

TRIO

life

magazine no. 17



Climate and change.

New challenges  
for the HVAC industry.



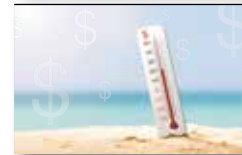
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**Climate change.  
 More challenges ahead.**

Our planet continues to warm. In the face of ever increasing emissions, scientists now fear that the goal to keep temperature rises well below 2 °C from the preindustrial era until the year 2100 may not be achieved. And the scenarios are indeed worrying: sea levels rising by up to sixty metres, parts of all flora and fauna becoming extinct, deserts and other dry regions expanding, the number of natural disasters growing.

These scenarios are also challenging the HVAC industry, which has to respond to extreme weather conditions and find acceptable solutions. According to BVT, an association of German retailers, 74,300 fans and indoor air conditioners were sold in the first six months of 2018 – more than three times as many as in the same period of 2015. Most of these units, however, were monobloc units or split units. This is rather unsatisfactory because such units are only suitable for cooling and, what is worse, don't work demand-based and are hence inefficient. It's not as if our industry didn't provide convincing solutions, even though energy efficiency remains high on our agenda and will require continued efforts.

*Climate and change* is the title of this newest edition of TROX life. It's a subject that affects all of us. An exciting subject to which all of us can relate. A subject that's going to have a lasting effect on our future. Talking about the future: We're excited to show you a futuristic building project, Leuphana University in Lüneburg, in northern Germany. And in a research report we inform you about approaches to ventilation and air conditioning that could revolutionise the HVAC industry: think 'personalised ventilation'.

We also provide you with a little compilation of the most important climate-change-related standards, guidelines and directives. Finally, we report on a round table meeting of customers and TROX staff, who discussed climate on a more personal, or interpersonal, level: in the workplace. Not surprisingly, everybody agreed that, apart from all things business, the human factor remains important. Personal relations with our customers and employees are something we consider essential, in spite of – or because of – increasing digitisation.

As serious as climate change is, this magazine also carries bits and pieces that offer a lighthearted look at the topic. Just as you would expect from TROX life.

It's yet another fascinating magazine. Enjoy the read.



Yours  
 Udo Jung  
 TROX Board of Management



# Climate and change.

Our climate. What exactly is it? What elements define the climate and what are the influencing factors? This is what we're trying to find out in this article. We're going to analyse the reasons for climate change and look at the implications for the HVAC industry.





### Climate.

Climate is commonly defined as the weather averaged over long periods of time. The standard averaging period is thirty years. Climate also includes statistics other than the average, such as the magnitudes of day-to-day or year-to-year variations. The climate is, however, not only characterised by processes in the atmosphere, but more so by the interaction of all of the earth's seven spheres, including continents and oceans; solar activity and the earth's unstable orbit (resulting in ice ages and interglacial periods) are other factors that play a role.

### Elements of the climate ...

Climate is the result of a number of factors that can be measured; these factors, both individually and in combination, characterise the climate on various levels.

- Atmospheric pressure
- Humidity
- Air temperature
- Precipitation
- Evaporation
- Solar energy from the sun and energy radiating back into space
- Salt content of the oceans and ocean currents
- Water temperature
- Ice thickness and snow depth and their density

Source: Wikipedia.

### ... and how they influence one another.

All the elements that make up our climate are interdependent. If the air temperature rises, for example, evaporation and humidity will also increase. This applies not only to the outdoor climate, but also to the indoor climate.

Assessing how indoor climate factors work together is a complex issue as you have to take into account that people also have an effect on their environment: they radiate heat.

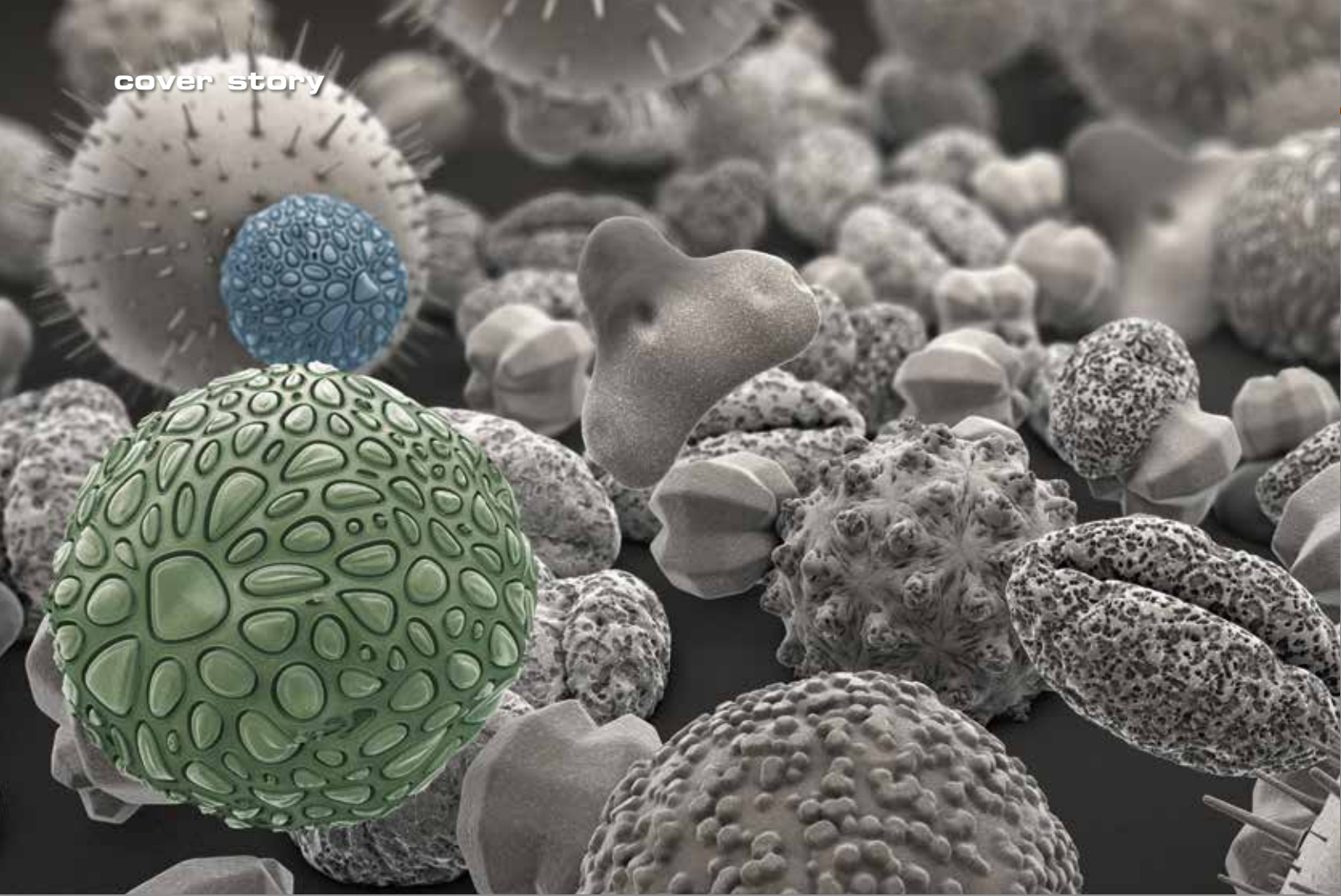
Research efforts to determine individual levels of comfort are even more complex. Each human being has a different perception when it comes to comfort. Each body reacts differently and has different ways to achieve heat balance. What is more, the body's thermoregulation system is difficult to measure. That's why computer-based model calculations are being used for this purpose. You will find more on this challenging subject in our science & technology section, and we have tried to break it down into easily digestible chunks.

