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The Snow Thieves

How high-carbon sponsors
are melting winter sports





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About the authors

Main author

Mats Abrahamsson is the founder and Executive Director of FACTWISE, a public interest-oriented research group specialising in community development and change.

mats@factwise.se

Co-authors

Andrew Simms is co-director of the New Weather Institute, coordinator of the Rapid Transition Alliance, assistant director of Scientists for Global Responsibility, an author and co-author of the original Green New Deal.

[@AndrewSimms_uk](https://twitter.com/AndrewSimms_uk)

newweather.org

Gunnar Lind and Anna Jonsson are co-founders of New Weather Sweden, researchers, authors and developers located in Stockholm, Sweden.

[@NewSverige](https://twitter.com/NewSverige)

newweather.se

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Summary



Global climate change is already affecting all sectors of society. This report looks at how carbon pollution is visibly ruining winter sports, tells the story of how the collapsing snow sports sector is being used as a billboard by some of the very major polluters whose emissions are speeding its downfall.

The study examines the toxic relationship between high carbon emitters, such as the car, oil and airline industries as sponsors, and the winter sports sector, as promoters of their own climate destruction through advertisements and sponsorships that normalise high carbon products, activities and lifestyles.

The report finds that:

- Through their pollution, high-carbon sponsors of winter sports are melting the future of the very sports they sponsor.
- With their clean, healthy outdoor image, winter sports are especially attractive to sponsorship from major polluters who want to 'sportswash' their image. We easily identified 107 high carbon sponsorship deals with skiing organisations, event organisers, teams and with individual athletes. We found car manufacturers, led by Audi to be the most active with a total of 83 sponsoring deals, of which Audi has 54. Fossil fuel companies and airlines come in next with 12 and 5 deals respectively.
- The activities of high-carbon sponsors of winter sports are destroying the very conditions those sports need to survive. The emissions of just two sponsors of the 'London Marathon of skiing', Sweden's famous Vasaloppet, the world's biggest cross-country ski race, energy company Preem and Volvo Cars, combined are estimated to be responsible for the loss of 1,260 million tonnes of glacier ice each year, or 210 square kilometres (km²) of snow cover (see Appendix 2). Compared to the area needed for the Vasaloppet ski race itself, *this amounts to melting the equivalent of 233 Vasaloppet ski races*. At the beginning of the 2022/23 season alpine skiers saw seven races in a row cancelled in Central Europe.

- In mid-latitudes in the Northern Hemisphere, winters are expected to shrink at a rate of 4.7 days per decade and may in a high emission scenario by the end of the century be as short as 31 days, from 18 December to 18 January, with winter lasting only a single month.
- European Ski resorts have experienced temperatures above 20°C this winter and some have simply had to close. In our heating world, the extent of snow cover has declined significantly over the past 90 years, with most of the reductions occurring after 1980.
- Over the period 1967–2015, the extent of snow cover in the Northern Hemisphere decreased by 7 percent on average in March and April and by 47 percent in June. In Europe, the observed reductions are even larger, at 13 percent for March and April and 76 percent for June.
- Compared to 1970, each year the snow cover in the northern hemisphere shrinks by an additional estimated 90,600 square kilometres on average, over one fifth the size of Sweden and over one third the size of Great Britain.
- The increasing consequences of climate change are already having an economic effect on local snow sport businesses. For the European skiing tourism market, an average warming of 2°C is expected to generate a loss of 10.1 million guest nights per winter season and an even greater loss of ski lift ticket sales. Each year more and more snow sport events are being cancelled because of a lack of snow or other anomalous weather events.
- The automobile sector is one of the main carbon polluters fuelling climate breakdown and simultaneously one of the largest spenders in sports sponsorship, including snow sports. In 2018, a very conservative estimate suggested that the global car industry spent USD \$1.285 billion on sports related sponsorships and is likely to have increased significantly since. That would amount to 64 percent of their total sponsorship money going into sports at the time.
- It has been estimated that the increased demand due to global car and airline advertising could have been responsible for between 202 million and 606 million tonnes of greenhouse gas emissions per year.
- There is a moral, legal, and practical case to end high-carbon advertising and sponsorship and the report calls for organisers, teams, and athletes to reject sponsorships from major polluters in order to save the future

of their sports. It also calls for decision-makers and regulators to follow the precedent of ending tobacco advertising and sponsorship to legally end the similar promotion of high carbon products and services.

1. What is at stake?



Global climate change is not a future problem, but happening right now. Average temperatures are rising, with more and longer heat waves. Sea levels are rising; seasons are changing; glaciers, ice sheets and snow covers are shrinking.

In mid-latitudes in the Northern Hemisphere, from Northern Africa to the Arctic Circle, winters are expected to shrink at a rate of 4.7 days per decade and may, in a high emission scenario, by the end of the century be as short as 31 days, from 18 December to 18 January.¹ In other words, winter may last only a single month.

Looking specifically at temperature changes during the main skiing season of November to March from 1970 to 2022, the average temperature in the Northern Hemisphere has increased with 0.35°C per decade or 0.035°C per year.²

Recent years have seen extraordinary heating over the Arctic. Mediterranean temperatures of 38°C have been recorded in Northern Siberia³ and temperature measurements in the northern Barents Sea have shown temperatures rising up to 4°C per decade, even higher than expected, as the white ice cover melts away and the darker sea surface captures more heat.⁴

Mostly due to the global distribution of land mass, Europe as a whole is heating up at twice the average rate for the planet. The alpine region of central western Europe is hit extra hard. Ski resorts have experienced temperatures above 20°C this winter and some have simply had to close.⁵

¹ Jiamin Wang, Y.Guan, L. Wu, X. Guan, W. Cai, J. Huang, W. Dong, B. Zhang: *Changing lengths of the four seasons by global warming*. Geophysical Research Letters, 48. Supporting Information. 19 February 2021.

<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020GL091753>

² NOAA National Centers for Environmental Information: *Climate at a Glance: Global Time Series*, published January 2023.

<https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series>

³ World Meteorological Organisation: WMO recognizes new Arctic temperature record of 38°C. Press Release Number: 14122021. 14 December 2021.

<https://public.wmo.int/en/media/press-release/wmo-recognizes-new-arctic-temperature-record-of-38%E2%81%B0c>

⁴ Isaksen, K., Nordli, Ø., Ivanov, B. et al.: *Exceptional warming over the Barents area*. Scientific Reports 12, 9371. 15 June 2022. <https://www.nature.com/articles/s41598-022-13568-5>

⁵ CBC News: *Lack of snow, warm weather spoiling ski season in Europe*. 6 January 2023.

<https://www.cbc.ca/news/world/photos/europe-snowless-ski-slopes-photo-scroller-1.6705657>

Skiing originated as a means of transportation in Scandinavia and is still seen as an important element of culture in many northern parts of the world. Most inhabitants in high latitude areas have childhood memories of skiing in the winter, and many still keep fit by continuing skiing into old age. Downhill skiing has exploded all over the world and around 380 million visits to ski resorts are recorded globally each year.⁶



People ski on a slope near Schladming, Austria. Photo: Matthias Schrader, AFP

Winter sports not only enhance health and culture but also generate income and employment, especially in higher altitude regions. For Switzerland for example, winter tourism activity generates around CHF 5 billion (USD 5.65 billion) per year. This represents about one percent of Swiss GDP, but more than 10 percent for local mountain regions.⁷

The increasing consequences of climate change are already having an economic effect on local snow sport businesses. For the European skiing tourism market, an average warming of 2°C is

⁶ Lauren Vanat: *2022 International Report on Snow & Mountain Tourism*. April 2022. <https://www.vanat.ch/RM-world-report-2022.pdf>

⁷ SWI swissinfo.ch: *The importance of 'white gold' to the Alpine economy*. 18 December 2020. <https://www.swissinfo.ch/eng/business/the-importance-of--white-gold--to-the-alpine-economy/46233650>

expected to generate a loss of 10.1 million guest nights per winter season and an even greater loss of ski lift ticket sales.⁸

Before the Covid-19 pandemic, a normal winter would see almost 400 million daily (downhill) skier visits world-wide, with more than half of those found in Europe.⁹ Most of the businesses engaged in winter tourism are small family-owned sole operators.

The European winter tourism market was valued at USD \$180 billion and was expected to rise to USD \$322 billion by 2032. The contribution of winter tourism to European GDP has been estimated between one and two percent.¹⁰

The global winter sports equipment market size was valued at USD \$14.69 billion in 2021 and was projected to grow at a rate of 8.5 percent to reach USD \$32.83 billion by 2031.¹¹

The International Ski and Snowboard Federation (FIS) has more than 30,000 active elite skiing athletes licensed and sanctions over 7,000 competitions annually.¹² The number of amateur and other non-elite competitors in all sorts of winter sports is of course much greater.

