



TROX / life

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TROX

TROX GmbH
Heinrich-Trox-Platz
47504 Neukirchen-Vluyn, Germany
Tel.: +49 (0)2845/20 2-0
Fax: +49 (0)2845/20 2-265
trox@trox.de
www.trox.de

Stadium air.

Stadiums and their particular flair.



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viewpoint

A fresh breath of stadium air.

At last, football reigns supreme again! Starting on 8 June, Poland and Ukraine will host the 2012 European Championship. When all our national football teams compete for the title, the championship venues will glow with football fever. To ensure that the stadium climate is not brought to a boil in the heat of the action, TROX has supplied air conditioning components for the arenas. They make for a healthy, comfortable climate and improved safety.

TROX technology is at play in seven out of eight official European Championship stadiums, which is the perfect excuse for offering our readers a tour of the world of stadiums and arenas. However, our latest magazine not only contains exciting facts and anecdotes to do with football; TROX life also has a look behind the scenes of football and stadium management.

The next World Cup is already shaping events. It will take place in 2014, in the most football-crazy country on earth: Brazil. Our colleagues of TROX Latin America are in the midst of planning for the largest stadiums in Brazil; the refurbished football temple Maracanã in Rio de Janeiro, among others. Of course, the air handling units will face particularly great challenges in Brazil's hot climate.

Find out more about the progress on the famous World Cup arena in Rio and the issues that planners and architects have to deal with in this legendary football venue in our interview with Brazilian star architect Daniel Fernandes. Brazil expects the matches to be boisterous and cheerful and TROX is taking part in the best way we know how: by providing ventilation components for the country's most important stadiums.

We are all looking forward to an exciting European Championship and wish you an interesting read of our magazine entitled "Stadium air".



Lutz Reuter
Chairman of the Board of Management of TROX GmbH

EURO 2012 Kick-off in Warsaw.

An opening match
on historic ground.

When the referee blows the starting whistle at the European Championship opening match between Poland and Greece on 8 June, TROX technology in Poland's National Stadium will make sure that there is no reason for the 55,000 spectators to panic even in the event of a fire.

project report

Warsaw's new landmark.

On the shore of the Vistula River, a multifunctional arena for 55,000 spectators has been built. It is the only one among the eight European Championship stadiums with a retractable roof. The new building sits on an embankment that was erected in 1955 with rubble from the Warsaw Uprising and has since been the site of the Dziesięciolecia National Stadium. To the city, it was very important that the existing embankment be disturbed as little as possible. The two lower levels of the new construction were therefore embedded in the embankment topography. Neither the level of the embankment crest nor that of the existing playing field was altered. The access roads, the geometry of the embankment and the two tunnels leading into the stadium were kept and integrated in the new building. The revival of this historic site as a sports centre with the "new" national stadium represents a cornerstone in Poland's national identity.

Fire protection and smoke extract technology from TROX prevents fire and smoke from spreading uncontrollably. Besides superior fire protection technology, TROX sound attenuators and air terminal units have also been installed in Poland's National Stadium. Moreover, an intelligent BMS ensures that the security and reliability of the technical building services can be monitored at any time. Warsaw is one of seven European Championship stadiums where TROX technology is in use.

A European Championship of great distances: 1,835 km from Gdansk to Donetsk.



Facts on the project

Building owner: Narodowe Centrum Sportu Sp. z o.o.
 Construction time: 2008-2011
 Architects: gmp – Architects of Gerkan, Marg and Partner (draft) together with J.S.K. Architekci, Warsaw, and Schlaich Bergermann and Partner, Stuttgart, Germany
 BSE implementation: Imtech Polska
 Seats: 55,000
 VIP lounges: 68, VIP lounges: 1
 Corporate seats: 2,600
 Press seats: 580
 Underground parking spaces: 1,800
 Length of stadium: 314 m
 Width of stadium: 280 m
 Height of stadium: 97 m

Information on BSE

76 air handling units
 1.5 million m³/h air volume
 2,700 fire dampers
 3,000 radiators
 Approx. 1,000 toilet units
 More than 35,000 sprinkler heads
 Heating capacity 15 MW
 Electric power rating 4 x 2,000 kVA
 Total air volume 1,500,000 m³/h
 Smoke extract air volume 1,200,000 m³/h

Large metal baffles in the national colours red and white and interwoven façade elements create an intriguing interplay of light and shadows.

The new EC stadiums at a glance:

Poland



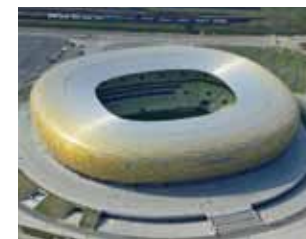
Warsaw
 National Stadium Warsaw
 Capacity: 58,145



Poznan
 Municipal Stadium Poznan
 Capacity: 43,090



Wroclaw
 Municipal Stadium Wroclaw
 Capacity: 42,771



Gdansk
 PGE ARENA Gdansk
 Capacity: 41,582

Ukraine



Kiev
 National Sports Complex (NSC) «Olimpiyskiy»
 Capacity: 70,050



Lviv
 Arena-Lviv
 Capacity: 34,915



Kharkiv
 Metalist Stadium
 Capacity: 38,633



Donetsk
 Donbass Arena
 Capacity: 51,504

National Stadium Warsaw // Copyright: ALPINE, PGE ARENA Gdansk // Copyright: ALPINE, Municipal Stadium Posen // Copyright: Euro Poznan 2012

project report



Air handling units handle 1 million cubic metres of air per hour.



Diffusers, such as jet nozzles in the upper stands, are also used for "airing" the turf.



Innovative air control blades offer extremely quiet air control and optimum swirl generation, the ideal comfortable climate in lounges, restaurants, press centres and changing rooms.



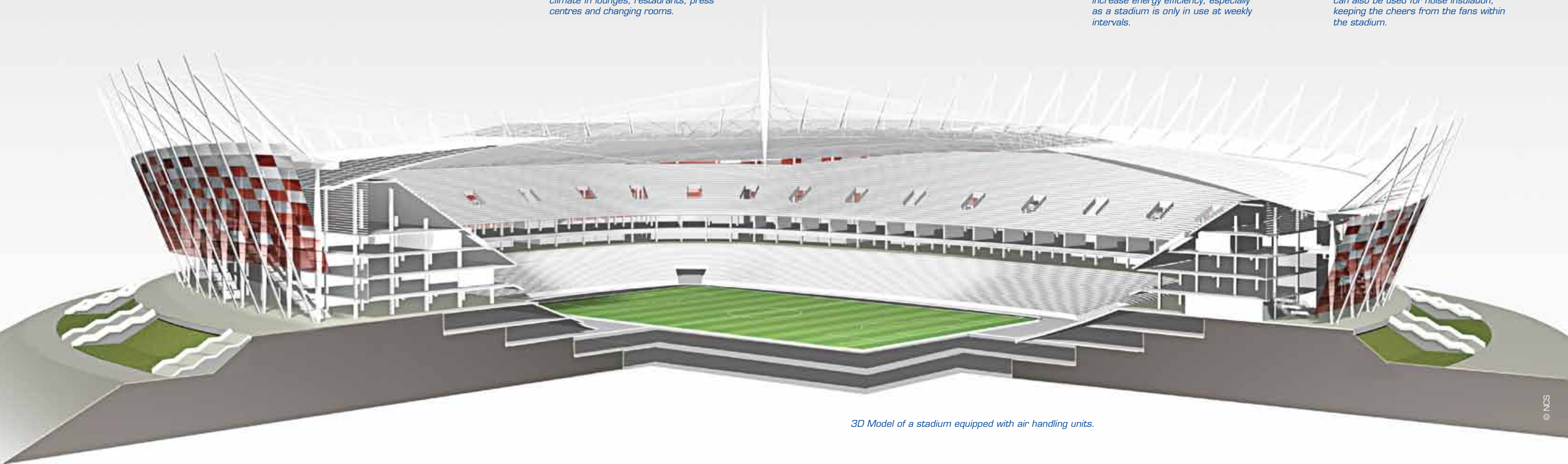
Superior fire and smoke protection technology ensure first-class safety for spectators.



