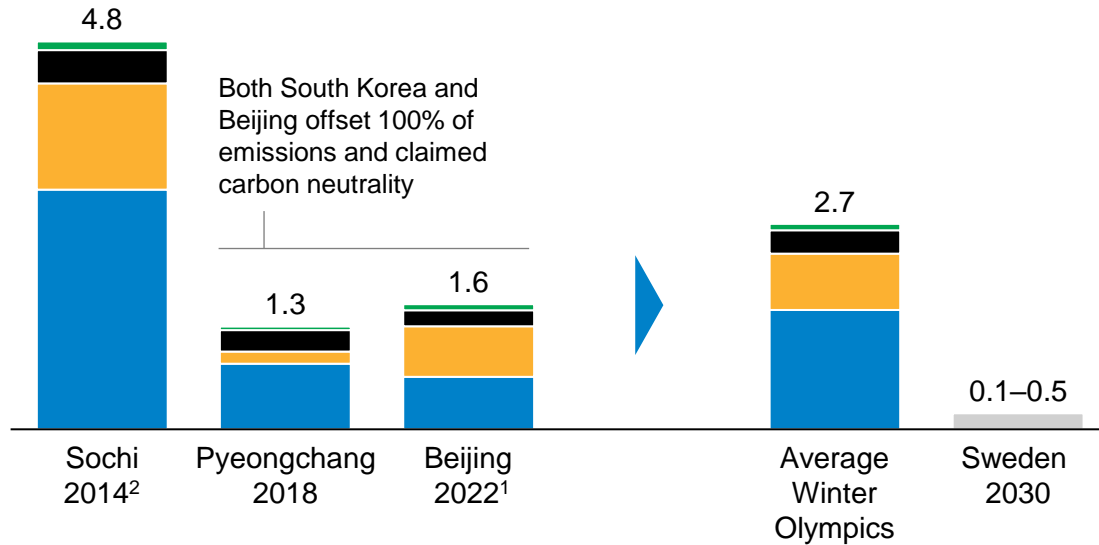
# Average emissions are estimated based on previous Winter Olympics – however, data quality and visibility are generally low

Other Electricity & heating Transport Construction

## Rough estimate

### Emissions for hosting Winter Olympics assuming no carbon offsets

Million tonnes of CO<sub>2</sub> per Olympics, excluding international aviation



## Assumptions and comments

**Data quality and visibility regarding emissions are generally low**, particularly when it comes to categorizing emissions from previous games.

**Average emissions are based on data from Sochi, Pyeongchang, and Beijing**, the only games that report emissions with a broader scope. However, note that emissions per category are rough estimates.

**The impact on potential emission reductions is relatively low despite the uncertain baseline.** This is because the potential relies on Sweden's capacity to reduce emissions rather than a bottom-up analysis of generated emissions specifically from a Swedish Olympics.

1. Covid adjusted, assuming there were spectators as planned

2. Only total reported emissions available, emissions per category are estimated using data from other games and considering factors such as level of new-built and grid intensity of Russia.

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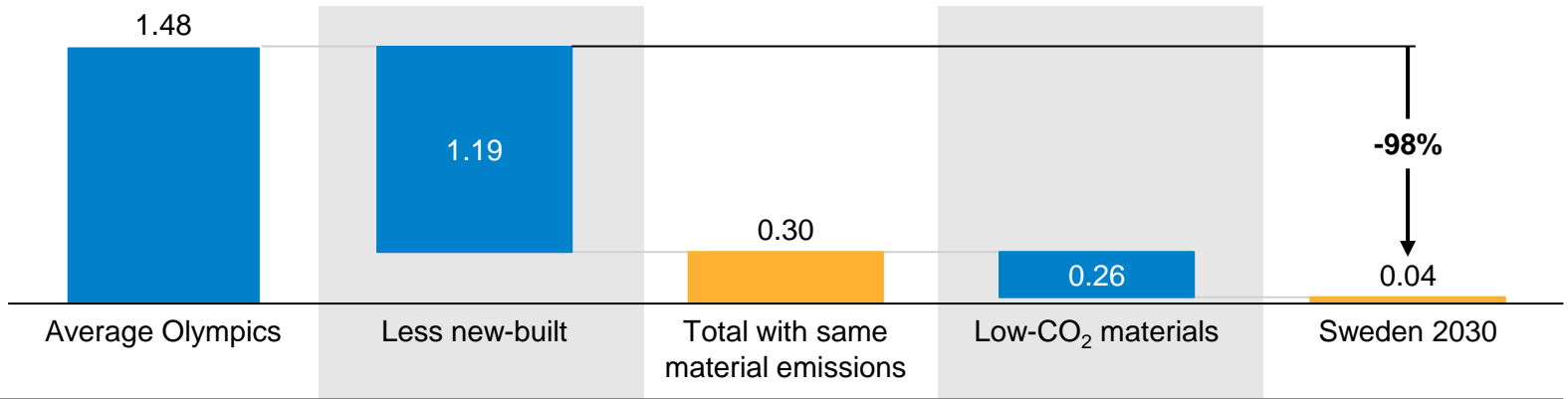
# Emissions from construction could be ~98% lower by having 80% less new-built and materials with ~88% lower carbon footprint

Estimate     Ambitious scenario

■ Deep-dive follows

## Estimated emissions from construction from average Winter Olympics relative to Sweden's 2030 bid

Million tonnes of CO<sub>2</sub> emissions



### Assumptions

Emissions from construction of infrastructure and venues, excluding construction of Olympic Village<sup>1</sup>

Only 10% new venues and infrastructure, 80% less than average Winter Olympics

Using materials with ~88% lower carbon footprint, e.g., carbon neutral cement, and fossil-free/recycled steel

1. The apartments for the Olympic Village will either be renovated units or newly constructed buildings, catering to the demand for additional housing in the area. The emissions from this construction are not attributed to the Olympic Games, as the housing will primarily address the long-term needs of urban growth. This approach aligns with the methodology employed by previous Winter Olympics.