Winter sports are also important for spectators and fans of skiing races and other snow sports. To use the Winter Olympics Games in Beijing 2022 as an example, an amazing 2.01 billion unique viewers tuned in to watch coverage across TV and digital platforms.

Winter sports fans around the world watched a combined 12 billion hours of Beijing 2022 coverage – an 18 per cent increase over the Games in PyeongChang and almost half of the viewers that were surveyed said that they wanted to watch more Olympic coverage in the future.¹³

A world without winter sports would be a very different world.

⁸ Andrea Damm, W. Greuell, O. Landgren, F. Pretenthaler: *Impacts of +2 °C global warming on winter tourism demand in Europe*. Elsevier. Climate Services, Volume 7, August 2017, Pages 31-46. 24 August 2017.
<https://www.sciencedirect.com/science/article/pii/S2405880715300297>

⁹ Lauren Vanat: *2020 International Report on Snow & Mountain Tourism*. April 2020.
<https://www.vanat.ch/RM-world-report-2020.pdf>

¹⁰ Future Market Insights: *Europe Winter Tourism Market Outlook (2022-2032)*. October 2022.
<https://www.futuremarketinsights.com/reports/europe-winter-tourism-sector-outlook>

¹¹ Jaya Bundele, R. Deshmukh: *Winter Sports Equipment Market by Product Type, by Sports, by Distribution Channel: Global Opportunity Analysis and Industry Forecast, 2021-2031*. July 2022. <https://www.alliedmarketresearch.com/winter-sports-equipment-market-A16904>

¹² International Ski and Snowboard Federation: *FIS Facts and Figures*. 19 August 2022.
<https://www.fis-ski.com/en/inside-fis/about-fis/general/facts-figures>

¹³ International Olympic Committee: *Olympic Winter Games Beijing 2022 watched by more than 2 billion people*. 20 October 2022.
<https://olympics.com/ioc/news/olympic-winter-games-beijing-2022-watched-by-more-than-2-billion-people>

2. Climate change impacts on winter sports



Human induced climate change is already having a big impact on snow sports. Effects that scientists have been warning us about, such as rising temperatures, glacier loss, and retracting snow covers, are now occurring. Global temperatures have risen an average 1.1°C since pre-industrial times¹⁴ and are expected to exceed 1.5°C within the next few years.¹⁵ Looking at actual temperature measurements, the average temperature increase over the five years 2017–2021 was already 1.27°C.¹⁶



Athletes start the men's 4x7.5km relay race at the Biathlon World Cup race in Ruhpolding, Germany, January 2023. Photo: Matthias Schrader, AFP

But changes in temperature are not evenly distributed across the globe. For instance, temperatures are rising faster over land, and

¹⁴ IPCC. *Climate Change 2021, The Physical Science Basis, Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. 2021. https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf

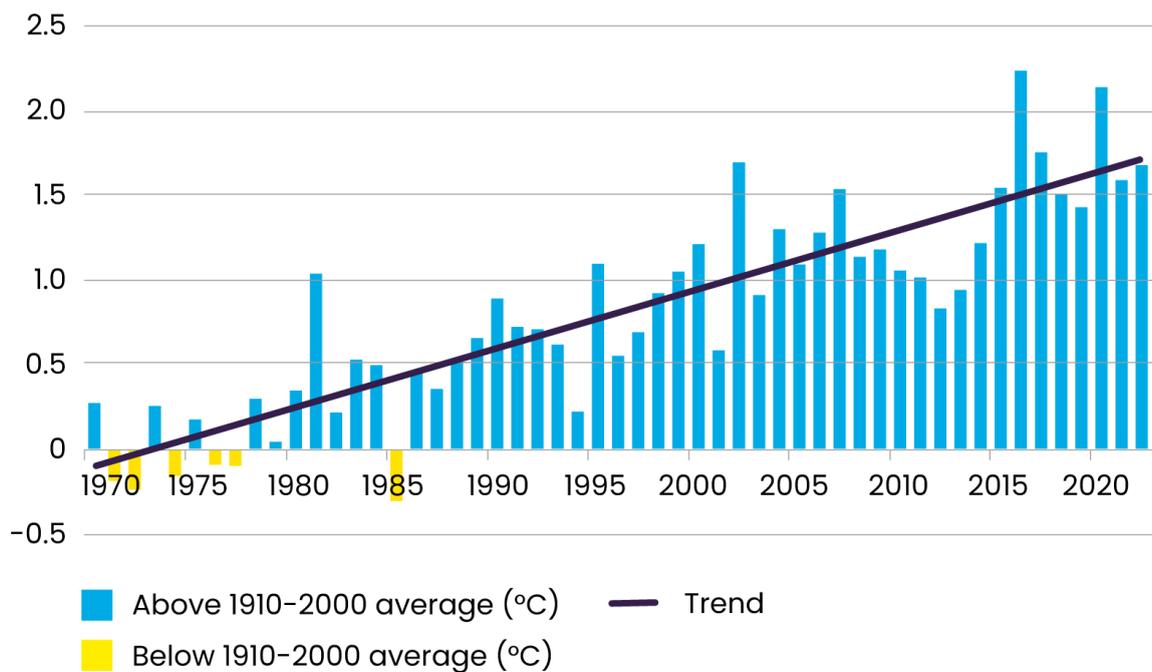
¹⁵ World Meteorological Organisation: WMO update: 50:50 chance of global temperature temporarily reaching 1.5°C threshold in next five years. Press Release Number: 9052022. 9 May 2022. <https://public.wmo.int/en/media/press-release/wmo-update-5050-chance-of-global-temperature-temporarily-reaching-15c-threshold>

¹⁶ Robert Rohde: *Global Temperature Report for 2021*. Berkeley Earth. 12 January 2022. <https://berkeleyearth.org/global-temperature-report-for-2021/>

over the past 45 years land temperatures have risen about twice as fast as those over the oceans.¹⁷ Warming has been particularly pronounced in the alpine regions of central western Europe. In Switzerland, the temperature was 2.4°C warmer in the last decade (2012–2021) and 2018 and 2020 were the warmest years on record at 3°C above pre-industrial times.¹⁸

Assessing climate impacts on skiing areas can sometimes be confusing as there still are sites that actually report good, and even increasing, snow depths. But, the explanation for that is not very promising for the future of snow sports: a changing climate often leads to increased precipitation, as warmer air can hold more moisture, and as long as the temperature stays below 0°C it will fall as snow. As warming continues up the slopes and northwards, the thick snow covers will be replaced by heavy rains. For this reason, snow cover extent may be a better indicator of change than snow depth.

Northern Hemisphere Land Temperature anomalies (°C), November–March (with respect to the 1920–2000 average)



Source: NASA¹⁹

¹⁷ European Union, Copernicus Climate Change Service: *Climate Indicators: Temperature*. <https://climate.copernicus.eu/climate-indicators/temperature>

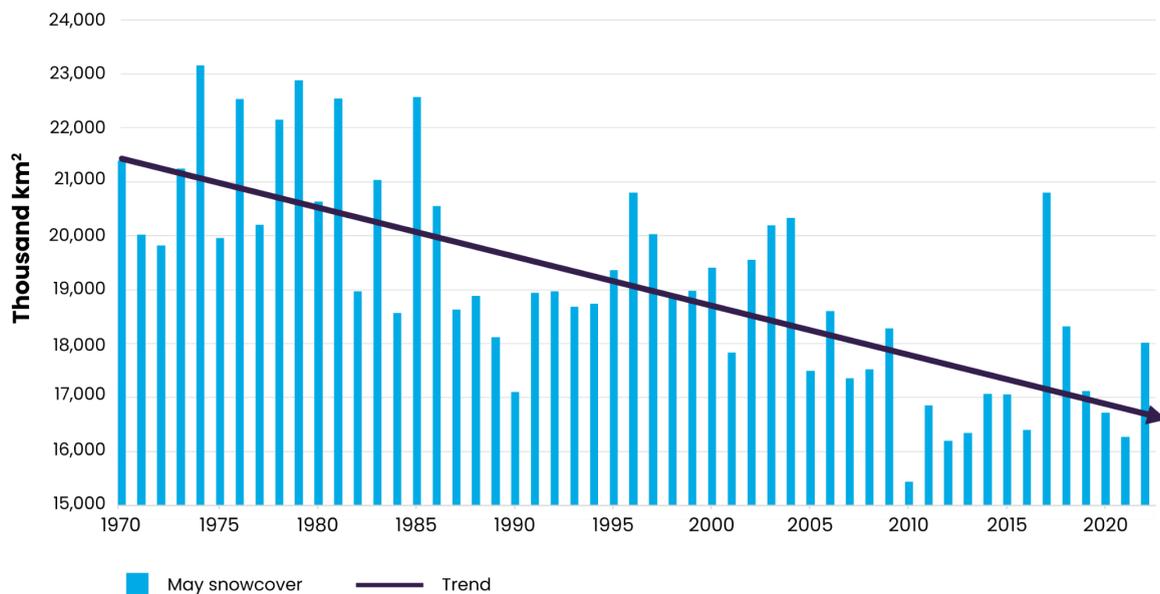
¹⁸ Federal Office of Meteorology and Climatology, MeteoSwiss: *Climate Change*. 2023. <https://www.meteoswiss.admin.ch/climate/climate-change.html>