Volume flow controllers not only ensure that the ventilation is adapted to the current demand but also increase energy efficiency, especially as a stadium is only in use at weekly intervals.



Splitter sound attenuators not only absorb the noise of the air handling units; a special design means that they can also be used for noise insulation, keeping the cheers from the fans within the stadium.



3D Model of a stadium equipped with air handling units.

© NCS

Masterful achievement, technically and architecturally.

Nestled in its surroundings, the arena will become a landmark visible for miles around. The commercial area includes various shops, offices, restaurants and pubs, cinemas, a gym, a museum and fan club facilities. The

underground car park is one of the largest in Poland with 1,800 spaces. The requirements for fire and smoke protection for this huge construction were no less daunting. Building services engineers and fitters worked under immense time pressure. Andrzej Marciniwicz, project manager for the National Stadium, and his team

worked around the clock to finish on time: "The tight schedule meant that we had to organise ourselves in two or even three shifts. However, we are proud, and rightly so, that we were able to install the central heating system with an output of 15 MW and the heat supply for the entire complex in only two months. Every day, an

average of 350 to 400 fitters worked on the site – at peak times, even up to 800 people!"

Turf ventilation.

Aerodynamic tests ensure the grass is greener on the inside.

When aerodynamics engineers hear the grass grow, they are without doubt considering the aerodynamic design of modern football stadiums.

INNIUS GTD GmbH in Dresden, Germany, a well-established specialist on complex computer-assisted calculation methods, has carried out advanced simulations for the Allianz Arena to provide the best possible conditions for the turf, well ahead of the construction.

According to FIFA, there are approx. 25,000 leaf blades per m², i.e. 200 million blades, on a playing field. The turf is normally replaced once or twice per year.



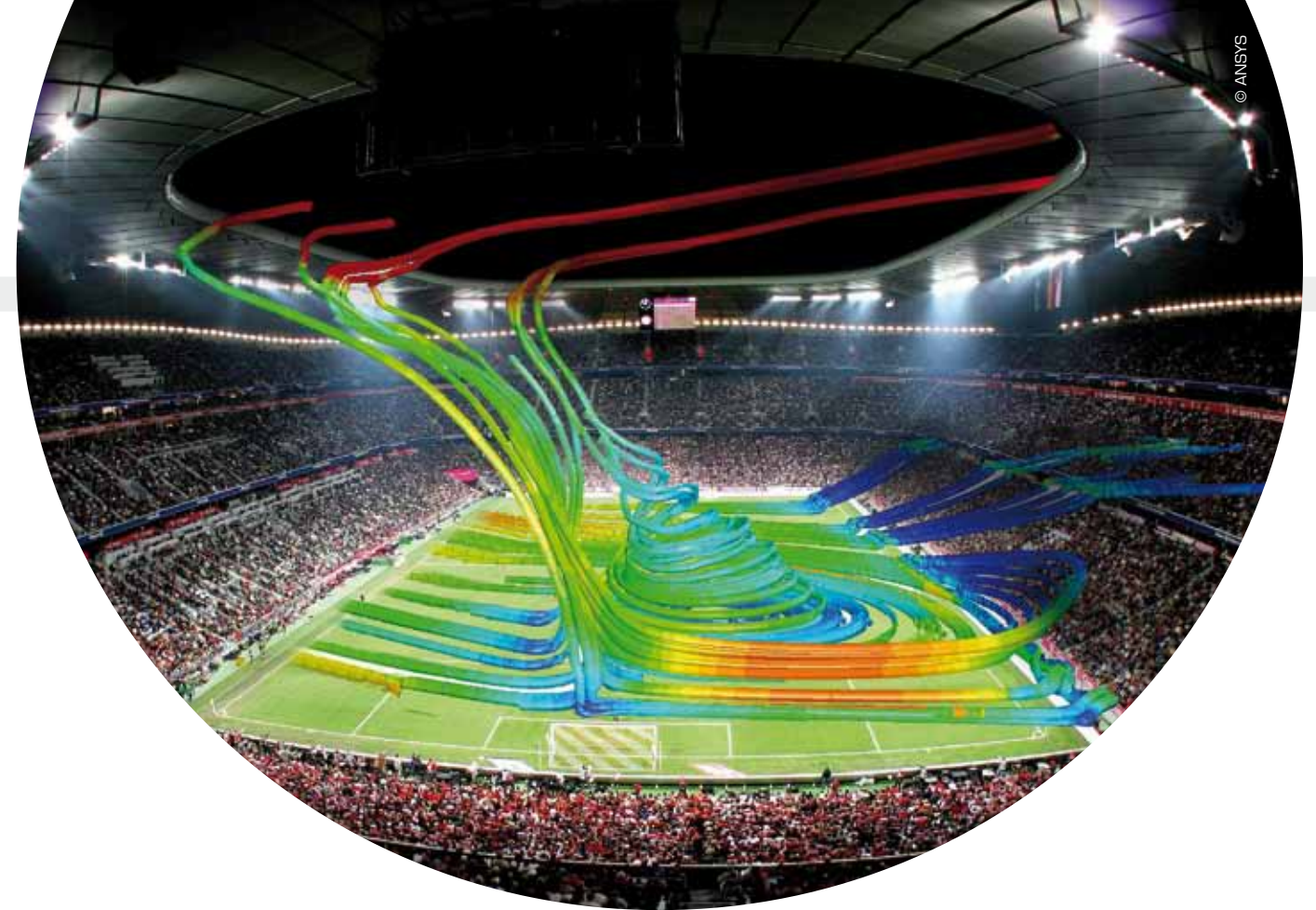
Grass needs to breathe, too!

Not since the erection of the Veltins Arena in Gelsenkirchen, Germany, where the grass is taken out of the stadium for ventilation and to soak up sunlight, we know that preserving the green inside the modern football temples, where the stands are built very close to the playing field, has become a real problem for the turf managers. The small openings in the roof or even closed retractable roofs mean that the turf does not get enough natural light or enough air. As a result, many stadiums have to replace the turf several times a year, even up to six times (Amsterdam Arena), depending on their use.