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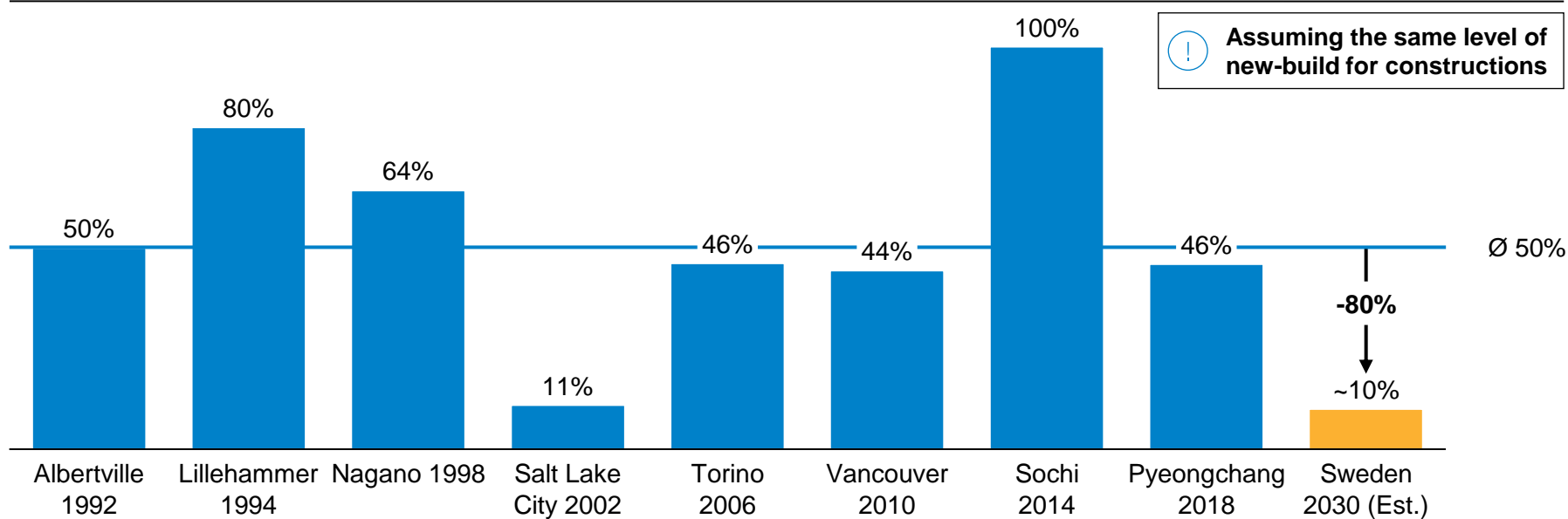
# Backup: Sweden would build 80% less new venues compared to the average for Winter Olympics

Only 10% of new-built assumed for Sweden compared to an average of 50%

Non-exhaustive   Ambitious scenario

## Average new-built for Winter Olympics 1992–2018

Share of new competition venues



Note: No data is available for Winter Olympics in Beijing, 2022.

Source: Martin, M., "An evaluation of the sustainability of the Olympic Games" (2021)

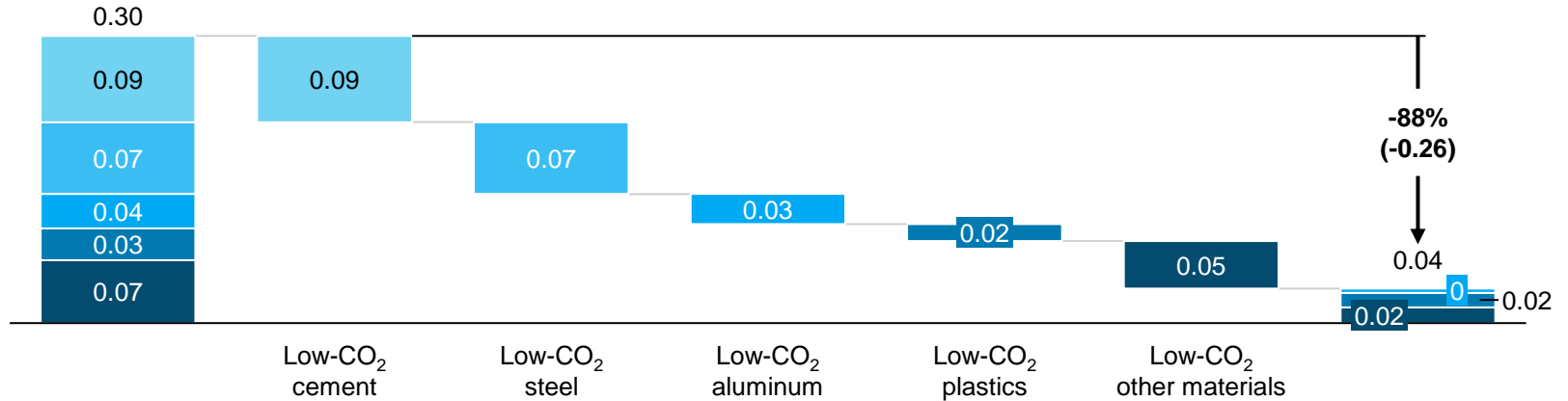
# Backup: Using green and recycled materials could cut emissions by ~88% in Sweden compared to the average Winter Olympics

Estimate      Ambitious scenario

## Emissions from construction in Sweden relative average Winter Olympics

Million tonnes of CO<sub>2</sub> emissions, excluding savings from less new-built

Note: For this to be possible, it is important to soon modify or build new production plants (e.g., adding CCS on cement plants).