¹⁹ NOAA, National Centers for Environmental Information: *Global Time Series*. 2023. https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series/n-hem/land/5/3/1970-2022?trend=true&trend_base=10&begtrendyear=1970&endtrendyear=2022

Snow cover extent has declined significantly over the past 90 years, with most of the reductions occurring after 1980. Over the period 1967–2015, snow cover extent in the Northern Hemisphere decreased by 7 percent on average in March and April and by 47 percent in June. In Europe, the observed reductions are even larger, at 13 percent for March and April and 76 percent for June.²⁰

Snow cover extent (SCE) is measured by scientists at Rutgers University Global Snow Lab from daily SCE maps produced by meteorologists at the US National Ice Center. Data for the Northern Hemisphere focusing specifically on May SCE from 1970 to 2022, show that the average snow cover decreased by 4,800 thousand km², from 21,400 thousand to 16,600 thousand km², an overall annual loss of 90,600 km².²¹

Change in May snow cover 1970–2022, Northern Hemisphere



The reason for choosing May for this comparison is that the changes are most pronounced at the end of the winter season. Between 1967 and 2022, April snow cover declined by 1.32 percent per decade, May snow cover by 4.1 percent per decade, and June

²⁰ European Environment Agency: *Snow cover*. 18 November 2021. <https://www.eea.europa.eu/data-and-maps/indicators/snow-cover-3/assessment>

²¹ Rutgers University Global Snow Lab: *Area of Snow Extent*. <http://climate.rutgers.edu/snowcover/index.php>

snow cover by 12.95 percent per decade.²² As the winter season shrinks, what has earlier happened in May and June will now happen in April and soon in March and February.



Snow cannon at the Biathlon World Cup in Ruhpolding, Germany, January 2023. Photo: Sven Hoppe/dpa

The annual increase in greenhouse gases consists almost exclusively of CO₂ emissions from the use of fossil fuels. Global energy-related CO₂ emissions rose by 6 percent in 2021 to 36.3 billion tonnes.²³ As there is an approximately linear relationship between the global surface air temperature in a given year and the cumulative emissions up to that year,²⁴ one can calculate the effect on changes in May snow cover as being 2.5 m² per tonne of CO₂ per year. As there is an approximately linear relationship between the global surface air temperature in a given year, and the cumulative emissions up to that year, one can calculate the effect on changes in May snow cover as being 2.5 m² per tonne of CO₂ per year (90,600 km² per year / 36 billion tonnes CO₂ per year = 2.5 m² per tonne of CO₂ per year).

²² NOAA Climate.gov: *Climate change: spring snow cover in the Northern Hemisphere*. 17 August 2022. <https://www.climate.gov/news-features/understanding-climate/climate-change-spring-snow-cover-northern-hemisphere>

²³ IEA: *Global CO₂ emissions rebounded to their highest level in history in 2021*. 8 March 2022. <https://www.iea.org/news/global-co2-emissions-rebounded-to-their-highest-level-in-history-in-2021>

²⁴ Rypdal M, Boers N, Fredriksen H-B, Eiselt K-U, Johansen A, Martinsen A, Falck Mentzoni E, Gravervsen RG and Rypdal K: *Estimating Remaining Carbon Budgets Using Temperature Responses Informed by CMIP6*. *Front. Clim.* 3:686058. 12 July 2021. <https://www.frontiersin.org/articles/10.3389/fclim.2021.686058/full>

3. Vasaloppet



Vasaloppet, Swedish for the Vasa-race, is the world's biggest cross-country ski race and one of the main skiing events in Sweden. The 'London Marathon' of ski races enjoys huge international popularity with, for example, over 50 British nationals taking part in 2023. It is an annual long distance cross-country ski race held on the first Sunday of March. The 90 km (56 miles) course starts in the village of Berga, just south of Sälen in western Dalarna, Sweden, and ends in the town of Mora in the central part of the province. It is the oldest cross-country ski race in the world, as well as the one with the highest number of participants.



The finish line of Vasaloppet in Mora with the race's motto "In forefathers' tracks – for future victories". Photo: Stina Rapp

The race was inspired by a legend that King Gustav Vasa, who is considered to be the founder of Sweden, made the journey when he was fleeing from Danish soldiers during the winter of 1520–1521 in the beginning of the Swedish War of Liberation from Denmark. According to legend, he fled on skis.

The race turned 100 years old last year and hundreds of thousands of skiers have made their way through the Vasaloppet course since its inception in 1922. It has grown from a race with 119 contestants on heavy wooden skis its first year, to 12 separate races engaging close to 100,000 skiers during the course of a whole week in the beginning of March each year.

Vasaloppet is also an important event for many ski fans and spectators and millions of television viewers follow the race from all around the world. It is reported that Vasaloppet contributes more than SEK 250 million (USD \$24 million) to the local tourism industry.²⁵

Vasaloppet invites sponsors in different categories with five “main sponsors” and several other lesser sponsors and “suppliers”. Volvo Cars has been a main sponsor since 1 September 2015 and Preem, Sweden’s biggest supplier of petroleum products, since 15 January 2009.

According to the latest self-reported CO₂ emissions from the two major sponsors of Vasaloppet, Volvo Cars report CO₂ emissions (scope 1, 2, and 3)²⁶ of 32 million tonnes²⁷ and Preem 52 million tonnes²⁸ making up a total of 84 million tonnes together.

A calculation using the numbers in the section above, and the relationship between CO₂ emissions and the loss of snow cover, shows that the businesses of Volvo Cars and Preem cause the loss of 80 and 130 km² of snow cover respectively each year. The two sponsors together are therefore responsible for the loss of 210 km² of snow cover.

The Vasaloppet ski area is wide in the beginning of the race, narrows to around 5 metres during the main part and widens a bit towards the finish line in Mora. The organisation behind Vasaloppet calls the area “Sweden’s longest and most narrow nature reserve” of 90km in length and 10 metres width, i.e. 0.9km².²⁹

²⁵ Vasaloppet: *Organisation – några hårda fakta*.
<https://www.vasaloppet.se/om-oss/organisation/>

²⁶ Scope 1 emissions are direct emissions from the company’s own resources. Scope 2 emissions are indirect emissions from the generation of purchased energy. Scope 3 emissions are indirect emissions that occur both upstream and downstream the value chain of the reporting company.

²⁷ VolvoCar Group: *Annual and sustainability report 2021*.
<https://vp272.alertir.com/qfw/files/press/volvocar/202204044874-1.pdf>

²⁸ Preem: *Fast track to climate neutrality, Sustainability Report 2021*. 1 June 2021.
https://www.preem.se/globalassets/om-preem/hallbarhet/hallbarhetsredovisning/preem-sustainability-report-2021_01_juni.pdf

²⁹ Vasaloppet: *Vasaloppet 100 år. Jubileumsskrift*. November 2021.
<https://www.vasaloppet.se/100ar/>

It is not unreasonable to conclude that Volvo Cars and Preem are responsible for the destruction of 80 km² and 130 km² of snow cover each year respectively, or 210 km² together. Compared to the area needed for the Vasaloppet ski race, this translates to the elimination of 89 Vasaloppet for Volvo Cars and 144 Vasaloppet for Preem, or 233 Vasaloppet for the two sponsoring companies together.

Another way of calculating the impact is to use existing research from the Institute of Geography at the University of Bremen and the Institute of Atmospheric and Cryospheric Sciences at the University of Innsbruck. This shows that an estimated loss of global glacier ice of around 1,260 million tonnes could be attributed to annual emissions from Volvo Cars and Preem.³⁰

Volvo and Preem

The automobile sector is one of the largest spenders in sports sponsorship.^{31,32} In 2018, it was estimated that the global car industry spent USD 1.285 billion on sports related sponsorships. That would amount to 64 percent of their total sponsorship money going into sports.³³ We believe that sum to now be very conservative and the real figure to be much higher.