In Munich's Allianz Arena, the grass is normally only replaced twice a year. Thanks to the translucent roof (light permeability 400 and 660 nm, 98 per cent UV permeability), the grass is guaranteed a vigorous growth. Turf ventilation is also ensured as the wind may flow from every direction under the stadium structure across the playing field. Both the profile of the exterior façade and the lower outline of the second tier produce a "nozzle effect", which helps provide good ventilation. The first tier was made lower than the others to allow for laminar air flows. In other stadiums, ventilators are used to imitate wind movement and the pitch even has artificial light.

As you can see, the aerodynamic design of a stadium is no longer all about spectator comfort. Sophisticated CFD* simulations are used particularly to ensure optimum air supply to the grass in the stadium.

The innovative simulation technology employed for the Allianz Arena calculated the use of energy in the entire stadium structure, based on a specified user profile and



a reference year of Munich climate data in hourly intervals. The aim was to analyse the possibilities and limitations of sufficient natural ventilation and air conditioning of the stadium interior under different weather conditions and building loads. The analysis showed that better turf aeration meant poorer spectator comfort and vice versa. The balance between a healthy turf and a happy audience was skilfully struck by architects and planners, to make for optimum climatic and aerodynamic conditions in the arena.

The ideal green.	
Turfed area	8000 m ² (111 x 71 m gross, 105 x 68 m net), approx. 400 rolls
Cost of laying rolled turf	100,000 euros or more
Sowing time	Ideally 14 months
Grass mix	25% tall-growing ryegrass and 75% horizontally spreading Kentucky bluegrass.
Hybrid turfs	Synthetic fibres are implanted in the existing natural turf. The roots of the natural grass establish themselves around the synthetic fibres and fix the sod of the rolled turf into a stable, even playing field.
Stripe pattern	The mowed grass is rolled into the mowing direction. The pattern created by changing mowing direction reflects the light differently, producing the effect of darker and brighter stripes.
Mowing height	On the day of the match 25–28 mm
Photosynthesis	The leaf blades require light of wavelengths 435 nm and 660 nm. A complete photosynthesis takes place at 10,000 lux.
Illuminance	Daylight of around 13,000 lux

*CFD – Computational Fluid Dynamics



feature

Fire protection in stadiums.



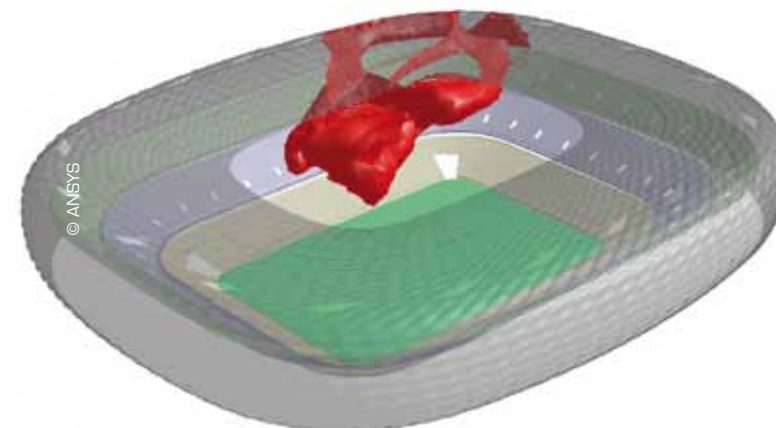
If flares are lit, the smoke must be extracted from the stadium as quickly as possible.

Besides spectator and player comfort, as well as optimum turf conditions, safety is one of the main issues when building a stadium. 95% of fire-related deaths are actually caused by the smoke. That is why keeping the stadium smoke-free, or at least limiting the amount of smoke in the spectator areas in the event of a fire, is so important.

Calculations based on simulations assume that the stands need to be kept smoke-free for 20 to 30 minutes in order for the audience to be able to leave the stadium unharmed. Jet nozzles are therefore used to improve the extract of smoke. Due to their inductive effect, they absorb the smoke and transport it toward the outlet in the stadium roof. This ensures that even the people in the top stands have time to escape the stadium unharmed.

When flares are lit.

Despite rigid security checks, fans often manage to smuggle pyrotechnics past security staff. People in the audience, particularly among the fanatics, often light flares. In view of the complex air flows and shifting ambient conditions, it is hardly possible to predict smoke propagation using conventional methods. Planning engineers are therefore aided by intelligent software, which accurately predicts the forming and circulation of smoke based on specific planning parameters and ambient conditions. This makes for very safe football stadiums around the world.



CFD analysis by INNIUS GTD GmbH for the Allianz Arena in Munich: simulating the propagation and concentration of smoke when a smoke bomb explodes.

Panem et circenses.

Antique arenas.



Even the ancient Romans knew of the “power of the games”. Satirist Juvenal coined the expression “panem et circenses”, saying that the Roman people who, at the time of the functioning republic granted generals their mandates and elected their public officers, had become sheepish and depoliticised, only wanting two things: bread and entertainment.

To this date, it refers to raising the spirits of the public (electorate) with generous election-time handouts and distracting them from everyday problems with brash entertainment.