### Assumptions

Based on average split for buildings in Europe

100% carbon neutral cement

100% recycled steel with renewable electricity

60% primary aluminum made with renewable electricity, 40% recycled aluminum

50% recycled plastics and 10% biobased plastics

75% lower emissions across other material

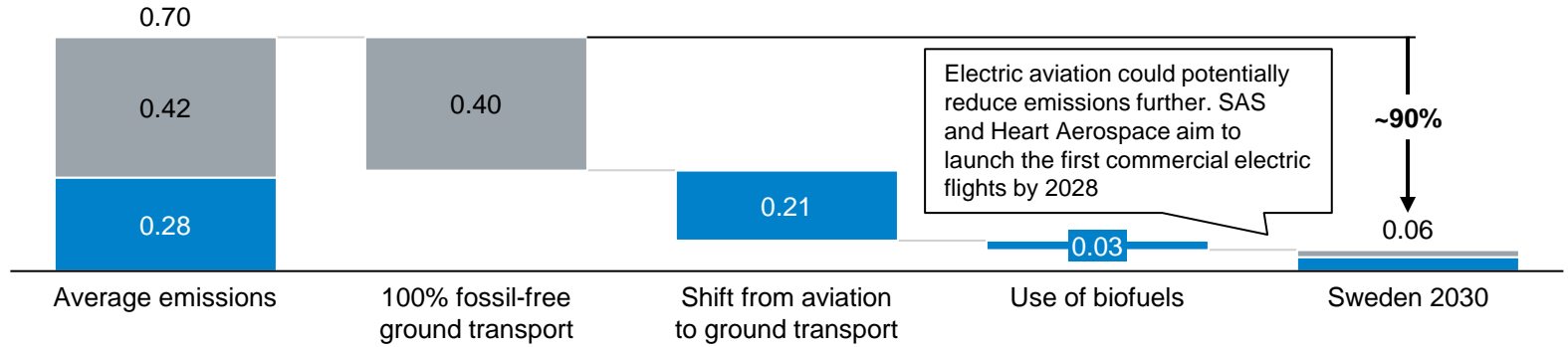
# Transport emissions could be ~90% lower assuming fossil-free ground transport, transport shift, and use of biofuels for aviation

Estimate Ambitious scenario

■ Ground transport  
■ Domestic air travel

## Emissions from domestic transport from Winter Olympics relative Sweden's 2030 bid

Million tonnes of CO<sub>2</sub> emissions, excluding international travel



Electric aviation could potentially reduce emissions further. SAS and Heart Aerospace aim to launch the first commercial electric flights by 2028

### Assumptions

Passenger-kilometers same as prior games and an assumed 60/40 split in emissions from ground transport and aviation

All cars, buses, and trains run on **100% renewable electricity or sustainably sourced biomass<sup>4</sup>**

**75% of domestic flights shift to ground transport** (trains, busses, and cars) with zero emissions

**Use of 50% biofuels** (maximum allowance)<sup>1</sup> Biofuels assumed to reduce emissions by 80%<sup>2</sup> relative fossil fuels<sup>3</sup>

1. Currently, ASTM D7566, the global jet fuel standard, permits only 50% Sustainable Aviation Fuels blends. Airbus and Boeing aim to achieve 100% blends in the future, but by 2030 widespread adoption may still be limited.  
 2. Based on data from current SAF supplier to Arlanda airport, which is third-party certified to be compliant with the Carbon Offsetting and Reduction Scheme for International Aviation (CORSA) guidelines on emissions calculation  
 3. Assumes no impact from water vapor, which generally does not occur for shorter domestic flights.  
 4. Assuming a 95% reduction. The use of biofuels in vehicles reduce emissions with roughly 80% relative fossil fuels while electrification has close to zero emissions.





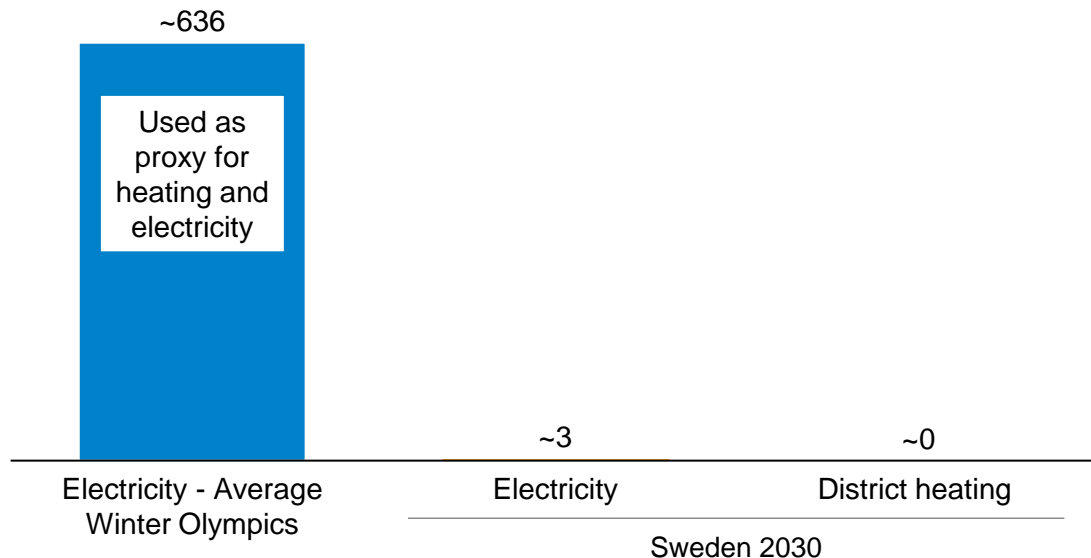
# Electricity and heating has close to zero emissions in Sweden