Car traffic is a major contributor both to toxic air pollution breathed in by people at ground level and to the accumulation of climate disrupting carbon dioxide in the atmosphere. The transport sector contributes around 25 percent of fossil fuel related CO₂ emissions³⁴ and passenger cars are estimated to account for 41 percent of these.³⁵

³⁰ Ben Marzeion, Georg Kaser, Fabien Maussion, Nicolas Champollion: *Limited Influence of climate change mitigation on short-term glacier mass loss*. Nature Climate Change. 2018. <https://www.nature.com/articles/s41558-018-0093-1>

³¹ Nick Lawson: *Innovative Sports Sponsorship Ideas For Auto Partners*. Medium. 7 October 2019. <https://medium.com/sqwadblog/understanding-your-auto-partners-needs-in-sports-sponsorship-a2e15bf4a50>

³² Omnicom Media Group: *Sports Sponsorship and the Auto Industry*. 3 October 2017. <https://omnicommediagroup.com/news/global-news/sports-sponsorship-and-the-auto-industry/>

³³ *Why Do Audi, BMW & VW Sponsor Sports?* CEO Today. 28 February 2018. <https://www.ceotodaymagazine.com/2018/02/why-do-audi-bmw-vw-sponsor-sports/>

³⁴ IEA: *Greenhouse Gas Emissions from Energy Data Explorer*. 10 November 2021. <https://www.iea.org/data-and-statistics/data-tools/greenhouse-gas-emissions-from-energy-data-explorer>

³⁵ Statista: *Distribution of carbon dioxide emissions produced by the transportation sector worldwide in 2020, by subsector*. 14 December 2021. <https://www.statista.com/statistics/1185535/transport-carbon-dioxide-emissions-breakdown/>

Volvo Cars is one of five main sponsors of Vasaloppet and likes to highlight its investments in electric vehicles. But Volvo has a reputation for producing the heaviest, and therefore most energy-consuming, cars in Europe, a high proportion of those being SUVs.³⁶ The International Energy Agency (IEA) reports that SUVs have been the second-largest contributor to the increase in global fossil CO₂ emissions in recent years.³⁷ Volvo was also a very late entrant into the market for full Battery Electric Vehicles (BEVs).



Two elite skiers in Vasaloppet 2021 carrying the logos of Volvo and Preem. Image: Måns Sunesson

In 2022, only 10.9 percent of Volvo's global sales of 615,121 cars were fully electric.³⁸

³⁶ Lucien Mathieu and Julia Poliscanova: *Mission (almost) accomplished*. Transport & Environment. October 2020. https://www.transportenvironment.org/wp-content/uploads/2021/05/2020_10_TE_Car_CO2_report_final-1.pdf

³⁷ Laura Cozzi, Apostolos Petropoulos: Growing preference for SUVs challenges emissions reductions in passenger car market. IEA. 15 October 2019. <https://www.iea.org/commentaries/growing-preference-for-suvs-challenges-emissions-reductions-in-passenger-car-market>

³⁸ Volvo Cars Global Newsroom: *Volvo Cars reports Full Year 2022 sales, share of fully electric cars at 10.9%*. Press release 5 January 2023. <https://www.media.volvocars.com/global/en-gb/media/pressreleases/308388/volvo-cars-reports-full-year-2022-sales-share-of-fully-electric-cars-at-109>



Load your Volvo up and hit the mountain... Volvo cars are marketed as ideal for winter sports enthusiasts with loads of accessories such as roof boxes, ski holders and snowboard racks. Image: Michel Grolet/Unsplash

All other produced cars were fossil fuel powered. In their corporate reporting, Volvo focuses much more on future ambitions than on actual performance.³⁹ Even so, recent research raises the prospect that a focus on energy-intensive battery SUVs could even lead to an overall increase in CO₂ emissions.⁴⁰ The size and weight of battery SUVs also present road safety dangers.

The company's most sold car globally is the XC60 model. The XC60 is produced both as a plug-in hybrid, called XC60 Recharge, and as standard petrol and diesel versions. Plug-in hybrids typically are presented as low CO₂ emission vehicles but have been shown in real-world tests to emit substantially more than earlier reported.

³⁹ VolvoCar Group: *Annual and sustainability report 2021*.
<https://vp272.alertir.com/afw/files/press/volvocar/202204044874-1.pdf>

⁴⁰ Jonatan J. Gómez Vilchez, Roberto Pasqualino, Yeray Hernandez (2023) [The new electric SUV market under battery supply constraints: Might they increase CO2 emissions?](#) *Journal of Cleaner Production*

Transport & Environment (T&E) in 2020 commissioned Emissions Analytics to compare the advertised official CO₂ emissions of three popular plug-in hybrid cars with real-world emissions. The XC60 Recharge was among them with official CO₂ emissions of 71 g/km. Real-world emissions were measured in several settings with 184 g/km in a realistic driving mode, rising to 242 g/km when running on the combustion engine and simultaneously charging the battery. Research by Austria's Graz University of Technology published in 2023 also found that plug-in hybrids pollute much more than official figures suggest.⁴¹

Another main sponsor of Vasaloppet is Preem, a Saudi-owned petroleum company based in Sweden and the largest supplier of petroleum products in the country. The company has close to 600 petrol stations and two oil refineries, representing 80 percent of the national refining capacity, located on the Swedish west coast. One of them, Preemraff in Lysekil, is the biggest refinery in Scandinavia. Together, the two refineries process about 18 million tonnes of crude oil per year and more than half of the petroleum products are exported to northern Europe.

Preemraff is Sweden's third biggest single emitter of CO₂. Only a few years ago, Preem had plans to expand operations at Preemraff, thereby doubling its CO₂ emissions. After an intensive campaign by local citizens and environmental organisations, the company finally abandoned their plans in 2020.

Preem now instead markets itself as "Leading the transition towards a sustainable society".⁴² However, looking behind its colourful advertising campaigns and lofty goals, and reading the fine print of their sustainability report, it reveals that the total emissions of CO₂ as a result of their activities actually *increased* from 2020 to 2021, amounting to a total of 52 million tonnes annually.⁴³

⁴¹ Dr. Claus Matzer, Cihan Geles, Prof. Dr. Stefan Hausberger (2023) [CO2 and emissions performance of PHEV vehicles](#), Graz University of Technology.

⁴² Preem: *Leading the transition towards a sustainable society*. <https://www.preem.com/in-english/about/vision/>

⁴³ Preem: *Fast track to climate neutrality, Sustainability Report 2021*. 1 June 2021. https://www.preem.se/globalassets/om-preem/hallbarhet/hallbarhetsredovisning/preem_sustainability-report-2021_01_juni.pdf

4. Why are winter sports important for the high-carbon sponsors?



The transport sector continues to rely on fossil fuels for 91 percent of its energy use and transport accounts for around a quarter of all global energy-related CO₂ emissions. Seventy-five percent of these come from road traffic, mostly from private cars. Air traffic accounts for another 11 percent (excluding non-CO₂ effects) of emissions from transports.⁴⁴

A whole market has grown up around sport sponsorships. An abundance of agencies, brokers, advisers, and other middlemen are ready to support marketing directors who want to promote their brands by helping them to find the right event, team, or athlete to sponsor.

In fact, many experts will tell you how sport sponsorship is the most effective way to market your brand.⁴⁵ They will tell you how sponsoring sports builds brand awareness, boosts sales, and creates emotional engagement between fans and the brand. And sports sponsorships are specifically important for companies with a tarnished reputation. Why?

Executives of oil companies, car manufacturers and airlines all know that they need public support to continue their business. Losing community support is their main business risk. Instead of changing their business, they are fighting hard to protect business-as-usual through public relations, marketing, and sponsorships.

It's called 'Sportswashing' and has been defined as "the practice of a controversial company or country using sports sponsorship to improve its reputation".⁴⁶

⁴⁴ Hannah Ritchie: Cars, planes, trains: where do CO₂ emissions from transport come from?. Our World in Data. 6 October 2021. <https://ourworldindata.org/co2-emissions-from-transport>

⁴⁵ Emanuele Venturoli: *The effectiveness of sport sponsorship: here's marketing's best kept secret*. RTR Sports Marketing. <https://rtrsports.com/en/blog/effectiveness-of-sport-sponsorship/>

⁴⁶ Collins English Dictionary: *Sportswashing*. <https://www.collinsdictionary.com/submission/24393/sportswashing>

It's called 'Sportswashing' and has been defined as "the practice of a controversial company or country using sports sponsorship to improve its reputation".⁴⁷

So why winter sports? One reason is the broad outreach that they enjoy. There are over 136 million European winter sports fans and winter sports are generating a huge 3,642 hours of free-to-air broadcasts in Europe.