### Climate change.

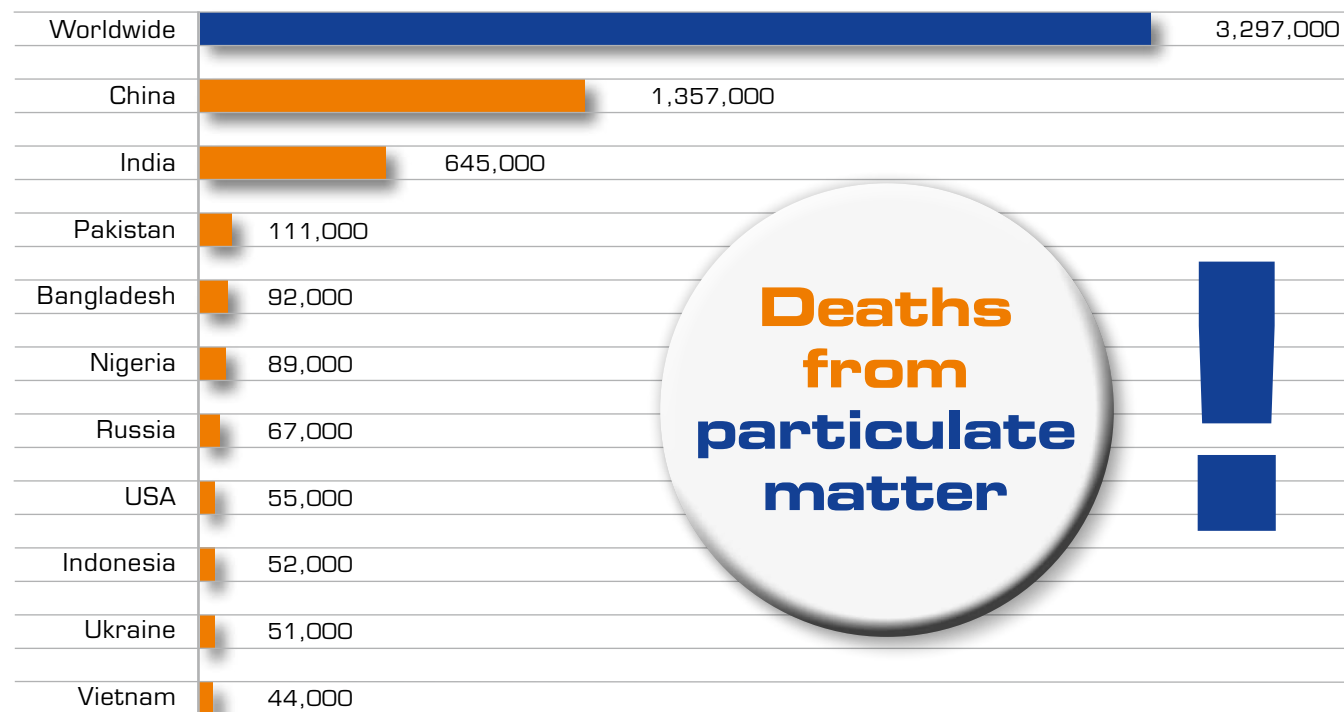
Humans have a considerable impact on the climate. Since the beginning of industrialisation, it has been, first and foremost, carbon emissions caused by humans that have led to global warming. Most scientists agree that annual emissions caused by human activity have led to a more rapidly occurring warming than was the case for warming events in the past sixty-six million years. In other words, the current warming is human-induced.\*

\* IPCC – Intergovernmental Panel on Climate Change.





Dust particles and spores under an electronic microscope.



**Deaths from particulate matter**

Source: Lelieveld et al., Nature, 2015.



**Ventilation and air conditioning.**

Our industrialised world requires comfortable working environments with technical facilities that operate smoothly. An issue that is equally important, but has not been high enough on the public agenda, is the quality of indoor air. Surveys by the WHO underline just how important this topic is. All over the world, increasing emissions of hazardous substances are contaminating the air we breathe to an ever-greater extent. As a result, around eight million people die prematurely each year due to the effects of increased particulate matter pollution; many deaths are also caused by indoor air contaminated with dust and other particles such as pollen, fungal and fern spores, or gaseous pollutants. This is surely a challenge for the filter technology.

We spend 90% of our time indoors. This fact illustrates the importance of good indoor air quality (IAQ) and adequate fresh air supply. There is no mistaking the positive effects of good indoor air quality. Healthy air increases personal comfort, improves performance and causes fewer infections and allergic reactions to airborne germs and particles, which, in the long term, also reduces the number of sick days. (See also the results of a British survey on page 33.)

TROX service technicians make sure that ventilation and air conditioning systems run smoothly and efficiently.



The climate change also affects the HVAC industry, which has to take the increasing global warming into account. 40% of the total energy consumption are caused by the building sector alone, and a sizable part of this is due to ventilation and air conditioning. Our industry has to find a balance between the most comfortable indoor climate and the highest energy efficiency. And this is the very reason for research efforts to determine an individual climate of comfort.

**Energy reserves.**

Scientists believe that clean room technology alone offers a savings potential of 40%, which equals the total electricity consumption of Portugal. \* The maintenance and monitoring of existing systems are other high-cost factors. However, only 2% of all ventilation and air conditioning systems are being serviced regularly: dust-laden filters, dirty ducts and wrong system settings all consume energy beyond all means.

The majority of existing systems are uncontrolled (open loop) and hence inefficient. They need to be fitted with intelligent control systems. Finding the individual comfort climate offers potential, too. If the set temperature is too high or too low to be comfortable, the energy is being wasted.

\* see TROX life 'Clean room air'.

**Conclusion.**  
The transition away from fossil fuels is a huge challenge faced by our industry. Our motto: Keep going!