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Emissions would be reduced by ~99% relative previous Games without compensation

## Estimate

### Emission intensity of electricity and heating in Sweden relative average Winter Olympics, kgCO<sub>2</sub>/MWh energy



### Assumptions and comments

The emission intensity of Sweden's power is expected to reach 3 kg CO<sub>2</sub> per MWh of electricity by 2030, this is 99% lower than the average grid intensity of the last three hosting countries (Russia, South Korea, and China)

Note that China and South Korea already bought energy certificates for their game and claim to use 100% renewables

Sweden could reach net-zero emissions by buying renewable certificates (Power Purchase Agreements) to reduce the final emissions

District heating in key cities for the Olympics (Stockholm Falun, and Åre) are expected to be fossil-free by 2030

1. Based on grid intensity of Sweden in 2030 (Estimated)

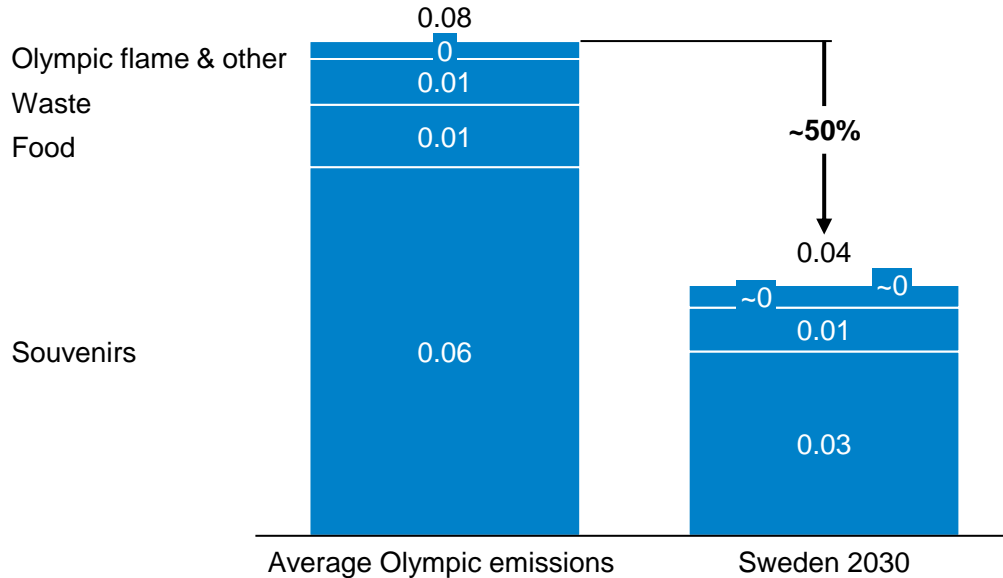
Source: GEP (2022); Olympics World Library (2023)

# Other emissions could be reduced by almost 50% compared to the average Olympics

Other emissions come from e.g., souvenirs, food, and waste

Estimate

**“Other emissions” for average Winter Olympics relative Sweden’s 2030 bid, Million tonnes of CO<sub>2</sub> emissions**



## Key assumptions

**50% lower footprint from souvenirs.** Lower material emissions (textiles, metals, plastics) by using recycled and low-CO<sub>2</sub> materials as well as renewable electricity during production

**Food emissions can be reduced by 30%.** More locally grown vegetarian alternatives, increase of white meat (e.g., chicken) relative to beef, no single-use packaging

**50% less emissions from waste.** No landfill and efficient waste management, minimize food waste by optimizing portions

**Zero emissions from the Olympic flame** by using 100% biofuels

**Other emissions assumed to be reduced by 50%**

Note: Based on emissions data from Winter Olympics in South Korea 2018

Source: Olympics World Library (2023); Carbon Responsible Games 2018 PyeongChang (2015); Naturvårdsverket Revision of emission factors for electricity generation and district heating (2016); IOC (2023); Beijing Post-Games Sustainability Report (2022); Beijing Pre-Games Sustainability Report (2022)

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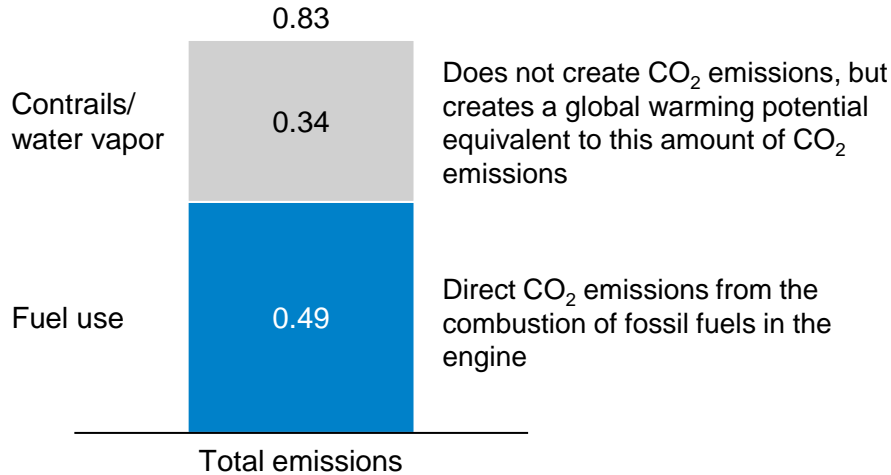
# International aviation contributes to ~0.8 million tonnes of CO<sub>2</sub> per Olympics, with fuel use accounting for ~0.5 million tonnes

International aviation excluded from main scope since the Organising Committee has limited influence over these emissions

## Estimate

### Emissions from international aviation for average Winter Olympics

Million tonnes of CO<sub>2</sub> emissions



### Assumptions and comments

Assumes 10,000 athletes & accredited personnel fly to Sweden from across the world. Average emissions from travel based on Olympics in Tokyo data (potentially shorter average distance to Sweden)

Assumes 330,000 spectators based on the previous Winter Olympics, and that 60% are traveling with aviation (i.e., 40% from Sweden and nearby countries).