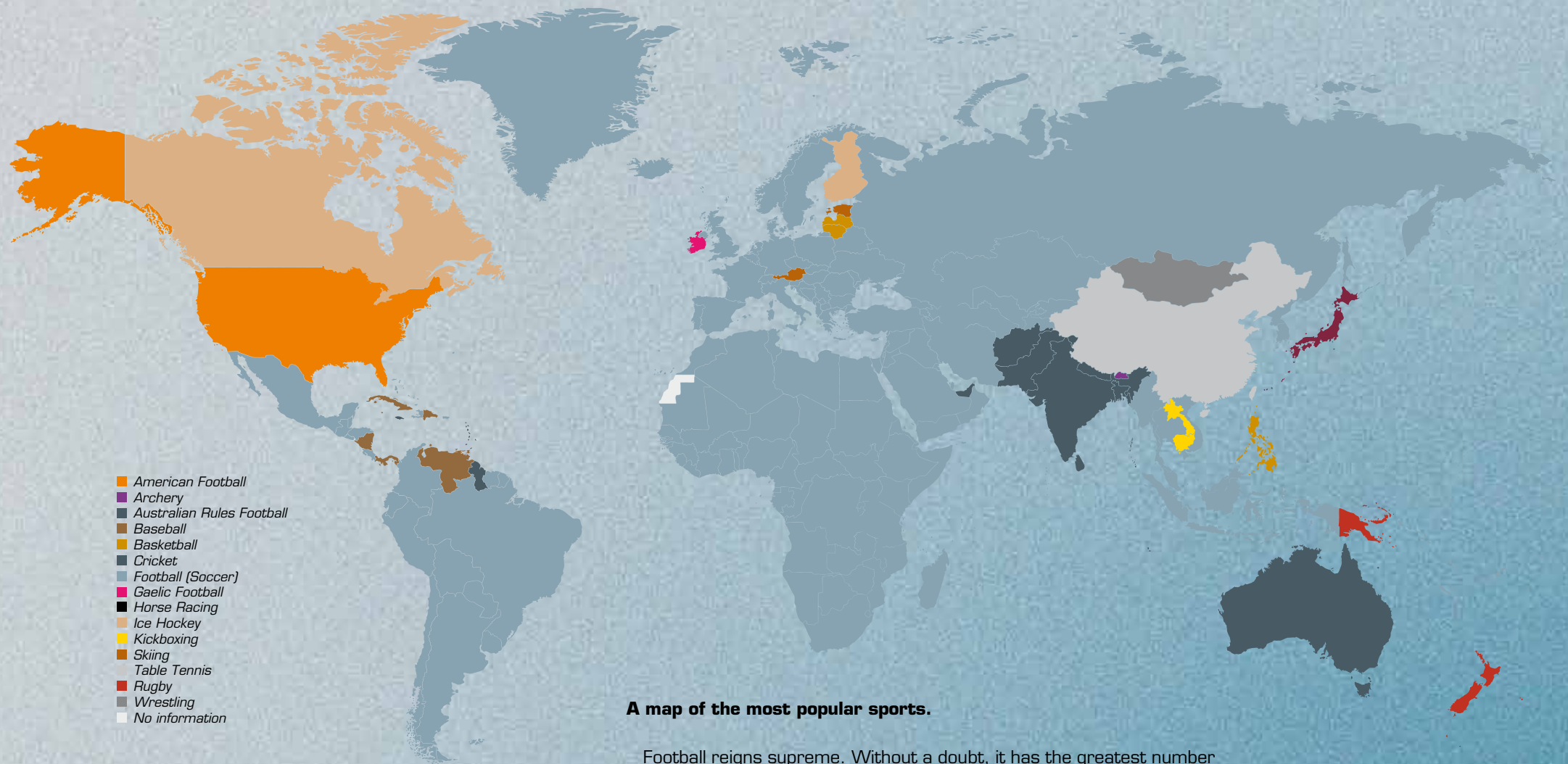


The great arenas of antiquity.

Construction work began under Emperor Vespasian around AD 70 and was completed ten years later by Domitian. Nearly 50 metres tall and 188 metres long, the Colosseum could accommodate 50,000 spectators, according to modern estimations. As Vespasian ran out of money during the construction, he imposed a tax on public lavatories. The saying “money does not stink” (pecunia non olet) dates from this era.

After the Colosseum in Rome and Capua's arena, Verona boasts the third largest preserved antique amphitheatre. Other well-preserved amphitheatres from the Roman Empire can be found in Pula on the Istria Peninsula, and in Nîmes and Arles in France. They could each hold around 25,000 visitors.

Modern arenas. Some stadium trivia.



The largest number of spectators...

...can be seated by Strahov Stadium in Prague. During the Communist era, up to 220,000 people gathered here regularly. With its 8 playing fields, surrounded on all sides by stands, the arena was used mainly for massive synchronized gymnastics displays (Spartakiads).

The May First Stadium in Pyongyang (150,000 seats) and the Salt Lake Stadium in Kolkata (120,000 seats) are thought to be the largest two “classical” stadiums in the world to host football matches. Among the arenas used purely for football, the Azteca Stadium in Mexico City with 105,064 seats is the world’s largest.

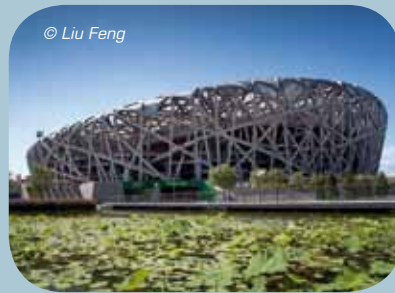
Maracanã, generally considered to be the largest stadium, owes its reputation to former times, when there were no safety restrictions. Rio’s legendary arena is therefore thought to have accommodated up to 200,000 football fans. Today, the official seating capacity is a mere 96,000.

A map of the most popular sports.

Football reigns supreme. Without a doubt, it has the greatest number of supporters worldwide, but many countries hold other sports closer to heart. In Pakistan, for instance, hockey is the national sport, brought to the Commonwealth nations by the British, just as cricket. Down Under, rugby is much more popular than football, whereas American football and ice hockey gathers the biggest crowds in the US and Canada.

TROX – a Champions League player

The European Championship stadiums are not the only venues where TROX perfects the art of handling air – the company has also had a hand in the most spectacular and famous arenas all over the world: from the Veltins Arena in Gelsenkirchen, Germany, and the National Stadium in Beijing to Soccer City in Johannesburg, South Africa, where the 2010 World Cup final was played. In each location, TROX has proven a consummate team player when it comes to ventilation and air conditioning technology.



© Liu Feng

National Stadium, Beijing



VELTINS-Arena, Gelsenkirchen, Germany



© Marc Jarman

Green Point Stadium, Cape Town



Wembley Stadium, London



Dubai Sports Swimming Complex



Sport as an economic factor

Higher, faster, further!



Dr. Erich Gluch, ifo-Institut

“No sports” was allegedly Sir Winston Churchill’s succinct answer to the question of how he had managed to attain such a respectable age in such good physical shape. It is a credo hardly embraced by the construction industry. Rather, sport has become an important growth engine, particularly in so-called emerging markets*. These markets encompass almost half of the world’s population and generate about a quarter of the global gross domestic product. No wonder then, that this is where recent great sporting events have taken place and where upcoming championships will take place.

In Germany, the federal government and the federal states spent 623 million euros on construction in the sport sector in 2005; in 1995 the figure was 950 million euros. However, the municipalities are the ones that provide the lion’s share of investment in construction for sport. Difu, the German institute for urban studies, estimated that the municipalities would need to raise about 24 billion euros for replacement construction and another 12 billion euros for catch-up measures in the period from 2005 to 2020. However, due to the bleak economic outlook, investments are likely to fall short.

Fortunately for the construction sector, privately funded sports facilities are much more prominent, and not just in Germany. Billions are spent every year on sports establishments, e.g. football arenas, gyms, rehabilitation centres, fitness centres or spas. However, the largest sums are invested in construction for top events, as can be seen in the following figures: Total economic spending for the 2006 World Cup is estimated to around 10 billion euros, although Germany already had excellent infrastructure and football stadiums. For the 2010 World Cup in South Africa, the total investment for infrastructure and stadiums is thought to have been as much as 13 billion euros. The plans for the London 2012 Summer Olympics began rather “modestly”. The costs have, however, more than tripled. The current estimate is around 12 billion euros. Still, it ranks as “cheap” in comparison to the announced 24 billion to be spent on the 2014 Winter Olympics in Sochi, Russia. Further investments worth billions have already been committed for the FIFA World Cups in Brazil (2014), Russia (2018) and Qatar (2022), and the Olympics hosted by Rio de Janeiro (2016) and Pyongyang, North Korea (2018).