# Leuphana. Traditional name - modern and sustainable architecture.

The name Leuphana was first mentioned by Greek astronomer and geographer Ptolemy, who lived in the 2nd century (AD). In his atlas, he used the term for a settlement in northern Germany. In the 19th century the settlement was allocated to the city we now call Lüneburg.



**Sustainable design.**

The central building of Leuphana University in Lüneburg is an architectural milestone in the dynamic campus development. An important and certainly the most striking part of the complex is the Libeskind Auditorium for up to 1100 people. According to the university it is also a testimony to their engagement with the history of the campus, their academic principles and their scientific standard.

Essential design criteria included a particularly sustainable construction and the resource saving use of electricity for lighting, ventilation and cooling. The façade is inclined so that the building casts its own shadow, which results in passive cooling, and the various parts of the complex are arranged in such a way that none of the external walls faces south.



*The Libeskind architecture illustrates the university's academic mission and scientific standard.*

The intensity of the LED lighting is controlled by PIR sensors and also depends on how much daylight is available. Add to this triple glazing, excellent insulation, heat recovery and reuse of low-temperature waste heat, and you have a construction that sets new and very high standards for the energy efficiency of public buildings.

*A sustainable construction and the resource saving use of energy characterises the building.*



*The Leuphana central building with the auditorium for 1100 people.*

The energy sources are renewable. Heating energy comes from a biogas power plant, while solar panels on the roofs provide additional electricity and cover 25% of the requirement already.

The building as such is a low-weight construction. Instead of steel fabric, hollow plastic building

blocks were placed in the concrete ceilings. This saved many tonnes of concrete and steel, which to produce would not only have required energy and water, but also produced CO<sub>2</sub>. A grey water system is used to collect rain water from the green roofs and the façade and make it available for flushing the toilets.

*Source: www.leuphana.de*

*Only renewable energy sources are used.*







Ventilation grilles create a nice pattern.

### Energy-efficient ventilation and air conditioning system.

Specialist consultants and HVAC contractors selected TROX ventilation and air conditioning components as they are perfectly complementary to one another: from an air handling unit to VAV terminal units and air terminal devices, and to fire dampers and smoke exhaust fans. The ventilation and air conditioning system ensures demand-based air supply while the fire protection system keeps people safe.

An air handling unit with an intelligent control system provides air based on demand.



### Ventilation and air conditioning components at Leuphana:

- Air terminal devices: TRS, TRS-K, TRS-R, LVS, Z-LVS
- External weather louvres: WG
- Fire protection: FKRS-EU, FK-EU, FKS-EU, KA-EU
- VAV terminal units and CAV controllers: TX, TVR, TVRS, TVJ, RN, RNS, VFC, EN
- Noise control: XSA, CA, CB, CAK, CF, CS
- Air handling units: X-CUBE
- Fans: X-FANS

### Leuphana central building

Design: Daniel Libeskind  
 Architects: rw+ Gesellschaft von Architekten mbH, Berlin  
 Building services: emutec GmbH, Norderstedt  
 HVAC contractor: Engie Deutschland GmbH, Hamburg  
 Year of completion: 2017





# Thermoregulation.

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We breathe in and we breathe out. When it's cold, we get cold and shiver. When it is hot, we sweat. Our blood pressure either rises or it falls. Our metabolism gains momentum or slows down. Our body responds to external influences. This is because we are always seeking the optimum balance – which is a core body temperature of about 37 °C.

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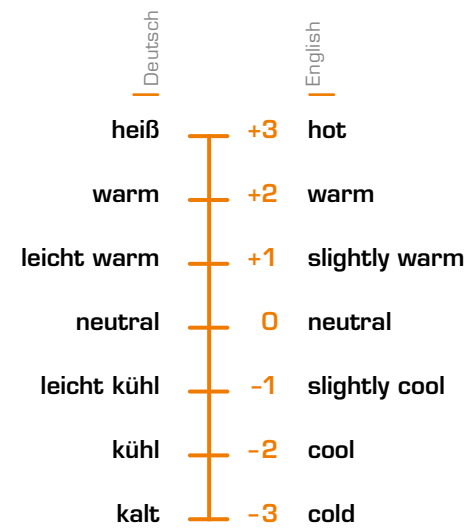


**Striving for optimum thermal comfort.**

Heat balance and comfort models are being used in research, and they are coupled with environmental simulations. The objective is to simulate the effect of people on the indoor climate and their perception of the indoor climate in terms of their thermal comfort. The results of these research efforts are used in the ventilation and air conditioning business as a starting point from which to derive a balance between comfort and energy efficiency.

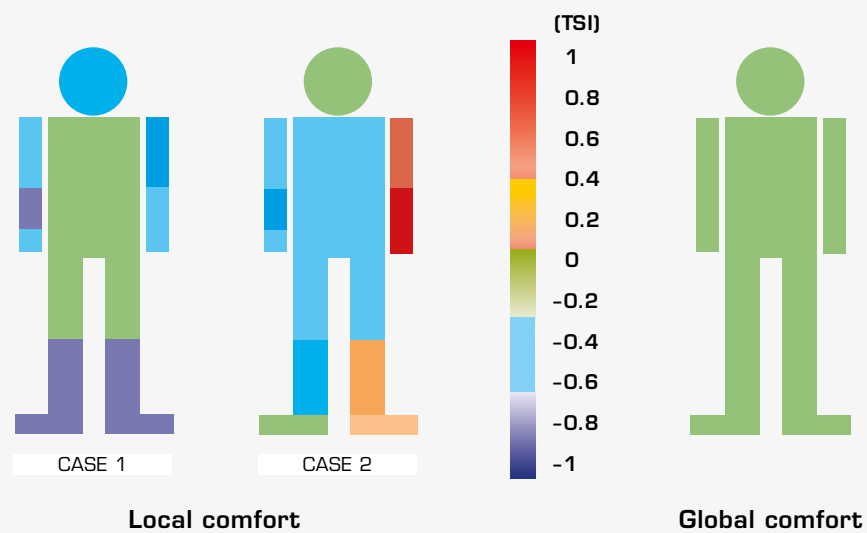
**Comfort model.**

Physiological criteria influence physical sensation. Physiology describes life processes in human cells, tissues and organs and includes the interaction of all physical, chemical and biochemical processes in the entire organism, such as metabolism, movement and