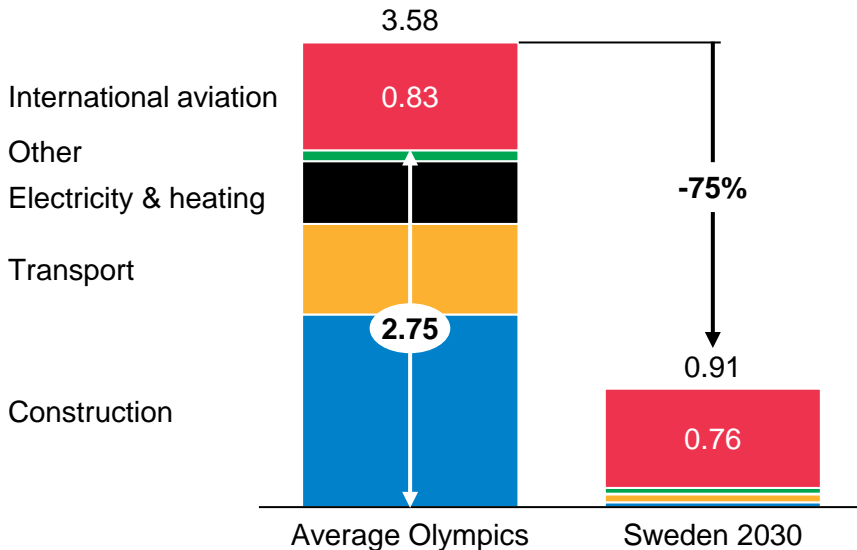
The impact of aviation comes both from fossil fuel use and the high-altitude effect of contrails and water vapor made by the flights. Here, we assume a global warming potential factor of 1.7 for the contrails.

# If including international aviation in the scope, emissions could be reduced by ~75% in an ambitious scenario

Estimate      Ambitious scenario

## Emissions from average Winter Olympics relative to Sweden's 2030 bid, without carbon offsets

Thousand tonnes of CO<sub>2</sub> emissions, excluding international travel



## Key assumptions

**Assumes 10% reduction in emissions from fossil fuels for international aviation compared to average Olympics.** This would be achieved by more efficient airplanes, higher degree of sustainable aviation fuels (e.g., biofuels), and a small shift to trains/boat travel.

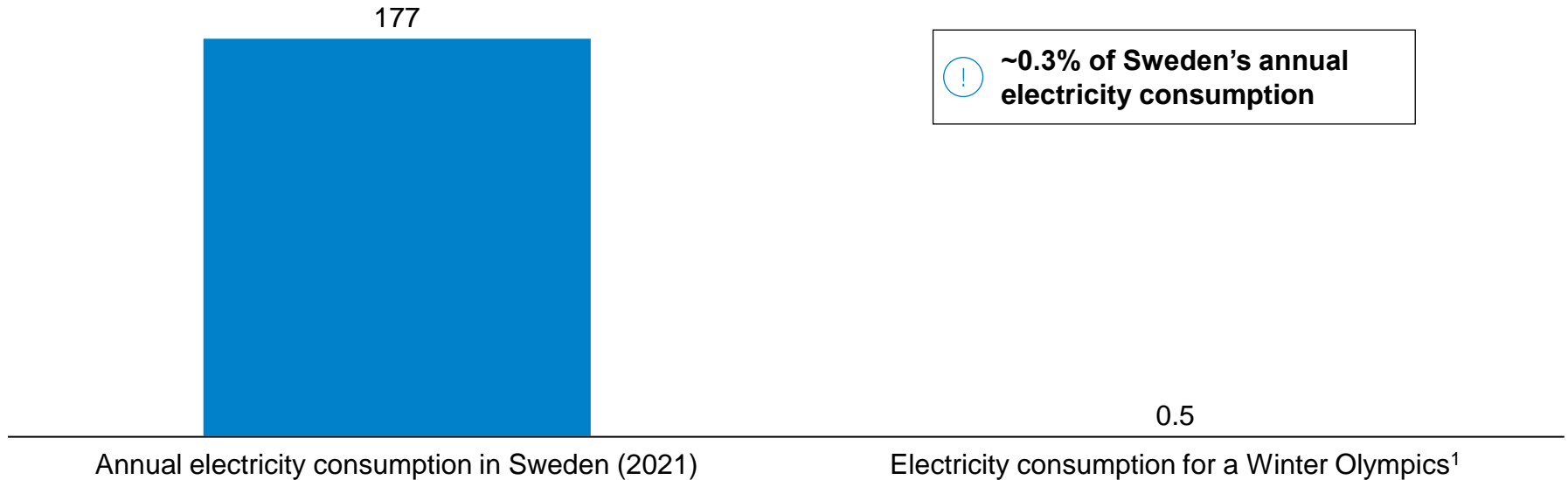
**Assumes a 3% reduction the impact from contrails/water vapor from less aviation due to a shift e.g., trains and boat transport.**