* emerging markets such as the BRICS states, Brazil, Russia, India, China, South Africa.



About a ball.

The inflatable natural product that became a high-tech gadget.

“You have to caress the ball with your feet to make it land in the other team’s goal.”

Edson Arantes do Nascimento,
better known as Pelé, thrice World Champion playing for Brazil



© adidas (large image, image on right)

The transformation of the football through the ages.

The football has always played a special role. Players and fans alike maintain a particularly close relationship with it. Some say Uruguay only won the World Cup in 1930 because they played the second half with "their" ball. In 1966, the leather ball's antics

reached an all-time high in what in Germany is known as the Wembley Goal. In or out? After the final whistle blow, Helmut Haller smuggled the legendary Wembley ball out of the stadium underneath his shirt. Following a campaign in the British newspapers, he finally returned it in time for the European Cup in England in 1996 – in return for then 180,000 deutschmarks.



Since the 1970 World Cup in Mexico, there has always been an official World Cup ball, originally developed by Adidas. The first official ball was also the first to be printed – in classic black and white, to the great joy of spectators, who were able to see the ball much better, whether watching a match in the stadium or at home on TV.



FIFA ball test criteria:



Circumference



Roundness



Water absorption



Rebound



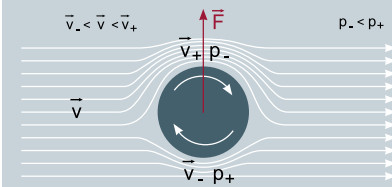
The ball becomes even rounder.

In the 1903 FA Cup final, players were still kicking an inflated pig's bladder about. Covered with leather, its oval shape made it look more like a rugby ball. It was not until a rubber solvent was discovered that balls could be made using waterproof rubber tubes, still, they were not entirely spherical. The lack of a valve meant that they had to be laced together. This produced a small bump which could cause nasty injuries after headers. In the 1920s, the non-laced leather ball was therefore greeted with much enthusiasm. The hand-crafted, unreliable round leather, which absorbed water when it rained and caused headaches due to the increased weight, was used until the 1982 World Cup in Spain, although

by then it was partly synthetic. For the 1978 World Cup in Argentina, expected to be very rainy, the leather ball was finally coated with polyurethane. It was not until after 1982 that the ball was made completely synthetic. The ball had become a high-tech gadget.

This year's European Cup ball, called Tango12, is supposed to be the roundest ball of all times, according to its designers. The rounder the ball, the more accurate the passes, which is why hundreds of models were developed and tested in the wind tunnel. In addition, computer simulations were used to minimise the number of panels on the ball. The fewer parts a ball has, the rounder it is.

The Magnus effect*



The Magnus effect is a phenomenon of fluid mechanics, which describes the effect of a perpendicular force to which a spinning spherical object is subjected in a fluid. The spinning object is subject to a force perpendicular to the line of motion and the axis of rotation. The spinning motion causes the particles on the upper side of the ball to accelerate and those on the lower side to decelerate. The velocity distribution around the ball is therefore heterogeneous and, according to Bernoulli's principle, so is the distribution of pressure.

*Heinrich Gustav Magnus 1802-1870

Image: Georg-August-Universität, Göttingen, Germany



The aerodynamics of the leather ball.

From an aerodynamic perspective, a sphere with a smooth surface is problematic. Any football fan will be familiar with goalkeeper complaints of the "knuckleball" phenomenon, which prevents them from catching the ball. Scientists at Loughborough University got to the bottom of the problem. According to their findings, balls kicked with little or no spin will move erratically. However, few players have mastered this particular way of

kicking, besides Cristiano Ronaldo and Frank Lampard. Spin makes the ball follow a steady trajectory through the air. Nevertheless, the so-called Magnus effect can cause rotating balls to swerve too. This is due to an asymmetric wake behind the ball. Because every force produces a counterforce, the ball veers slightly off course and, under certain conditions, changes direction, or "swerves". Ball scientists have now come up with a recipe for making balls

with optimum aerodynamic properties for accurate passes: "aero grooves" – small aerodynamic indentations, which stabilise the ball in flight.

Adidas CEO Herbert Hainer announced that the new generation of balls will be faster and more consistent than its predecessors – promising even more spectacular action in the goal area and more goals being scored.



Why do golf balls have dimples?

Let us take a moment to look at a much smaller spherical object: the golf ball. Its flight characteristics were improved almost intuitively. The ball used to be smooth, until someone discovered that balls with little imperfections travelled further. So, they started making little recesses and patterns in the surface of the ball. A rough surface, as was later proven, produces turbulence and reduces aerodynamic drag. Balls used nowadays therefore have dimples, the introduction of which is highly scientific: their effective symmetric distribution is derived from Euler's formula.



© adidas (image on top left, image on bottom right)

Open air.

Mega events find their way into stadiums.

Whenever music fills the air and booming bass notes roll over tens of thousands of excited music fans, then mega bands like the Rolling Stones or U2 are on tour. The concert business has become the bands' main source of income. TROX life has had a look behind the scenes of the world tours that are no longer confined to closed concert halls with limited space; they now fill the largest arenas around the globe.



Open-air concerts attract millions.

Still, the largest concerts have taken place outside the confines of the arena. Every New Year's Eve, Sugarloaf Mountain in Rio de Janeiro becomes the backdrop for an event of gigantic proportions at Copacabana. International stars like Madonna, Jean Michel Jarre, the Stones and Rod Stewart have all played there. The latter holds the world crowd record with a whopping 3.5 million spectators, with the others achieving audiences of "merely" 2 millions. By comparison, Simon and Garfunkel's legendary concert in Central Park, with 500,000 fans, seems almost modest.

Today, bands run up astronomical operating expenses. U2 raised the bar for stage technology to a whole new level. The huge stage structure, which went by the name "the claw", permitted a 360° use of the stadium, i.e. the stage was visible from all sides – a first in arena tours. Three of these monsters, which look as if they had escaped from the film Transformers, were used in the world tour to ensure everything went smoothly. The cost of building them alone amounted to 90 million euros.

The largest concert tours.