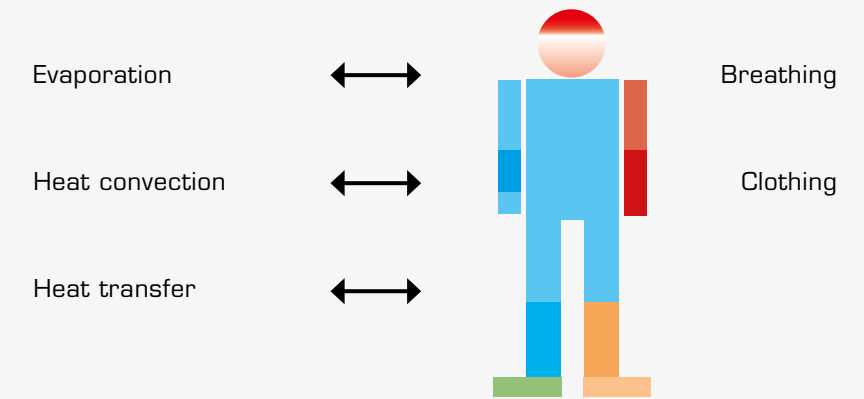
*Predicted mean vote (PMV) of the thermal sensation scale in accordance with ISO 7730:2003.*

**Local thermal sensation (TSI) for an overall comfort of 0.9.**



*Thermal sensation, i.e. feeling warm or cold, depends largely on the temperature of the skin and can vary in strength. The local thermal sensation can differ completely in different environments, but results in the same feeling of comfort. Source: Comfort study conducted by RWTH Aachen University with test subjects in an airplane cabin.*

**Interaction between the body and the environment.**



*The presence of people also affects environmental conditions as a result of their emitted heat and moisture.*

blood circulation. Physiological criteria influence thermal comfort. To understand and evaluate the effect of these criteria, scientists have developed heat balance models\* that also include parameters such as the insulation capacity of clothing, level of activity, air temperature, mean radiation temperature, humidity and airflow velocity. So the overall perception or sensation is simulated and then evaluated with a variable (called PMV, or predicted mean vote) and indicated on a 7-grade scale from cold to hot.

*\* The Danish scientist Poul Ole Fanger is regarded as the pioneer.*

Standard comfort models that treat the human body as a single zone fail when the surroundings are inhomogeneous. Clear statements are only possible upon analysis of local effects. Extensive experimental tests on subjects in climate measurement chambers were used to develop models for an inhomogeneous environment. The person is divided, so to speak, into body zones (see graphic p. 18).

**Heat balance model.**

The human body responds to its environment, temperature, airflow velocity or intensity of radiation, and responses include sweating or shivering to regulate the heat balance. Cold receptors on

the skin and heat receptors in the hypothalamus (an important region of the brain which controls numerous different systems within the body) send signals to other parts of the body to maintain the equilibrium between energy production and energy output and to keep the body temperature at a comfortable level.

Therefore, so-called thermoregulation models\*, which are used to reproduce the dynamic development of surface and body temperature, simulate the human body with regard to metabolism and blood circulation under framework conditions that vary in terms of time.

The presence of people affects their environment as a result of the heat and moisture emitted from their bodies. A heat balance model therefore simulates heat conduction and heat re-distribution within the body, heat production – for instance through the work of muscles – and heat loss as a result of breathing, free and forced convection (heat transfer) and the evaporation of moisture on the skin. These interactions must be taken into account for a correct simulation of room air flows and the assessment of comfort.

*\*Shin-ichi Tanabe from Japan is regarded as one of the pioneers.*



**Mathematical-physical models predict thermal sensation and comfort.\***

To predict thermal comfort, a new generation of climate measuring systems has been developed. The perceived temperature, i.e. the equivalent temperature, is recorded in climate measurement chambers. The benefit of this method is that transient (temporary) heating and cooling can be described with a significantly greater scope of application.

The assessment criteria of proven comfort models are converted by means of computer technology to provide the equivalent temperature as a singular variable. Test subjects are then surveyed under thermally real environmental conditions in the climate measurement chamber to confirm and quantify the validity of the measurement results of the model with the aid of statistical methods.

The equivalent temperature is measured by attaching several sensors, including heat flow sensors, directly to the person or to a manikin. The temperature of the air, the background radiation temperature and convection via the airflow velocity are also recorded.

The thermo-physiological parameters of skin temperature and core body temperature, which are important for thermal sensation, can only be recorded using accurate technical measurement methods. What's more, they are characterised by inaccuracies. For this reason, they are usually calculated mathematically from the measured thermal framework conditions.

\*That condition of mind that expresses satisfaction with the thermal environment.