**Assumptions for other categories are the same**

# Hosting the Olympics would only use an equivalent of ~0.3% of Sweden's annual electricity consumption

## Estimate

### Electricity consumption of Winter Olympics vs. Sweden's annual consumption, TWh



1. Covid adjusted

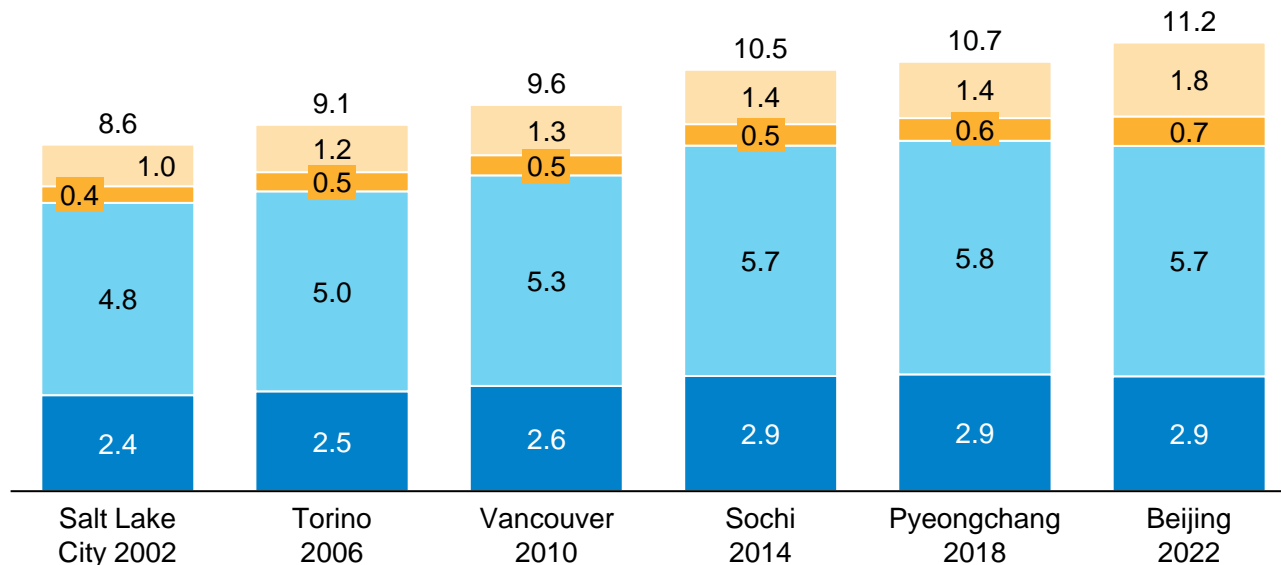
# Number of athletes and accredited personnel have reached 10–11 thousand people for the Olympics and Paralympics

■ Paralympic accredited personnel    ■ Olympic accredited personnel  
■ Paralympic athletes                    ■ Olympic athletes

Estimate

## Athletes and accredited personnel for Winter Olympics and Paralympics

Thousand of people, estimate



### Key assumptions

Assuming each Olympic athlete have additional 2 people traveling with (i.e., accredited coach or other personnel)

Assuming each Paralympic athlete will need to have 3 additional caches or personnel

Data based on previous years participants in the Olympics and Paralympics Winter games