U2

NO. 1
360° Tour
110 concerts
2009-2011
7,268,430 visitors

AC DC

NO. 4
Black Ice World Tour
167 concerts
2008-2010
4,846,965 visitors

NO. 6
Vertigo Tour
131 concerts
2005-2006
4,619,021 visitors

Madonna

NO. 7
Sticky & Sweet Tour
85 concerts
2008-2009
3,545,899 visitors

Rolling Stones

NO. 2
Voodoo Lounge Tour
124 concerts
1994-1995
6,336,776 visitors

The Police

NO. 8
Reunion Tour
156 concerts
2007-2008
3,300,912 visitors

NO. 3
Bridges to Babylon Tour
143 concerts
1997-1999
5,576,032 visitors

NO. 5
A Bigger Bang Tour
144 concerts
2005-2007
4,680,000 visitors

Bon Jovi

NO. 9
Licks Tour
115 concerts
2002-2003
3,470,945 visitors

NO. 10
The Circle Tour
137 concerts
2010-2011
3,442,539 visitors

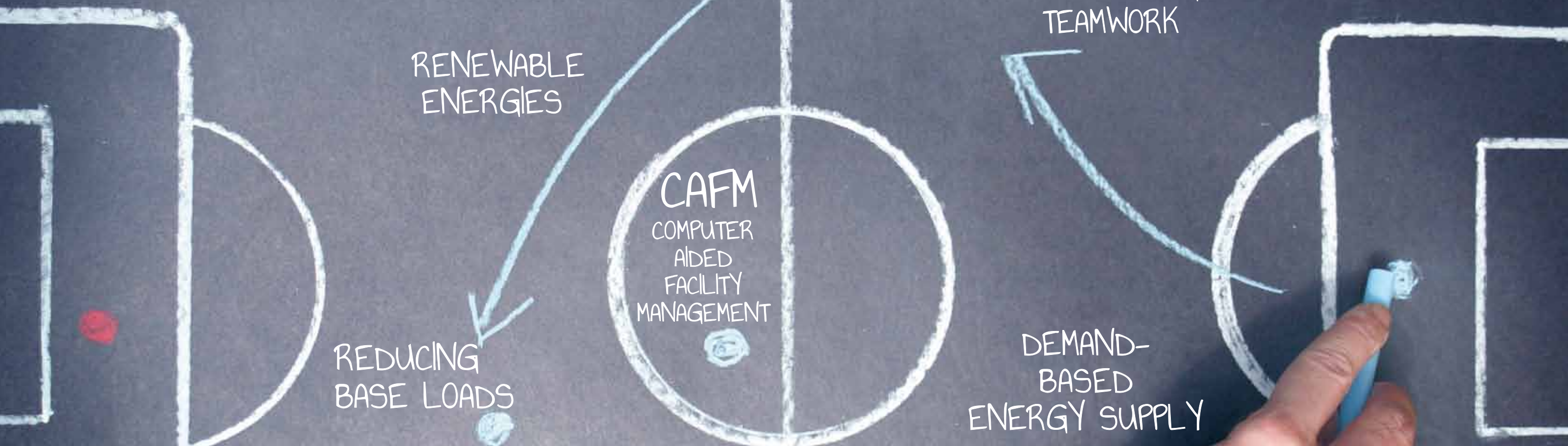


The greatest world tours of all times.

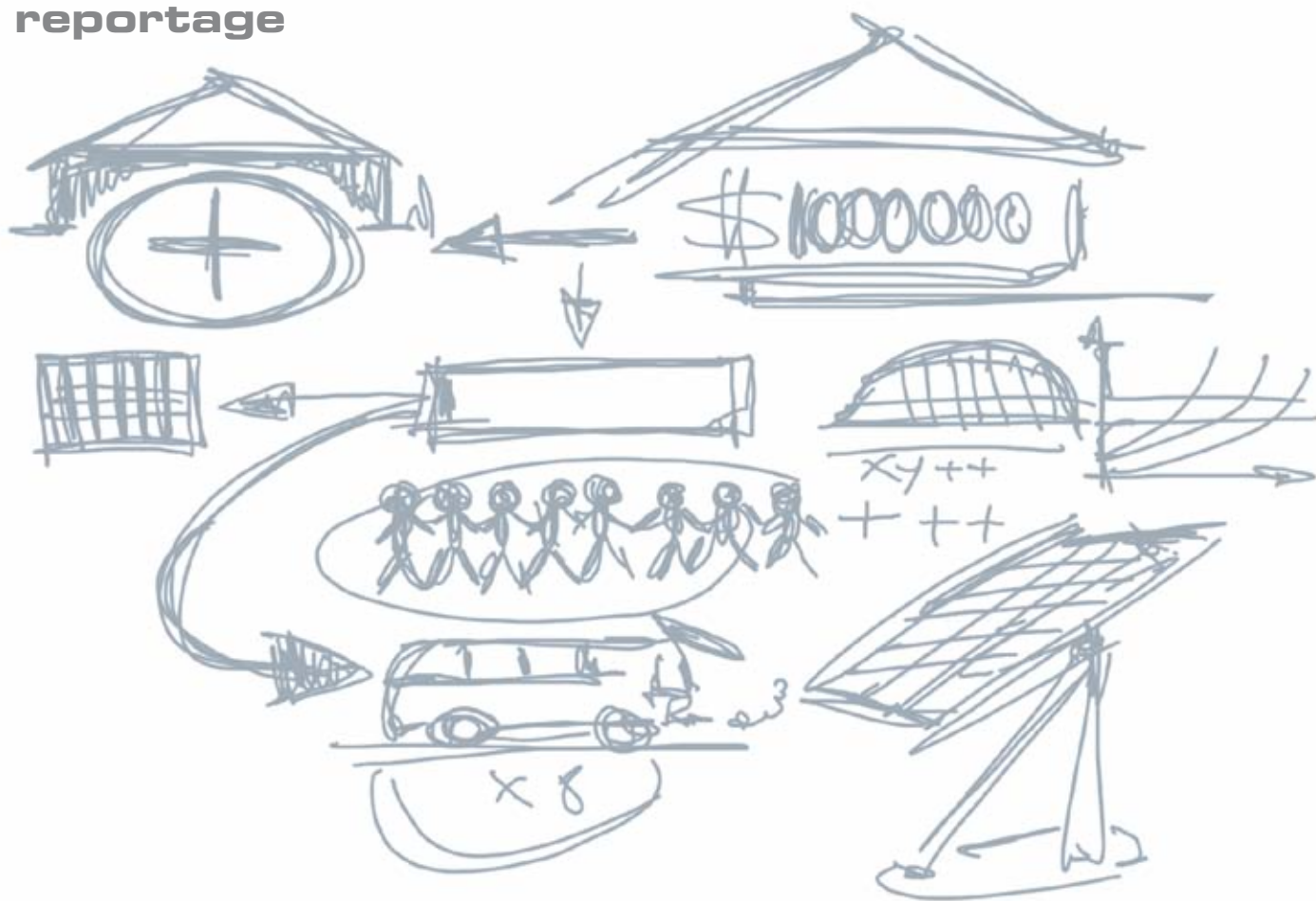
The world record for tours is held by U2. In their 360° Tour, the Irish band recently sold 7 million tickets to 110 concerts, taking in over 700 million US dollars and playing to an average of 66,000 music fans per concert. However, the undisputed tour veterans and granddads of rock 'n' roll – The Rolling Stones – boast an incredible four positions among the top ten. In the last decade, they enthralled almost 20 million spectators at their concerts. They were also the forerunners of stadium rock, with their 1981 Tattoo Tour being the first open-air tour in huge arenas.

When tens of thousands crowd into the stadium, safety is of utmost importance. Many arenas therefore opt for innovative fire and smoke protection technology from TROX.

Highly efficient stadiums.