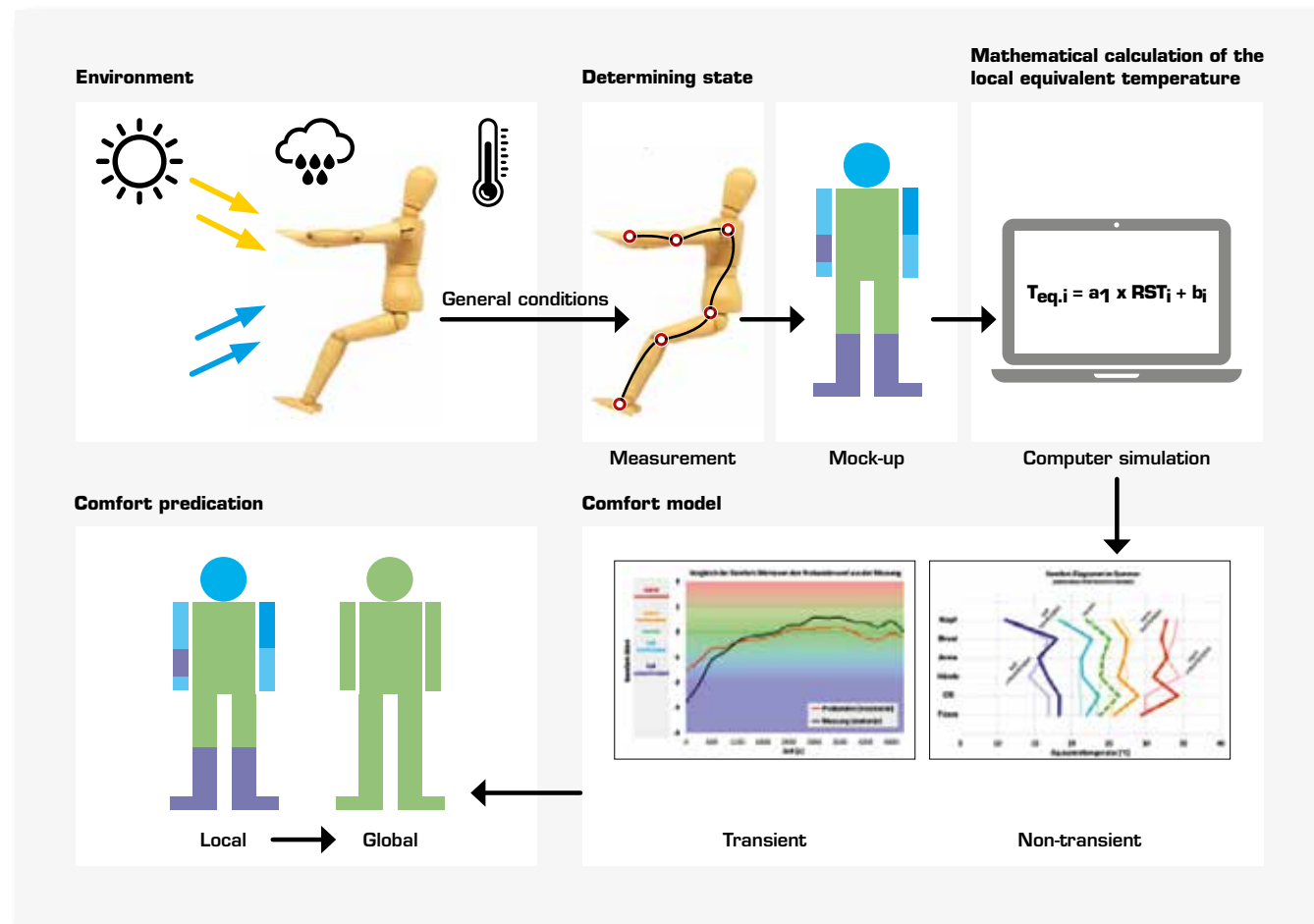


Depending on the physiognomy, the body zones of the person will exhibit a different heat sensation.

RWTH Aachen University is working on a 'thermal person' typology. People with different physiognomies spend some time in a climatic test room and are then asked about their thermal sensation. The ultimate objective is to enable 'personalised ventilation' in buildings and vehicles, taking into account the different physiognomies of people.

With electric vehicles and their range problems, the energy for heating and cooling is considerably limited – generally taking up about 50% of the energy. This is why an optimum balance between indoor climate and energy efficiency is so important.

The scenario of creating your own personal climate using a chip card or smartphone will soon no longer be a thing of dreams.



Schematic illustration of a mathematical-physical comfort model. Sources: E.ON Energy Research Center; RWTH Aachen University.

**Everybody is different.**

We can be fat or thin, tall or small, muscular or angular. We can be scantily dressed or wrapped up snugly. And everybody's internal clock reacts differently.

Static systems work by taking an average view of people. Dynamic research approaches, on the other hand, want to incorporate individual differences, clothing and level of activity. They even take into consideration whether we come from outside and whether we previously travelled by foot, by car, bus or train.

**Thermal sensation and thermal comfort.**

The simple experiment by the English philosopher John Locke shows the complex cause-effect relationships. In the tests, a person placed one hand in a container of warm water and the other hand in a container of cold water. After a short period of time, both hands were placed in a third container with a mean water temperature. The hand that was previously in the warm water was perceived as cold, while the other hand was perceived as warm, even though both hands were exposed to the exact same temperature. The assessment of the sensation of being cold or warm, i.e. thermal sensation, thus heavily depends on the skin temperature and can vary in strength, even between individual body parts.

Source: Dr.-Ing. Rita Streblov, Dr.-Ing. Andreas Wick, Professor Dirk Müller: Advanced thermal comfort modelling for optimum interior design.

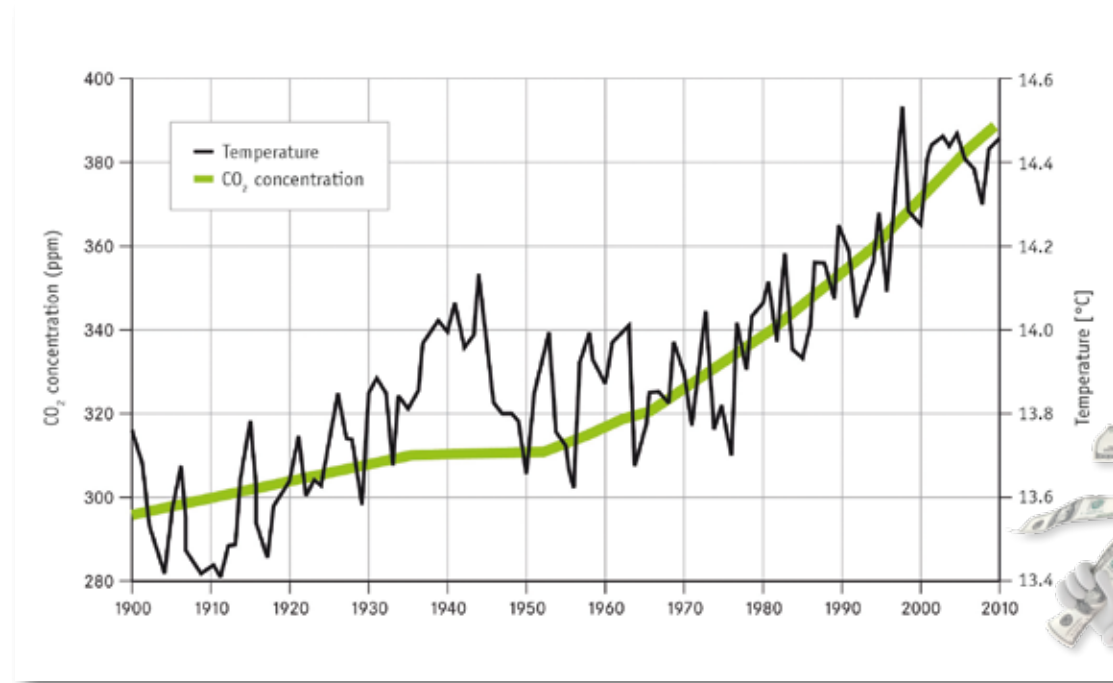


**0.5 °C less  
global warming.  
Global benefits  
exceeding  
20 trillion.**

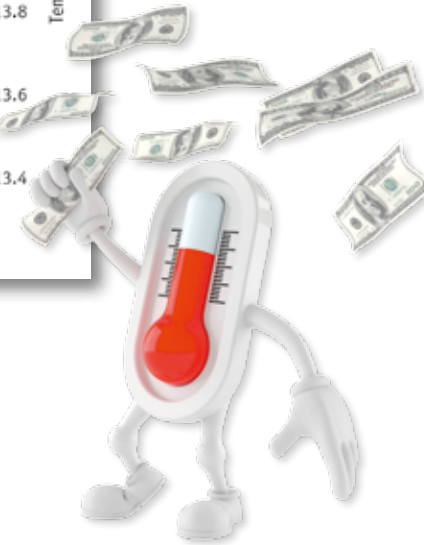


A study by a team of US scientists working with Marshall Burke from Stanford University in the magazine 'Nature' has revealed some astounding findings. Limiting global warming to 1.5 °C instead of 2 °C (Paris Agreement) would save the global economy at least 20 trillion US dollars by the end of the century.