Corporate marketing departments see opportunities in targeting an arena with a clean image and a large number of reachable fans. Research shows that winter sports fans are more actively engaged and that there are fewer negative attitudes towards sponsors of winter sports than towards those sponsoring other sports. In fact, experts say that because of these reasons, winter sports are more attractive to sponsors than, for example, football.⁴⁸

High-carbon polluters will not talk about the climate impacts of their production. They will want to make you associate their brand with clean air, health, activity, sustainability, and nature. Being associated with winter sports meets all these targets.

⁴⁷ Collins English Dictionary: *Sportswashing*,
<https://www.collinsdictionary.com/submission/24393/sportswashing>

⁴⁸ Lars Stegelmann: *Winter Sports – More Attractive to Sponsors than Football*. Nielsen Sports. 5 January 2016.
<http://niensports.wpengine.com/winter-sports-more-attractive-to-sponsors-than-football/>

5. No snow – no show



Vasaloppet and other events at a high enough latitude or altitude may be able to continue operations for some time but many other snow sport venues and events see trouble already growing. Recently, almost 200 elite downhill and cross-country skiers signed a letter calling on FIS to take action on climate change.⁴⁹

The average February daytime temperature of Olympic Winter Games locations has steadily increased over time. During the 1920s to 1950s, the average maximum daily temperature of host cities in February was 0.4°C. During the 1960s to 1990s, the maximum daily temperature in February increased to 3.1°C, and further increased to 7.8°C during 2000–2010. Sochi, Russia in 2014 was the warmest city ever to host the Olympic Winter Games.⁵⁰ Without the development of artificial snowmaking, it would be difficult to successfully complete an Olympic programme in the host cities of recent decades.⁵¹

Concerns about the effects of climate change on potential hosts of the Winter Olympics have led the IOC to delay the election of the host of the 2030 Games,⁵² while digesting the results of academic research that shows a potential reduction in the number of climate-reliable host locations. As well as discussing a rotating line-up of cities, the IOC is weighing up a proposal that would require hosts to show average minimum temperatures of below zero degrees for snow competition venues at the time of the Games over a ten-year period.⁵³

⁴⁹ The Christian Science Monitor. *Alpine athletes call for climate action as bare slopes shorten season*
<https://www.csmonitor.com/Environment/2023/0213/Alpine-athletes-call-for-climate-action-as-bare-slopes-shorten-season>

⁵⁰ Daniel Scott, Natalie L. B. Knowles, Siyao Ma, Michelle Rutty & Robert Steiger: *Climate change and the future of the Olympic Winter Games: athlete and coach perspectives*, *Current Issues in Tourism*, 26:3, 480–495. 10 January 2022.
<https://www.tandfonline.com/doi/full/10.1080/13683500.2021.2023480?journalCode=rcit20>

⁵¹ Michelle Rutty, D. Scott, R. Steiger & P. Johnson: *Weather risk management at the Olympic Winter Games*. *Current Issues in Tourism*, 18:10, 931–946. 17 February 2014.
<https://www.tandfonline.com/doi/full/10.1080/13683500.2014.887665>

⁵² Host City: *IOC climate change concerns delay election of 2030 Olympics host*. 7 December 2022.
<https://www.hostcity.com/news/event-bidding/ioc-climate-change-concerns-delay-election-2030-olympics-host>

⁵³ Ed Dixon: *Winter Olympics could rotate between pool of hosts*. SportsPro Media. 8 December 2022.
<https://www.sportspromedia.com/news/winter-olympics-host-cities-2030-2034-ioc-climate-change/>

Meanwhile, alpine skiers have had to watch seven races in a row being cancelled in Central Europe at the beginning of the 2022/23 season and the warmer climate has also caused the season's first IBU Cup biathlon race to be cancelled.⁵⁴

"In Austria, the resorts around Salzburg last had snow a month ago. In Chamonix in France, the snow cannons are idle because the water to fuel them is in short supply. In Switzerland, some resorts have even opened their summer biking trails rather than try to offer winter sports. Others have simply shut down their ski lifts indefinitely."

BBC News, 3 January 2023⁵⁵

On 5 January 2023, FIS announced that they had to postpone the Para World Snowboard Championships, due to take place only a few weeks later, to March, citing "the unseasonably warm temperatures".⁵⁶

In spite of measures to mitigate the effects of climate change, many races have had to be moved or cancelled in the long-distance cross-country world cup Ski Classics. Already between 2012 and 2016, 14 out of 29 races were forced to change plans and either move the race to a colder place, shorten it, or simply cancel the whole race. Sixteen of these races had to depend on artificial snow for the whole or parts of the track, in itself a challenge with ski tracks being between 30 and 90 km long.⁵⁷

Plastering over

The winter sports industry is increasingly responding to the threatening effects of climate change with investments in snowmaking facilities. In an Olympic setting, artificial snow was first introduced at the 1980 Winter Olympics in Lake Placid, New York, and has since been used increasingly. About 80 percent of

⁵⁴ Lisa Edwinsson: *Klimathotet mot vintersporterna: "Det kommer vara en utmaning att kunna tävla"*. Dagens Nyheter. 28 December 2022. <https://www.dn.se/sport/klimathotet-mot-vintersporterna-det-kommer-vara-en-utmaning-att-kunna-tavla/>

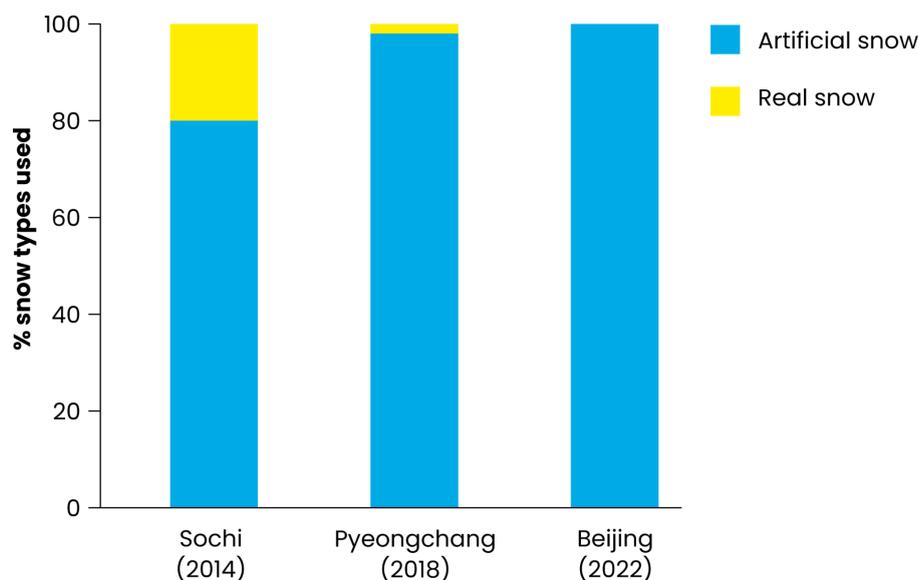
⁵⁵ Imogen Foulkes: *Snow shortage threatens Alps with wet winter season*. BBC News. 3 January 2023. <https://www.bbc.com/news/world-europe-64151166>

⁵⁶ The International Ski and Snowboard Federation: *2023 FIS Para World Snowboard Championships Postponed*. 5 January 2023. <https://www.fis-ski.com/en/para-snowsports/news-multimedia/2023-fis-para-world-snowboard-championships-postponed>

⁵⁷ Erik Melin Söderström: *Klimatförändringskänslighet och anpassning av längdskidåkning i Nordeuropa*. Peak Innovation. 2017. http://peakinnovation.se/wp-content/uploads/2017/10/Pop.version_omvärldsanalys.docx-2.pdf

the snow used in Sochi, Russia in 2014 was artificial, topped by 98 percent in Pyeongchang, South Korea in 2018. In the Beijing Winter Games 2022, 100 percent of the snow used was artificial.⁵⁸

Today, the majority of ski slopes in the European Alps are equipped for snowmaking. 25 percent of skiing areas in Germany, 39 percent in France; 54 percent in Switzerland; 70 percent in Austria; and a whopping 90 percent of ski areas in Italy are served by artificial snowmaking machinery.⁵⁹



But snowmaking also comes with a cost. In Switzerland, larger resorts use around 17 percent of their daily operating expenses for snowmaking. Snowmaking also uses large amounts of water and energy to produce the snow, and if that energy is fossil-fuel based, which is highly likely, then making snow is itself contributing even further to CO₂ emissions and loss of more snow.

Snow cover is also commonly secured by so-called “snow farming”, the storing of large piles of snow covered by sawdust or canvas cloth collected during colder periods, sometimes from one season to the next.⁶⁰

⁵⁸ Chad de Guzman: *What Artificial Snow at the 2022 Olympics Means for the Future of Winter Games*. Time 8 February 2022.

<https://time.com/6146039/artificial-snow-2022-olympics-beijing/>

⁵⁹ Seilbahnen Schweiz: 2022 – Fakten & Zahlen zur Schweizer Seilbahnbranche. 2022.