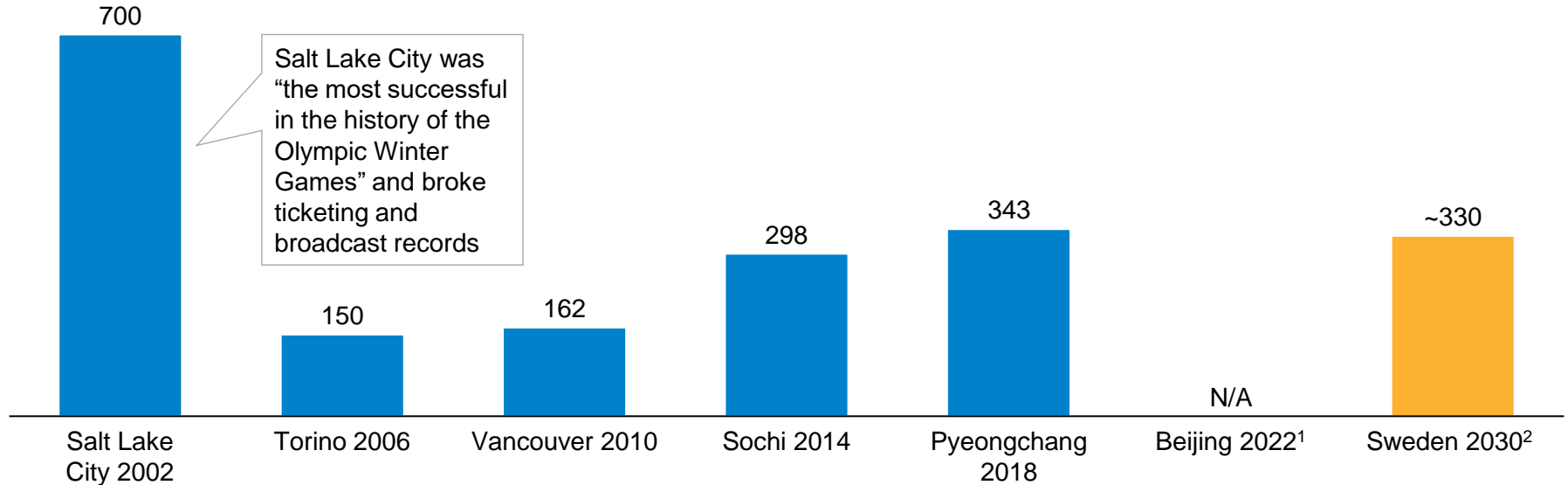
1. Covid pandemic

# Number of spectators are assumed to be roughly 330 thousand people for the Swedish Olympics

Non-exhaustive

## Number of spectators

Thousands visitors during the Winter Olympic month



1. Covid pandemic

2. Assumption based on previous Winter Olympics, excluding Beijing due to Covid pandemic





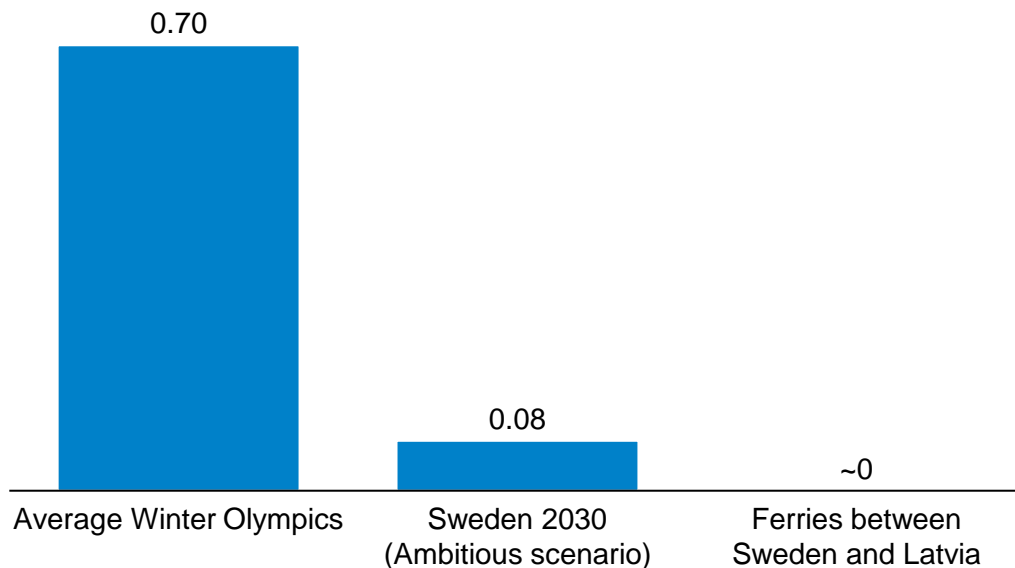
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# Emissions from ferries to Latvia are negligible compared to total transport emissions

## Estimate

### Emissions of ferries relative to transport emissions of Olympics

Million tonnes of CO<sub>2</sub> emissions



1. pkm = passenger kilometre, distance travelled by individual passengers  
Note: Assuming 28 teams with 4 persons per man and woman competitors in bobsleigh.  
Source: Olympics Beijing (2022); DEFRA (2022); Team analysis

## Comments and assumptions

**The Sweden Olympics plan to host the bobsleigh and similar competitions in either Latvia or Norway**

**If these competitions were held in Latvia**, an estimated ~13 tonnes of CO<sub>2</sub> emissions would be generated from ferries. Emissions from ferries are thus negligible compared to other transport emissions and are therefore excluded from further analysis

**The calculations assume** ferries between Stockholm (Sweden) and Sigulda (Latvia) for ~700 athletes and accredited people, a distance of ~500 km one-way, and an emission factor of 0.02 kgCO<sub>2</sub>/pkm<sup>1</sup>

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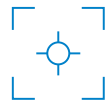


## Context

**The Swedish Olympic Committee (SOC) is pursuing the opportunity to host the Winter Olympics in 2030**, with major competitions in Stockholm, Åre, and Falun. However, certain events like bobsleigh and luge are planned for either Latvia or Norway

**SOC's objective is to deliver a remarkable Olympic celebration while creating the most sustainable games ever seen.** With a focus on three sustainability pillars (environment, social, and economic), SOC aims to establish a new standard for hosting games in a sustainable manner

**This document gives a first estimate of the potential emissions reduction and climate targets** that could be achieved by hosting the Games in Sweden compared to the average Winter Olympics



## Methodology and scope

**The analysis is a top-down assessment** based on primarily data from previous Winter Olympics and robust assumptions of the reduction potential that the Swedish Olympics and Paralympics<sup>1</sup> could achieve

**The work is based on best available data**, covering four key categories: Construction, Transport, Electricity & Heating, and Other (e.g., souvenirs). It should be noted that due to limited data availability, several assumptions were made during the analysis