The increasing CO<sub>2</sub> concentration is also responsible for global warming.  
 Source: CO<sub>2</sub> concentration in the earth's atmosphere and mean global near-surface air temperature between 1900 and 2010 (graphic based on Latif, 2012, updated).



The high savings that could be achieved by reducing global warming by 0.5 °C would primarily be generated by preventing extreme weather-related damage, repair measures and health problems. The effort that would be needed to achieve this ambitious goal has not yet been scientifically substantiated. US economists estimate, however, that the benefits of the cost savings will ultimately be at least 30 times greater than the additional costs of implementing radical climate protection measures.

Fully in line with the conclusion of the Stanford scientists, the climate conference of 2018 in the Polish city of Katowice resulted in significant progress in two areas: firstly, the community of states adopted a rulebook to enable the implementation of the Paris Agreement. Secondly, the participating states signalled that they would not stop at the previous commitments, but acknowledge the findings of the Intergovernmental Panel on Climate Change and implement further measures to curb global warming. The states are also required to explain how they will contribute to achieving this goal of limiting global warming to well under 2 °C or, preferably, to 1.5 °C.

In addition to global warming, air pollution is another great concern to national economies and also causes very high costs. According to the WHO, these costs amount to 1.6 trillion US dollars in the EU alone, which is almost a tenth of the EU's gross domestic product.

'These scientific findings underline the urgent need for action,' said Dr Zsuzsanna Jakab, WHO Regional Director for Europe. 'If the various political spheres pull together here, we will not just save the lives of people, but also generate results that enable astounding financial savings.'

Over 90% of citizens in the European area are exposed to levels of particulate matter that exceed the WHO air quality guideline value. This results in premature deaths and economic costs exceeding 1.4 trillion US dollars; if illnesses caused by this air pollution are factored in, the total is even 1.6 trillion. Any savings that are generated from corresponding measures could then, if the political will was there, be put into climate protection.





# Climate change and legislation.



Regulations, guidelines and standards respond to climate change. This naturally has an impact on the actions and targets of companies and their markets.





**For environment and energy management in our industry, the following aspects are relevant:**

- EPBD (Energy Performance of Buildings Directive)
- Ecodesign regulations
- Standards and guidelines
- Voluntary commitments
- UN Charter
- Environment management – ISO 14001
- Energy management – ISO 50001
- Requirements of associations such as Eurovent (e.g. label for air handling units)

**The EPBD demands higher efficiency and better indoor air quality.**

The Energy Performance of Buildings Directive published by the EU Commission is one of the most important European directives affecting building construction and building services. The directive is not directly applicable in the individual states, but rather the member states must create their own laws for its implementation. In Germany, the directive is being implemented via the Energy Saving Ordinance.

Since 1 January 2019, new buildings owned by government offices have had to meet low-energy building requirements; from 1 January 2021 onwards, all new buildings will have to meet these requirements. The member states must draw up their own national plans to increase the number of low-energy buildings.

*Energy-efficient air handling units with infinitely variable fans and heat recovery.*

As part of the new standard, the building owner must be able to provide a numerical indicator expressing the primary energy consumption of the building in kWh/m<sup>2</sup> per year. The directive also prescribes inspections of HVAC systems, including those integrated with building automation systems. The inspection requirements for non-residential buildings will now be based on an energy threshold value of > 250 MWh annual primary energy consumption.

**Energy-efficient refurbishment is essential.**

The introduction to the draft of the EPBD states that the quota of energy-efficient refurbishments carried out on existing buildings was as low as 0.4 to 1.2% at the time, and then across all member states.

Considering that around 75% of all existing buildings are deemed inefficient by modern standards, there is huge potential to reduce energy consumption and greenhouse gas emissions by renovating the energy systems in some of these properties. For this reason, various campaigns are being planned Europe-wide, including financial incentives, to significantly boost this percentage over the next few years. The EPBD also encourages the use of intelligent controls for building services, and promotes building automation and building management solutions.

Although thermal comfort and room air quality are mentioned in the EPBD, there are still no legal regulations on the quality of indoor air.



**Requirements of the Ecodesign directive for the HVAC industry.**

With the ErP ecodesign directive, important demands are placed on ventilation systems. These requirements, which, in contrast to the EPBD, will be directly applicable without the need for additional national laws in all EU member states, should significantly increase the efficiency of ventilation systems and reduce power consumption.

**The relevant requirements for air handling units based on ecodesign directives:**

- Obligation for multi-stage or infinitely variable control of fans
- Minimum requirements for electrical efficiency
- Heat recovery obligation for supply and extract air units
- Minimum heat recovery specifications (heat recovery efficiency min. 68% for run around coil systems and min. 73% for all other heat recovery systems)
- Heat recovery systems have to be equipped with a thermal bypass
- Existing filters must be monitored with respect to their final pressure loss
- Certain technical data of a device have to be listed in the technical documentation

**Environment management – ISO 14001.**

The standard specifies the requirements with which an organisation can improve its environmental performance, fulfil legal and other obligations and achieve environmental targets. The central elements of the ISO 14001 are:

- Planning: definition of environmental targets and corresponding measures, responsibilities and procedures
- Execution: implementation of stipulated measures and procedures
- Monitoring: checking of responsibilities, procedures and the measures with respect to the environmental targets and environmental guidelines (so-called environmental policy) of the organisation
- Improvement: adjustment of responsibilities, processes and measures and, if necessary, the environmental targets and environmental guidelines



'The diverse legal and normative specifications have to be complied with in ventilation and air conditioning. This is already resulting in considerable energy savings and good room air quality in many buildings. In principle, it is both possible and practical to aim for a far greater level of efficiency than the minimum level required. This has to be analysed on a case-by-case basis. The aim should always be to achieve the best possible comfort level with the lowest possible energy requirements in rooms for people!'

**Martin Lenz**

Chairperson of the Air Handling Units product group at the Eurovent Association, Deputy Chairperson of the VDI 3803-1 working group 'Central ventilation and air conditioning systems'