<https://www.seilbahnen.org/de/Branche/Statistiken/Fakten-Zahlen>

⁶⁰ Swedish Portal for Climate Change Adaptation: *Storage of snow ensures skiing during warmer winters*. 11 January 2011.

<https://www.klimatanpassning.se/en/cases/storage-of-snow-ensures-skiing-during-warmer-winters-1167149>

6. High-carbon money going to winter sports



The sports sponsorship market is booming. In 2022 it was valued at USD 77.69 billion and is now expected to grow by 8.67 percent yearly to reach USD \$151.19 billion in 2030,⁶¹ representing a substantial amount compared to media owners' total revenue from advertising of 808 billion worldwide in 2022.⁶²

Sponsors can elect to sponsor an individual athlete, a team, a sports organisation, a particular skiing event or a whole race series, like the Audi FIS Alpine World Cup, the BMW IBU Biathlon World Cup, or the Toyota U.S. Grand Prix for snowboard and freeski.

It is not possible to put a reliable figure on the value of sponsorships to winter sports specifically. Instead, we have taken a snapshot of the width of the market by creating a sample of existing sponsorships to the winter sports sector (see Appendix 1). It should be noted that this sample does not say anything about the size of the deals, only the number.

"It's remarkable when those who can pick and choose, choose without thinking."

Swedish biathlete Björn Ferry, Olympic and World champion, about athletes advertising high-carbon companies.

To give us an indication of what the market looks like we have sampled 107 high-carbon sponsoring deals with skiing organisations, event organisers, teams and with individual athletes. Car manufacturers, led by Audi have been the most active with a total of 84 sponsoring deals, of which Audi has 55. Among those sponsored by Audi there is even the global body representing snowsports, FIS. Fossil fuel companies and airlines come in next with 15 and 7 deals respectively.

⁶¹ Research and Markets: *Sports Sponsorship Market Research Report by Type (Club & Venue Activation, Digital Activation, and Signage), Application, Region - Cumulative Impact of COVID-19, Russia Ukraine Conflict, and High Inflation - Global Forecast 2023-2030*. January 2023. <https://www.researchandmarkets.com/reports/5666338/sports-sponsorship-market-research-report-by-type#tag-pos-1>

⁶² *Advertising media owners' revenue worldwide from 2014 to 2027*. Statista. 6 January 2023. <https://www.statista.com/statistics/236943/global-advertising-spending/>

However, fossil fuel interests can go far beyond corporate sponsorships to the state level. In late 2022, for example, it was announced that Saudi Arabia, a petro-state, would be hosting the 2029 Asian Winter Games, and is thought to be interested in bidding to host the 2030 winter Olympics.

7. The case for ending high-carbon sponsorship of winter sports



The negative health impacts of the use of fossil fuels are significant. The WHO expects climate change to cause approximately 250,000 additional deaths per year between 2030 and 2050. The direct damage costs to health are estimated to be USD \$2–4 billion per year by 2030.⁶³ But the loss of life due to the pollution that results from burning fossil fuels is much greater still. Some of the most recent research resulting from the work by Harvard and three British universities in 2021 estimated that there are over 8 million deaths annually attributable to just fossil fuel air pollution, or one fifth of all premature deaths globally.⁶⁴

“Saving our planet is now a communications challenge”

Sir David Attenborough⁶⁵

There is nothing odd or anomalous with a ban on fossil fuel advertising. Marketing of many harmful products, such as tobacco or alcohol, is already banned or regulated.

The international WHO Framework Convention on Tobacco Control (FCTC) that was concluded in 2003 requires a “comprehensive ban on all tobacco advertising, promotion and sponsorship”. Most countries today have strict and far-reaching bans on the marketing of tobacco products. There is no reason the marketing of fossil fuels, fossil fuelled cars and airlines shouldn’t be restricted in the same way. And, in fact, at the city and municipality level around the world just such new controls on high carbon advertising are being introduced. Some mainstream media outlets too have begun to restrict categories of high carbon advertising, such as by oil companies.

⁶³ World Health Organisation: *Climate change and health*. 30 October 2021. <https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>

⁶⁴ Reuters, 9th February 2021 [<https://www.reuters.com/article/us-health-pollution-fossil/fossil-fuel-pollution-causes-one-in-five-premature-deaths-globally-study-idUSKBN2A90UB>]; ‘Fossil fuel air pollution responsible for more than 8 million people worldwide in 2018’, Harvard, 9th February 2021

⁶⁵ BBC: *Sir David Attenborough joins Instagram to warn ‘the world is in trouble’*. 24 September 2020. <https://www.bbc.com/news/entertainment-arts-54281171>



Artwork by Lindsay Grime. Installations by Brandalism, 2022

It can also be argued that fossil fuel advertising should already be banned under the EU's Unfair Commercial Practices Directive (UCPD) which prohibits misleading advertising.⁶⁶ Legal experts point out that advertising should be deemed misleading if it incorrectly portrays the consumption of fossil fuels at current levels as acceptable and normal, thereby obscuring the fact that their production and use must urgently be phased out to meet the goals of the Paris agreement.⁶⁷

The purpose of advertising is to achieve brand recognition, dominance and to sell more products. Advertising would not be the multi-billion industry it is if it didn't work. The reason for a car manufacturer to sponsor a ski race is in the end to sell more cars. As a sponsorship manager at Volvo Cars puts it: "There are many good reasons for Volvo to be engaged actively in sports... We

⁶⁶ European Commission: *Directive 2005/29/EC of the European Parliament and of the Council, Unfair Commercial Practices Directive*. Official Journal of the European Union. 11 May 2005. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32005L0029&from=EN>

⁶⁷ Clemens Kaupa: *Smoke Gets in Your Eyes: Misleading Fossil Fuel Advertisement in the Climate Crisis*. *Journal of European Consumer and Market Law*, 1/2021. 23 Mars 2001. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3786647

increase awareness of our trademark. And, naturally, we sell more cars.”⁶⁸

In terms of a clear precedent, since the origin of professional sports, the tobacco industry was once the main sponsor of athletes and sport events.⁶⁹ When the connection between tobacco and lung cancer was established in the mid 20th century, the industry pushed even harder and were able to delay legislation for decades. Even today, big tobacco is seeking ways to circumvent advertisement bans through the promotion of smokeless tobacco products, that culturally normalise smoking and leave the door open to real tobacco.⁷⁰

A recent study revealed that the increased demand due to global car and airline advertising could have been responsible for between 202 million and 606 million tonnes of greenhouse gas emissions in 2019 – an order of magnitude ranging from between the Netherlands’ entire emissions that year to almost twice those of Spain.⁷¹ It has been estimated that private household consumption drives around two thirds of global greenhouse emissions,⁷² indicating that the choices made by consumers and households are important in driving or mitigating climate change.

There are already many initiatives around the world, both private and public, to ban or regulate high-carbon advertising.⁷³ In France, car makers must soon pick one of three slogans to include in TV, radio, print and online adverts: “On a daily basis, take public transport”, “Consider carpooling”, or “For short journeys, walking or

⁶⁸ Volvo Cars: *Sports is a vital part of the sponsoring strategy*. Press release. 27 December 2007. <https://www.media.volvocars.com/global/en-gb/media/pressreleases/13805?preview=true&t=14054e1a-dc65-48e3-baec-1390d3d4d382>

⁶⁹ Alan Blum, *Tobacco in sport: an endless addiction?* BMJ Journals, Volume 14, issue 1, 25. February 2005. <https://tobaccocontrol.bmj.com/content/14/1/1>

⁷⁰ U.S. Department of Health and Human Services. *E-Cigarette Use Among Youth and Young Adults. A Report of the Surgeon General*. Atlanta, GA, 2016. https://e-cigarettes.surgeongeneral.gov/documents/2016_SGR_Full_Report_non-508.pdf

⁷¹ Greenpeace and New Weather institute: *Advertising Climate Chaos*. 2022. https://www.newweather.org/wp-content/uploads/2022/02/Advertising-Climate-Chaos_web.pdf

⁷² Diana Ivanova, J. Barrett, D. Wiedenhofer, B. Macura, M. Callaghan, and F. Creutzig: *Quantifying the potential for climate change mitigation of consumption options*. Environmental Research Letters 15-9. 20 August 2020. <https://iopscience.iop.org/article/10.1088/1748-9326/ab8589/pdf>

⁷³ Reclame Fossilvrij: *Worldwide initiatives to ban fossil fuel advertisements*. <https://verbiedfossilereclame.nl/only-words/>

bicycling is preferable.”⁷⁴ The City of Amsterdam and seven other Dutch cities have banned fossil fuel advertising onboard public transport.⁷⁵ In the UK, several city councils have passed motions to restrict high-carbon advertising.⁷⁶ On the media side, British newspaper *The Guardian* has banned all advertising from fossil fuel firms since January 2020.⁷⁷

“The climate crisis is here, and winter sports are promoting it by advertising the use of products that are frying the planet and destroying the sport we love. It is a big irony that fossil fuel sponsorships are so common in a sport that is heavily dependent on cold winters and snow. We need to take responsibility and stop accepting fossil fuel sponsorships and promoting climate destruction. Fossil fuel companies are melting the snow of winter sports, and it needs to stop.”