From an energy perspective, stadiums are a rare breed of building with a seemingly insatiable hunger for energy. They are peculiar because during short periods they accommodate 50,000 spectators or more, but 80% of their energy is consumed when they are not in use for events.



ENERGY EFFICIENCY AND CLIMATE PROTECTION HAVE THE POTENTIAL TO BECOME THE GROWTH DRIVERS OF THE 21ST CENTURY.

PETER LÖSCHER, CHAIRMAN OF BDI'S ECONOMY FOR CLIMATE PROTECTION INITIATIVE AND CEO OF SIEMENS AG, AUGUST 2009

Saving energy – a great challenge.

According to Rolf-Jürgen Merz, Director of Stadium and Arena Technology with Imtech, energy saving potentials of 20 to 30% and more are not rare, as demonstrated in many cases with German stadiums. By optimising energy management, it is possible to save a six-figure sum in euros every year, not to mention the lasting environmental benefits: approx. 1,000 tonnes less CO₂ emissions.

Increasing energy efficiency by turning off wasteful systems.

A wasteful use of energy is still very much commonplace around the playing field. However, merely optimising existing systems can have a great impact on the conservation of resources. For instance, a hydraulic adjustment could lead to an increase in efficiency by up to 20% in stadium heating and cut the energy consumption by approx. 200 MWh. An

optimisation of turf heating circuits and integrating them in the heating return flow may even achieve a cut in the energy used by up to 400 MWh.

High efficiency is a question of optimum and effective interaction.

Alternating quickly from defence to attack and the appropriate deployment of forces are the key elements advocated by the promoters of a modern "combination football". Swift reaction to conditions in constant flux and a demand-based energy management is the recipe for success in modern stadium technology, in which a central BMS with innovative bus systems forms the basis. Retrofitting frequency inverters and variable volume flow controllers or using air quality sensors will ensure that ventilation energy is only used where it is needed. A reduction in base loads which may lead to saving potentials of 350 MWh or more can often be achieved using relatively simple means during periods



with no matches, for example:

- Screens – the Allianz Arena alone is equipped with around 1,100 screens – are no longer left in the uneconomical standby mode.
- The number and luminosity of light sources is reduced.

A PRUDENT USE OF ENERGY IS BECOMING INCREASINGLY IMPORTANT IN COMBATING CLIMATE CHANGE. WE ARE THEREFORE DESIGNING A COMPLETE SYSTEM FOR STADIUMS.

KLAUS BETZ, CEO OF IMTECH DEUTSCHLAND GMBH & CO. KG

A high yield thanks to the additional use of dormant energy resources.

The conditions for use of renewable energy in stadiums are virtually ideal: Extensive roof areas constitute the perfect location for solar panels. Vast car parks and even the playing field itself, in the case of new stadiums, are perfect for installing heat pump systems.

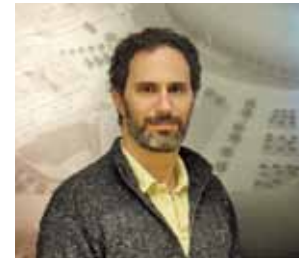
Basic heat loads can be covered using decentralised energy generation in, for example, a combined heat and power plant, which decreases peak loads, cuts costs and is more environmentally friendly. Investment in a combined heat and power plant pays for itself after only 1.5 to 3 years.





interview

The 2014 World Cup. Mythic Maracanã.



Daniel Fernandes,
Fernandes/Arquitetos Associados

Interview with Brazilian star architect Daniel Fernandes.

Brazil is preparing for one of the greatest events the country has ever seen: the 2014 FIFA World Cup. As if that were not enough, it will also host the Summer Olympics, only two years later. Most agree that the World Cup in this football-crazy country will be a truly special event, in a boisterous and cheerful atmosphere. The construction work in the cup venues are in full swing! In Rio, for instance, the legendary football temple Maracanã is being renovated to meet the requirements of a world cup. TROX life chatted with Daniel Fernandes, the architect in charge of the project.

Senhor Fernandes, Brazil has caught the world cup fever! You, as the architect responsible for Maracanã, must be feeling the pressure.

We are right on target, but the pressure to keep to the schedule is intensified by the Federation Cup, which will take place ahead of the World Cup, in 2012. Maracanã is definitely a much more complex project than building a new stadium, and every single person involved is giving his or her all to complete it. Because of the deadline of February 2013, work is subject to a rigorous, intense schedule.

I have read that Maracanã is not only being reconstructed; it is virtually being reinvented.

Indeed, the aim of the project is to make Maracanã the best stadium on the planet, while respecting the limitations of a 60-year-old stadium. We have a great responsibility to fulfil our ambitions without affecting the stadium's iconic status. Time and again, we have to ask ourselves: what can go and what must be kept? We have to be both conservation officers and modernizers. The great Maracanã experiment is unique. Future visitors will be taken on a journey in time. On the way to the stadium, the history of Maracanã will remain visible and the stadium will maintain the familiar appearance of the past, without major changes. Once inside, you will find yourself in the present, where the old and the new blend and work in perfect harmony. In the stands, finally, you will arrive in the future: a completely new stadium, moulded in the shell of the "old" Maracanã.

At the base of the Sugarloaf Mountain: the 2014 World Cup.

Maracanazo.

In the 1950 World Cup, the host country Brazil lost very unexpectedly 2-1 to Uruguay. 60 years on, Brazilian football fans still remember it painfully as Maracanazo, which means "the shock of Maracanã". The match against Uruguay attracted the largest audience of all times. The exact number of spectators is unknown, but is estimated to be roughly 200,000. The winners of the preliminaries, i.e. Brazil, Spain, Sweden and Uruguay, played each other for the title in a round-robin

knockout stage. Having enjoyed a clear win against Spain and Sweden, the Brazilians thought themselves home free. But the Uruguayans, who had got off to a slow start, achieved a surprising turnaround and won by 2-1. A quote from the scorer of the winning goal, Ghiggia, became legendary: "Only three people have ever silenced 200,000 people at the Maracanã with a single gesture: Frank Sinatra, Pope John Paul II and myself."



Behind the listed façade, the time-honoured Maracanã Stadium ...



... is being completely remodelled for the World Cup.

What makes Maracanã so special?

No doubt, the appeal of the building is due to the fact that it is steeped in history, whereas other, new stadiums still need to earn their place in history and are merely considered on their architectonic merits. Speaking of architecture, due to building height restrictions, the Maracanã Stadium is extremely low for an arena that has accommodated as many as 200,000 fans. That is why its characteristic shape and large dimensions cannot be appreciated as a distant landmark; they only become imposing up close.

What are the greatest challenges facing you?

Achieving a symbiosis between the traditional and the modern; the interesting balancing act of preserving and renovating. The planning stage therefore involved defining strict procedures, which would be able to tackle problems and challenges arising throughout the construction phase.

How important is ventilation technology for a stadium located in hot and humid Brazil?

Comfort is one of the essential requirements in any building, and even more so in a stadium seating 80,000 spectators. At the same time, we need to ensure a high degree of safety. The air conditioning systems for the public areas, lounges, restaurants, changing rooms, press centres and administrative offices are gigantic, and the load placed on fire protection and smoke extraction systems is enormous.