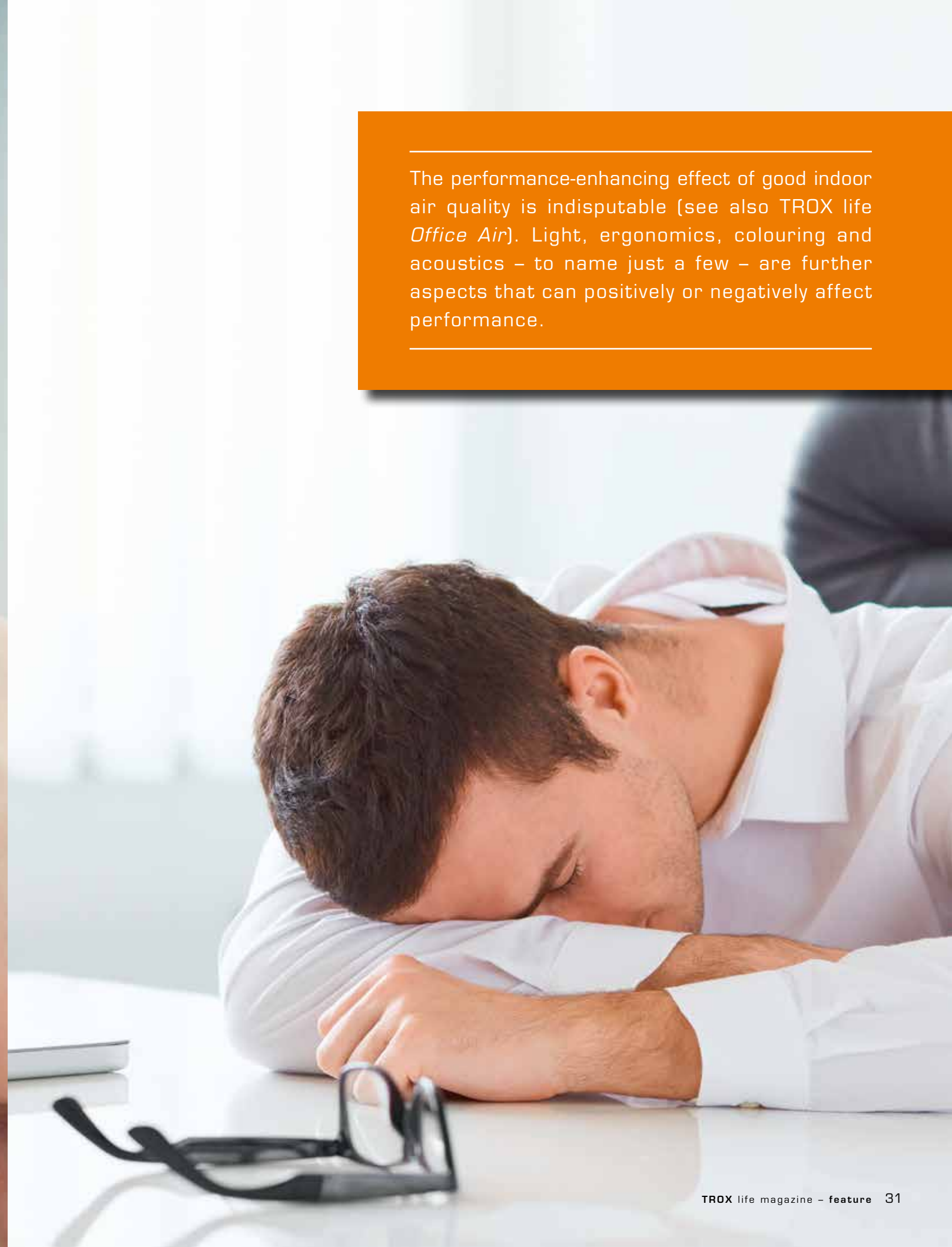
**Energy management – ISO 50001**

With this standard, companies can systematically and consistently increase their energy efficiency. The cost savings that can be generated will thus enable them to strengthen their competitiveness. The standard refers to the factors that can be influenced by a company and can be adapted to individual requirements.

Energy management systematically records the energy flows and indicates the areas with potential for energy savings. It can influence organisational and technical processes and procedures. It reduces the overall energy consumption of an operation (including the energy required for production) as well as the use of basic substances and additives, and it consistently improves a company's energy efficiency.



# HVAC at work. Strategies for a performance- enhancing office.



The performance-enhancing effect of good indoor air quality is indisputable (see also TROX life *Office Air*). Light, ergonomics, colouring and acoustics – to name just a few – are further aspects that can positively or negatively affect performance.





**New findings that could transform the office climate.**

Two recent studies have revealed how productivity can be boosted even further. Key words: the ideal working rhythm and power napping.

**52-17.**

A research team from the Latvian Draugiem Group looked at the productivity of people working in an office environment: i.e. the time the test subjects spend at their screens, the time they spend on certain tasks and when they get distracted. A performance comparison of different groups revealed some astonishing results.

It is difficult to believe, but there could be hope yet for a better (shorter) working day at the office. Little to no additional performance was generated by working an extra two hours. In fact, what turned out to be much more significant was the working rhythm: alternating between productive phases and breaks. The study showed how important it is to take regular breaks, as they enhance concentration. The group that took breaks were more productive than their colleagues who worked without a break.

The researchers discovered that the ideal working rhythm was 52 minutes of work followed by a 17-minute break. Taking a proper break to eat, walk or chat benefits the working rhythm of the brain. It takes just under an hour of work for the brain to get tired and require a regeneration break. This is particularly the case after a phase of high concentration.

Source: <https://www.linkedin.com/pulse/perfect-amount-time-work-each-day-dr-travis-bradberry?trk=mp-reader-card>.

**The healthy office nap.**

The beneficial impact of a power nap is common knowledge. The importance of an afternoon nap for health was impressively shown in a study by the Harvard School of Public Health in Boston. For six years, they studied 24,000 people in Greece, where they carried out surveys, analyses and medical observations. Their conclusion: People who take an afternoon nap for half an hour or more at least three times a week were 37% less likely to suffer a fatal heart attack. Even afternoon naps of less than half an hour still reduced the risk by 12%.

Could an office nap also have a positive effect on performance? Sara Mednick and her colleagues from the Harvard University conducted 'sleep

research' experiments in an office environment. 30 test subjects performing concentrated mental work were divided into 3 test groups and given four blocks of work each.

A third of the test subjects were permitted to sleep for an hour after two blocks of work, another third were permitted half an hour. The remaining third stayed awake. The best performance, no surprises here, was recorded in the first block of work for everyone. The performance of the second block was significantly lower.

The results:

- A nap lasting an hour: performance improved due to the sleep and this level was maintained until night time.
- A nap lasting half an hour: performance was retained in the second block of work. There was no noticeable increase or decrease in performance.
- No afternoon nap: reduction in performance with each subsequent block of work.

These findings should have a lasting impact on the design of offices in the future.



**Indoor climate increases productivity.**

A new British study has confirmed that a poor indoor climate reduces performance at work. Good air increases it. A total of 7,850 interviews were held with people working in two office buildings, where they underwent tests at alternating room temperatures, CO<sub>2</sub> concentration levels and relative room air humidity. Tasks included reading tests, tasks with numbers and cognitive tests.

As the British economic output is lagging behind that of other countries, the researchers assumed that one of the reasons for this was the environmental conditions in offices. Their research project 'The Whole Life Performance Plus (WLP+)' provided proof that this analysis was spot on and that there is a connection between a poor indoor climate and unsatisfied, unproductive employees and staff generally feeling unwell. The study also revealed that improving the indoor climate can increase productivity – by up to 12%.