Emil Johansson Kringstad, elite Swedish cross-country skier

Multinational oil and gas giant Total backed out of a sponsorship of the Paris Olympic Games 2024 after city mayor Anne Hidalgo had increasingly campaigned for environmentally sound initiatives. Total’s CEO Patrick Pouyanne said he did not want to be a “sponsor who is pilloried”.⁷⁸

⁷⁴ Lottie Limb: *French car adverts must encourage people to bike and walk*. Euronews.green. 7 January 2022.
<https://www.euronews.com/green/2022/01/07/french-car-adverts-must-encourage-people-to-bike-and-walk>

⁷⁵ Reclame Fossielvrij: *Worldwide initiatives to ban fossil fuel advertisements*.
<https://verbiedfossielereclame.nl/only-words/>

⁷⁶ Andrew Simms: *It worked with cigarettes. Let’s ban ads for climate-wrecking products*. New Scientist. 4 May 2022.
<https://www.newscientist.com/article/mg25433851-200-it-worked-with-cigarettes-lets-ban-ads-for-climate-wrecking-products/>

⁷⁷ Jim Waterson: *Guardian to ban advertising from fossil fuel firms*. The Guardian. 29 January 2020.
<https://www.theguardian.com/media/2020/jan/29/guardian-to-ban-advertising-from-fossil-fuel-firms-climate-crisis>

⁷⁸ France24: *Total pull sponsorship plug on 2024 Olympics over ‘eco-Games’*. 5 June 2019.
<https://www.france24.com/en/20190605-total-pull-sponsorship-plug-2024-olympics-over-eco-games>

8. Save Our Snow!

Our recommendations



For winter sports to have a future, immediate measures to stop the emissions of greenhouse gases must be taken. Fossil industry advertising undermines action in many ways. It stimulates the demand for fossil fuels and products and activities that depend on them, locking us even deeper into high carbon infrastructure and behaviour, and thereby blocking change and needed investments in renewable energy and energy-efficient solutions.

The United Nations, in collaboration with the International Olympic Committee (IOC) and a diverse set of sports organisations launched the Sports for Climate Action Framework in 2018. The International Ski and Snowboard Federation (FIS) joined three years later.

Reforms in the field of sports, such as those initiated by the Climate Action Framework, are welcome and necessary to meet international climate targets but far from enough.

It is unacceptable for sports organisations to claim climate action credentials or carbon neutrality while accepting money from companies who are directly undermining their climate commitments. If global sports are to take the issue of climate breakdown seriously, it must be consistent and coherent and review its partnerships with organisations whose practices go against their efforts to safeguard the future of our planet.

Sports organisations, competitions, teams, and individual athletes must be consistent with their declared climate concerns. That means taking responsibility for the additional global warming that results from supporting the agendas of high-carbon industry through helping them communicate their misleading and destructive messages. Winter sports need to take their climate commitments seriously and cut their self-destructive ties to high-carbon emitters.

Recommendations:

For sports organisations, event organisers, teams, and athletes:

- Positively screen corporate sponsors and turn down sponsorship and advertising from companies promoting clearly high carbon lifestyles, products, and services,

especially those in the automotive, airlines and fossil fuel industries.

- Sign up to the UN Sport for Climate Action Framework and within one year of signing draw up and publish a comprehensive plan to ensure that their own operations and that of their sport (including spectators' travel) are zero carbon by 2030.
- Set clear annual targets and steps on how to achieve them.

For lawmakers and regulators (national or local):

- Prohibit advertisements for fossil fuels, as well as air, road, and water-borne transportation (other than transport services of general economic interest) powered by fossil fuels.
- Prohibit advertisements from any undertakings active in the market for fossil fuels, in particular by extracting, refining, supplying, distributing, or selling fossil fuels.
- Prohibit sponsorships by undertakings defined under the point above, or the use of trademarks or commercial names used for fossil fuels.

Appendix 1



Table 1: Sample of 107 high-carbon sponsors of snow sport. The table is put together with material that is openly published on the internet. All information is taken from the sponsored entities own material and websites.

Sponsor	Business	Sponsee	Type	Sport	Country
Air China	Airline	Winter Olympics 2022	Event	All	International
Air New Zealand	Airline	Snow Sports New Zealand	Organisation	Multi	New Zealand
Alfa Romeo	Car manufacturer	Nina Ortlieb	Athlete	Alpine	Austria
Audi	Car manufacturer	Ramona Siebenhofer	Athlete	Alpine	Austria
Audi	Car manufacturer	Manuel Feller	Athlete	Alpine	Austria
Audi	Car manufacturer	Marco Schwarz	Athlete	Alpine	Austria
Audi	Car manufacturer	Johannes Strolz	Athlete	Alpine	Austria
Audi	Car manufacturer	Flachau	Event site	Alpine	Austria
Audi	Car manufacturer	St Anton	Event site	Alpine	Austria
Audi	Car manufacturer	Levi	Event site	Alpine	Finland
Audi	Car manufacturer	Tessa Worley	Athlete	Alpine	France
Audi	Car manufacturer	Fédération Française de Ski	Organisation	Alpine	France
Audi	Car manufacturer	Lena Dürr	Athlete	Alpine	Germany
Audi	Car manufacturer	Emma Aicher	Athlete	Alpine	Germany
Audi	Car manufacturer	Rome Baumann	Athlete	Alpine	Germany
Audi	Car manufacturer	Thomas Dressen	Athlete	Alpine	Germany
Audi	Car manufacturer	Andrea Filser	Athlete	Alpine	Germany
Audi	Car manufacturer	Fabian Himmelsb	Athlete	Alpine	Germany
Audi	Car manufacturer	Stefan Luitz	Athlete	Alpine	Germany
Audi	Car manufacturer	Andreas Sander	Athlete	Alpine	Germany

Sponsor	Business	Sponsee	Type	Sport	Country
Audi	Car manufacturer	Alexander Schmid	Athlete	Alpine	Germany
Audi	Car manufacturer	Dominik Schwaiger	Athlete	Alpine	Germany
Audi	Car manufacturer	Linus Strasser	Athlete	Alpine	Germany
Audi	Car manufacturer	Luis Vogt	Athlete	Alpine	Germany
Audi	Car manufacturer	Kira Weidle	Athlete	Alpine	Germany
Audi	Car manufacturer	Ski World Cup	Event	Alpine	International
Audi	Car manufacturer	Fis Alpine World Cup	Event	Alpine	International
Audi	Car manufacturer	Federica Brignone	Athlete	Alpine	Italy
Audi	Car manufacturer	Alex Vinatzer	Athlete	Alpine	Italy
Audi	Car manufacturer	Cortina d'Ampezzo	Event site	Alpine	Italy
Audi	Car manufacturer	Petra Vlhova	Athlete	Alpine	Slovakia
Audi	Car manufacturer	Åre	Event site	Alpine	Sweden
Audi	Car manufacturer	Swedish alpine ski team	Team	Alpine	Sweden
Audi	Car manufacturer	Swedish alpine ski team	Team	Alpine	Sweden
Audi	Car manufacturer	Joana Hählen	Athlete	Alpine	Switzerland
Audi	Car manufacturer	Jasmine Flury	Athlete	Alpine	Switzerland
Audi	Car manufacturer	Michelle Gisin	Athlete	Alpine	Switzerland
Audi	Car manufacturer	Lara Gut-Behrami	Athlete	Alpine	Switzerland
Audi	Car manufacturer	Wendy Holdener	Athlete	Alpine	Switzerland
Audi	Car manufacturer	Corinne Suter	Athlete	Alpine	Switzerland
Audi	Car manufacturer	Beat Feuz	Athlete	Alpine	Switzerland
Audi	Car manufacturer	Niels Hintermann	Athlete	Alpine	Switzerland
Audi	Car manufacturer	Swiss-Ski	Organisation	Alpine	Switzerland
Audi	Car manufacturer	Franziska Preuss	Athlete	Biathlon	Germany
Audi	Car manufacturer	Sofie Krehl	Athlete	Cross-	Germany