The upcoming sporting events in Brazil are going to be sustainable, is that right?

Sustainability has become a huge and heavily debated issue in relation to Maracaña, the 2014 World Cup and the 2016 Summer Olympics. The public perception of the careful use of energy and climate initiatives will have a lasting impact on the way people think about these issues. The World Cup and the Olympics will set an example and contribute to a greater awareness in large swathes of the population.

When Brazil last hosted the World Cup, Uruguay beat you 2-1. Who will become world champion this time?

It's hard to say. If Brazil's national team keeps going the way it is right now, the home crowd won't be able to tip the balance in its favour. Of course, like any Brazilian, I hope that we will win, and I will never lose that hope. Whoever wins the cup, the country and the people will be the real winners.

Senhor Fernandes, thank you for speaking to us!



The Heinz Trox Foundation: 20 years on.

“When a profession and a company have brought you so much joy and such good friends, you want to give something back.” These are the words of Heinz Trox. Early on, he therefore set the course by creating a foundation with specific aims: firstly, to ensure the continuity of the TROX GROUP and safeguard its jobs. Secondly, to focus more research on a field often neglected in favour of other, more popular branches of science: basic research into ventilation and air conditioning technology. Last year, the Heinz Trox Foundation celebrated 20 years.



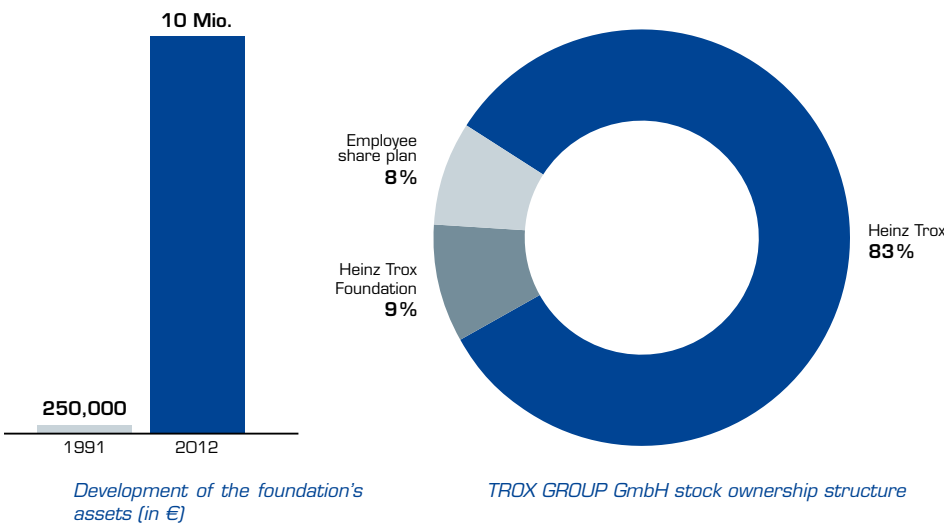
The Foundation council (from left to right): Heinz Trox, Dr. Wilhelm Dettmering, Michael Rademacher-Dubbick, Dr. Hans W. Fechner, Volkmar Halbe, Dr. Andreas Seelmann, Walter Hahn

Upon his demise, Heinz Trox' shares will pass to the foundation, making sure that his company group, which has an equity ratio of almost 50% and therefore a sound financial position, is well equipped for the future and protected against takeovers. The brand name TROX will therefore continue to exist for many years to come.

Since its creation, the Heinz Trox Foundation has distributed more than 1.7 million euros. Roughly two thirds of these funds have gone to German research establishments. Their research findings have been published in technical and scientific journals or other publications.

The TROX GROUP itself is not granted any preferential treatment for exploiting research results.

The foundation does not only serve scientific purposes, however. Roughly one third of its profits go to charitable projects.



Examples of funded research:

- Energy efficiency potential of innovative building, lighting and air conditioning concepts in office blocks
- Improving indoor air quality using air purifiers (decontaminators)
- Limitations to miniaturisation in heat recovery systems
- Bonding of plastics and composites as a method for sealing and filling gaps
- Actuators, controls and sensors in building automation

X-CUBE on air.



Roof installation on prepared steel structure

Last October, the opening ceremony for the new X-CUBE production facility in Anholt took place, and just two months later, in December, the first X-CUBE units were shipped. One of the first X-CUBE units now provides a comfortable indoor climate in a section of the Evangelische Krankenhaus Wesel hospital. It is a special hygiene version, compliant with DIN 1946, part 4.

Bocholt-based company Hans Hund Gebäudetechnik installed the new X-CUBE. “Our company has a long-standing tradition of always seeking innovative solutions,” said Hans Hund when the device was delivered to the construction site. “When installed, the air handling unit distinguishes itself by a high degree of stability and quick and straightforward assembly.”



The first X-CUBE units to be shipped: one weatherproof version for outdoor installation and one which meets the hygiene requirements of DIN 1946.



Another special kind of X-CUBE has been installed by KEUCO, a reputable manufacturer of bathroom accessories, furnishings and fixtures. This unit is a weatherproof version that has a roof with an overhang, and is used for ventilation and air conditioning of the KEUCO

exhibition centre. The energy efficiency of the air conditioning system is improved with a heat wheel for heat recovery.

Cup final.

The football season is nearly over, but the ball is still in play. I've rarely looked forward to visiting the stadium as much as for this final.

Only five minutes to kick-off. I can't see the playing field – my view is blocked by a huge club banner swaying to and fro. Apparently, the players are entering the field now. Everybody leaps to their feet. A splash of beer soaks my right trouser leg. The stadium commentator tries to make himself heard above the din. He reads the names of the players, but they are barely

audible. What a great atmosphere! Has the match started yet, or what? I missed the starting whistle. I still can't see anything.

Behind me, a group of supporters has taken up position. Their vuvuzelas and drums produce a noise level equivalent to that of a jumbo jet taking off. I join their chant. After a successful play by our team, the first human wave surges through the stadium. My other leg is now wet too. The club banner has been furled. I can finally get a first glimpse of the players. They all seem to be there. Great atmosphere.

The crowd whistles and boos. Only a small, distant fraction of the audience seems to be pleased. The other team has scored a goal! My briefly afforded view of the pitch is suddenly blocked by heavy smoke.

The stench of burning pyrotechnics is awful. I love football.

In a fit of euphoria, my neighbour loses control over his hot dog. Mustard marries with beer on my leg. Apparently we scored a goal. Half-time!

Like dignitaries on an official state visit, small groups of spectators stand around chatting quietly. The queues to the kiosks are better organised than those at a London bus stop. My trousers are almost dry. Time for second half.

You'll never walk alone – I'll be back again next season!

Dirk Trusheim, gb-report



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Schuster Thomsen Röhle Communication
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Editorial team:
Christine Roßkothen, TROX GmbH
Klaus Müller

Ralf Joneleit
Sven Burghardt

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Angela Kauffeldt

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Klaus Müller

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