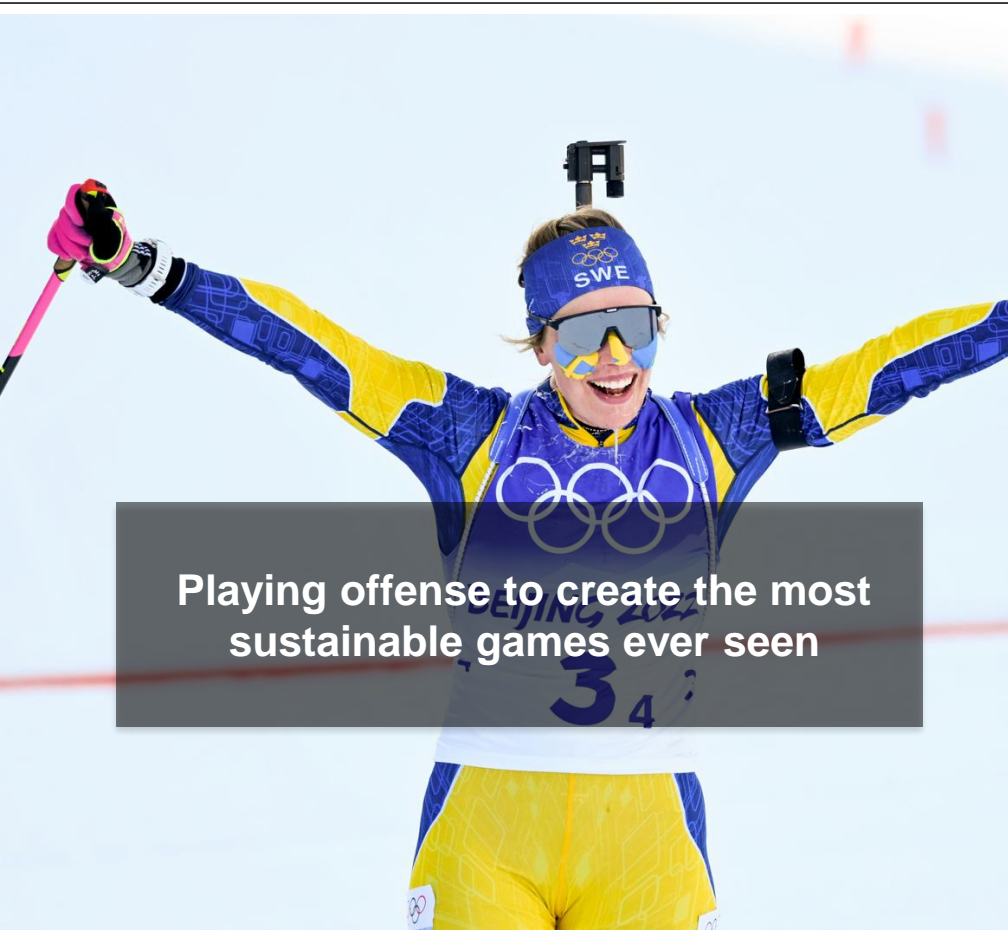
**Scope of emissions aligns with best practice and what the hosting Olympic country can influence.** The scope excludes emissions from activities such as constructing the Olympic Village and international aviation. However, there are additional sensitivity analyses covering these areas.

1. Throughout the document, the term "Olympics" encompasses both the Olympic and Paralympic Games.



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# Climate ambition for the Swedish Winter Olympics



Playing offense to create the most sustainable games ever seen



Reduce emissions by **80–90%**



Compensate remaining emissions **twofold**

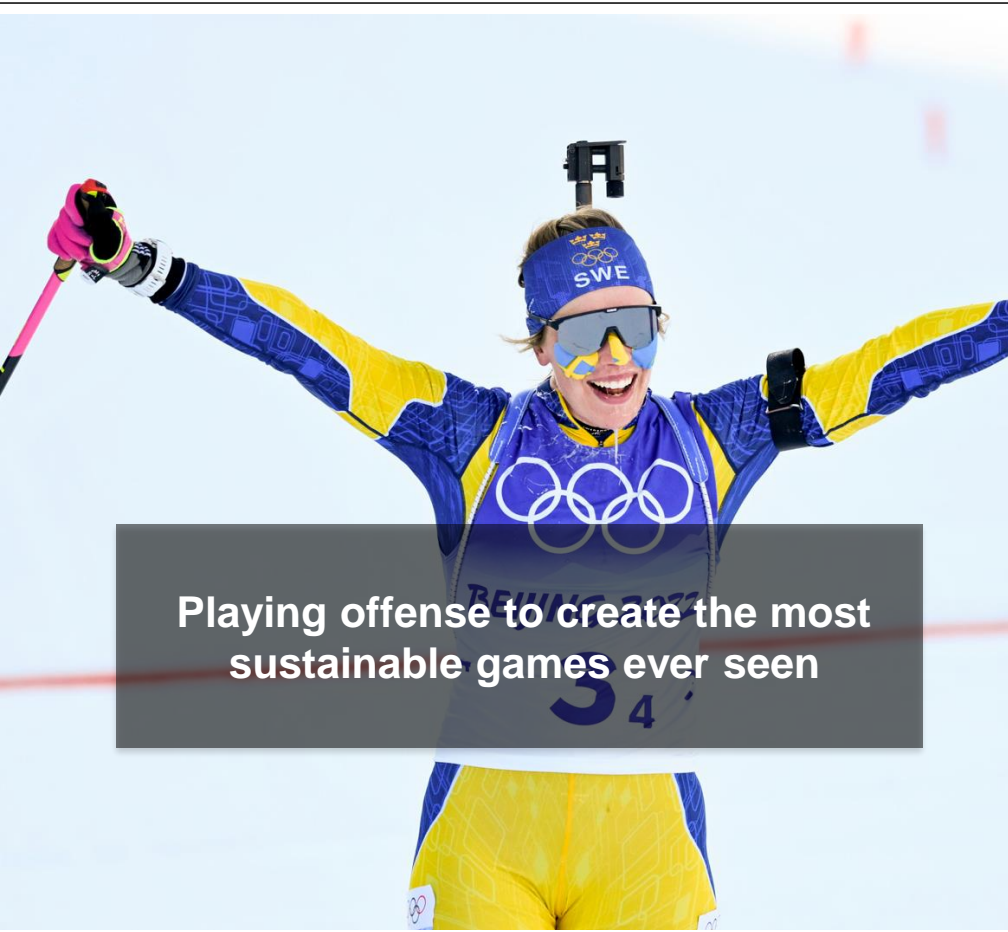


**80%** less new-built venues and infrastructure



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# Climate ambition for the Swedish Winter Olympics



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Reduce emissions by  
**80–90%**



**100%** green electricity and  
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**80%** less new-built venues  
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