Sponsor	Business	Sponsee	Type	Sport	Country
				country	
Audi	Car manufacturer	FIS Ski Cross World Cup	Event	Freestyle	International
Audi	Car manufacturer	Ski Austria	Organisation	Multi	Austria
Audi	Car manufacturer	Czech Ski & Snowboard	Organisation	Multi	Czech Republic
Audi	Car manufacturer	Suomen Hiihtoliitto	Organisation	Multi	Finland
Audi	Car manufacturer	International Ski and Snowboard Federation (FIS)	Organisation	Multi	International
Audi	Car manufacturer	Federazione Italiana Sport Invernali	Organisation	Multi	Italy
Audi	Car manufacturer	Johannes Rydzek	Athlete	Nordic Combined	Germany
Audi	Car manufacturer	Daniela Maier	Athlete	Ski cross	Germany
Audi	Car manufacturer	Cornel Renn	Athlete	Ski cross	Germany
Audi	Car manufacturer	Florian Wilmsmann	Athlete	Ski cross	Germany
Audi	Car manufacturer	FIS Ski Jumping World Cup, Râşnov 2021	Event	Ski jumping	Romania
Audi	Car manufacturer	FIS Ski Jumping World Cup, Planica 2023	Event	Ski jumping	Slovenia
Austrian	Airline	Austrian Olympic Committee	Organisation	Multi	Austria
BMW	Car manufacturer	Lech/Zürs	Event site	Alpine	Austria
BMW	Car manufacturer	Vanessa Hinz	Athlete	Biathlon	Germany
BMW	Car manufacturer	International Biathlon Union	Organisation	Biathlon	International
BMW	Car manufacturer	BMW IBSF Weltcup, Altenberg 2023	Event	Bob + skeleton	Germany
BMW	Car manufacturer	Felix Loch	Athlete	Luge	Germany
BMW	Car manufacturer	International Luge Federation	Organisation	Luge	International

Sponsor	Business	Sponsee	Type	Sport	Country
BMW	Car manufacturer	Holmenkollen Skifestival 2023	Event	Multi	Norway
British Airways	Airline	Team Great Britain	Team	Alpine	Great Britain
CNPC	Fossil fuels	Winter Olympics 2022	Event	All	International
Equinor	Fossil fuels	Norwegian cross-country ski team	Team	Cross-country	Norway
Ford	Car manufacturer	Smart Energy Cup, Ulricehamn 2022/23	Event	Cross-country	Sweden
Ford	Car manufacturer	Swedish cross-country ski team	Team	Cross-country	Sweden
Gazprom	Fossil fuels	Russian Alpine Ski and Snowboard Federation	Organisation	Alpine	Russia
Lufthansa	Airline	Croatian Ski Association	Organisation	Multi	Croatia
Lukoil	Fossil fuels	Alexander Bolshunov	Athlete	Cross-country	Russia
Lukoil	Fossil fuels	Cross Country Ski Federation of Russia	Organisation	Cross-country	Russia
Mercedes Benz	Car manufacturer	Kronplatz	Event site	Alpine	Italy
Petrol Group	Fossil fuels	Žan Kranjec	Athlete	Alpine	Slovenia
Petrol Group	Fossil fuels	IBU Cup Biathlon, Pokljuka 2023	Event	Biathlon	Slovenia
Petrol Group	Fossil fuels	World Ski Jumping Ladies, Ljubno 2023	Event	Ski jumping	Slovenia
Petrol Group	Fossil fuels	FIS Ski Jumping World Cup, Planica 2023	Event	Ski jumping	Slovenia
Petrol Group	Fossil fuels	Snowboard World Cup, Rogla 2022	Event	Snowboard	Slovenia

Sponsor	Business	Sponsee	Type	Sport	Country
Preem	Fossil fuels	Vasaloppet	Event	Cross-country	Sweden
SAS	Airline	Swedish alpine ski team	Team	Alpine	Sweden
Scania	Truck manufacturer	Swedish cross-country ski team	Team	Cross-country	Sweden
Singapore Airlines	Airline	Freestyle Federation of Russia	Organisation	Freestyle	Russia
Sinopec	Fossil fuels	Winter Olympics 2022	Event	All	International
Skoda	Car manufacturer	Kathi Truppe	Athlete	Alpine	Austria
Subaru	Car manufacturer	Killington	Event site	Alpine	USA
Subaru	Car manufacturer	Ski Association of Japan	Organisation	Multi	Japan
Subaru	Car manufacturer	Manuel Faisst	Athlete	Nordic Combined	Germany
Subaru	Car manufacturer	Johannes Rydzek	Athlete	Nordic Combined	Germany
Tatneft	Fossil fuels	Russian Cup in Alpine Skiing, Belokurikha 2023	Event	Alpine	Russia
Tatneft	Fossil fuels	Russian Alpine Ski and Snowboard Federation	Organisation	Alpine	Russia
Toyota	Car manufacturer	Team Great Britain	Team	Alpine	Great Britain
Toyota	Car manufacturer	Paula Moltzan	Athlete	Alpine	USA
Toyota	Car manufacturer	Steven Nyman	Athlete	Alpine	USA
Toyota	Car manufacturer	Travis Ganong	Athlete	Alpine	USA
Toyota	Car manufacturer	Ryan Cochran-Siegle	Athlete	Alpine	USA
Toyota	Car manufacturer	Beaver Creek	Event site	Alpine	USA
Toyota	Car manufacturer	Austrian Olympic Committee	Organisation	Multi	Austria
Toyota	Car manufacturer	Winter Olympics 2022	Event	Multi	China

Sponsor	Business	Sponsee	Type	Sport	Country
Toyota	Car manufacturer	Deutscher Skiverband	Organisation	Multi	Germany
Toyota	Car manufacturer	International Olympic Committee	Organisation	Multi	International
Toyota	Car manufacturer	US Ski & Snowboard	Organisation	Multi	USA
Uno-X	Fossil fuels	Johannes Høsflot Klæbo	Athlete	Cross-country	Norway
Volkswagen	Car manufacturer	Fédération Française de Ski	Organisation	Cross-country	France
Volkswagen	Car manufacturer	Engelbrektsloppet, Norberg 2023	Event	Cross-country	Sweden
Volvo Cars	Car manufacturer	Vasaloppet	Event	Cross-country	Sweden

Appendix 2



For the calculation of the loss of snow cover, we have used data and information from Rutgers University Snow Lab showing an overall annual northern hemisphere loss of 90,600 km² of May snow cover since 1970.⁷⁹

As there is an approximately linear relationship between the global surface air temperature in a given year and the cumulative CO² emissions up to that year,⁸⁰ we have used the yearly CO² emissions of 36.3 billion tonnes⁸¹ and calculated the effect on changes in May snow cover to be 2.5 m² per tonne of CO² per year (90,600 km² per year / 36 billion tonnes CO² per year = 2.5 m² per tonne of CO² per year).

Using this figure and multiplying with the yearly emissions of CO₂ by Volvo Cars and Preem (32+52 = 84 million tonnes),^{82,83} we conclude that the two companies could account for the destruction of 80 km² and 130 km² of snow cover each year respectively, or 210 km² together.

Compared to the total area of snow cover needed for the Vasaloppet ski race, 0.9 km²,⁸⁴ this translates to the elimination of 89 Vasaloppet for Volvo Cars and 144 Vasaloppet for Preem, or 233 Vasaloppet for the two sponsoring companies together.

The calculation is also explained in detail in section 2, Climate change impacts on winter sports.

⁷⁹ Rutgers University Global Snow Lab: *Area of Snow Extent*.
<http://climate.rutgers.edu/snowcover/index.php>

⁸⁰ Rypdal M, Boers N, Fredriksen H-B, Eiselt K-U, Johansen A, Martinsen A, Falck Mentzoni E, Graversen RG and Rypdal K: *Estimating Remaining Carbon Budgets Using Temperature Responses Informed by CMIP6*. *Front. Clim.* 3:686058. 12 July 2021.
<https://www.frontiersin.org/articles/10.3389/fclim.2021.686058/full>

⁸¹ IEA: *Global CO₂ emissions rebounded to their highest level in history in 2021*. 8 March 2022.
<https://www.iea.org/news/global-co2-emissions-rebounded-to-their-highest-level-in-history-in-2021>

⁸² VolvoCar Group: *Annual and sustainability report 2021*.
<https://vp272.alertir.com/afw/files/press/volvocar/202204044874-1.pdf>

⁸³ Preem: *Fast track to climate neutrality, Sustainability Report 2021*. 1 June 2021.
https://www.preem.se/globalassets/om-preem/hallbarhet/hallbarhetsredovisning/preem_sustainability-report-2021_01_juni.pdf

⁸⁴ [6] Vasaloppet: *Vasaloppet 100 år*. Jubileumsskrift. November 2021.
<https://www.vasaloppet.se/100ar/>