Anja Deden  
Customer Support



Rolf Krenzer  
Head of the Central Branch

# TROX Round Table. Working climate.



Dennis Klein  
Engineering firm



Jürgen Windegger  
Wholesales



Michaela Schmitz  
Customer Support



Nils Markwaldt  
Product Management



The weather can change in the blink of an eye – warm sunshine can often be followed without warning by a heavy thunderstorm. Climate change, on the other hand, is something that happens gradually and almost imperceptibly. This does not only apply to meteorological and geopolitical climate change. The working climate, or work atmosphere, can also be the subject of change, and TROX is no exception. So TROX customers and TROX employees met some time ago for a round table discussion of the working climate. Has there been a climate change? How do we improve our future? TROX life has compiled the results of this interesting exchange.







'Our customers always have our ear, and our field sales team is no exception.'

Nils Markwaldt, TROX Product Manager

**How is TROX perceived?**

According to Anja Deden, Team Coordinator/Customer Support, and Rolf Krenzer, Head of the Central Branch, the once rather conservative company has become more modern and open. While the emphasis used to be on good work, perfectly fitting suits and correctly knotted ties in the past, today this is all a lot more relaxed. Words such as 'approachable', 'amenable' and 'authentic' are now the buzzwords.

TROX is still a renowned market leader in the ventilation industry, on that there is no doubt. The emphasis is on product diversity, with TROX being well known for offering complete systems. However, there has been a noticeable change here too. TROX is no longer just a component supplier, but an approachable

'Digitisation will be the order of the day for us all in the near future. Linking complex systems with many companies, that will be the focus. It is why we are upgrading our IT.'

Rolf Krenzer, Head of the Central Branch

company where 'people do business with people', says Jürgen Windegger of LTW Lufttechnik West. And Dennis Klein, of engineering firm Rempe | Polzer, adds: 'I always get good advice and feel that people take my questions seriously.'

**Personal proximity.**

Anja Deden: 'Thanks to the low fluctuation level in our company, our customers have had the same TROX contacts for years. You know precisely what needs to be taken into consideration. Our customer contact is very good. This is also something that becomes very apparent on the phone.'

It means that when questions arise, specialist consultants know their contact partners. And they will have an answer by the following day at the latest. This personal and valued contact makes cooperation very easy. Wholesale partner Jürgen Windegger agrees. TROX, in contrast to many other companies, prioritises the entire customer relationship and the project as a whole rather than just the individual case.

Rolf Krenzer, Head of the Central Branch, thinks that TROX typically responds swiftly. 'The external sales team will arrive on site and jump right in to help customers.'



'I always get good advice and feel that people take my questions seriously. When I call, I am always given further assistance.'

Dennis Klein, engineering firm Rempe | Polzer



'Thanks to the low fluctuation level in our company, our customers have had the same TROX contacts for years. Our customer contact is very good. This is also something that becomes very apparent on the phone. We are proud to work for TROX and very much enjoy the part we play.'

Anja Deden, Team Coordinator/Customer Support

**What can TROX learn from other companies?**

There are companies, also in our industry, which are looking to centralise operations and close regional sales offices. But we are aware of the importance of being in close proximity to customers. So the unanimous view is that TROX does not operate the same as other companies do with call centres.

Also, the attempts of companies to become as hip as the young start-ups with all the latest work-life balance concepts were not always successful. According to Product Manager Nils Markwaldt, there is a greater focus on concepts that actually suit the company at TROX and employees are asked about what they really want.

**Not everything always runs smoothly ...**

... and then, from the customer and employee perspective, there is one thing that takes priority: speaking honestly with one another. 'Fast and mercilessly open communication' is what Jürgen Windegger wants. This is not always easy and there is always room for improvement. But: 'We are definitely getting there.'

Michaela Schmitz, Team Coordinator/Customer Support for the filter business, recalls a fire last year that led to a brief production stoppage. The affected customers were directly informed. In her opinion, the many years of successful customer relations make it easier to talk about even the more difficult issues.





**What do our customers expect?**

From a business perspective, product data is essential. 'To document 80% of all products means that part numbers, pictures and dimensions have to be entered for 1.2 million items', says Jürgen Windegger. This results in an enormous backlog, an issue that is generally common knowledge and one that TROX is intensively working on over the course of digitisation.

**What will cooperation look like in the future?**

Service and digitisation are the buzzwords of the future. According to Nils Markwaldt, the current motto at TROX is 'service is the new product'. Particularly for a system supplier, this involves building this system for each customer on an individual basis and connecting them with one another in all its complexity. With the service partner HGI, TROX has already taken this step. The service area is being expanded with many new employees.

Communication is also an issue on site, e.g. when well-trained ventilation fitters meet with drywall builders and often have to explain the technical characteristics and regulatory-compliant installation processes in the face of language barriers. 'Technical instructions in other languages would not be a bad idea,' says Dennis Klein.

**Where are the solutions?**

This brings us back to the issue of proximity to the customer. Nils Markwaldt describes the problem-solving of Product Management at TROX as an issue that is 'not decoupled'. According to him, research is not anything done in isolation, independent of actual demand; instead, TROX does actually listen to their customers and to their external sales staff. 'TROX is different from other companies. If you call TROX, you are put on to a specialist. This means that problematic situations virtually always have a positive outcome.' The specialist consultant is in agreement here: 'When I call, I always get further assistance.' And Anja Deden ensures that a customer is not just connected with somebody quickly, but with somebody who will provide concrete assistance.



'One day we may be able to supply a product that customers can print on a 3D printer on the construction site.'

Michaela Schmitz, Team Coordinator/Customer Support for the TROX filter business



'TROX is no longer just a component supplier, but an approachable company where people do business with people.'

Jürgen Windegger, LTW Lufttechnik West KG

planning data on their project via the cloud from any location and at any time.

Also, to have a position on the market that protects the reliable network of retailers and manufacturers against aggressive global players for the long term is another of my wishes. And new innovative products such as RadioDuct systems with which we can be first on the market. 'Because it's fun to be the one launching something like this,' says Krenzer. Which brings us back to where we started in the words of Jürgen Windegger: 'Joy is in the humanity'.

**We would like to thank the participants of the round table discussion for this meeting.**

Advanced digitisation in TROX will also accelerate many steps. Michaela Schmitz says that customers in the new myTROX portal can track their orders, configure products and even order some products online. In the future, users will also be able to book seminars and an online maintenance management system will also be available. Jürgen Windegger considers it essential to synchronise the working methods of all those involved in a project. For him, this involves finding out where something can be automated and where people need to continue speaking to people. 'Climate change, yes – but not at any cost!'

**Ideas and wishes for the future?**

To put it in a word: diverse. The demand is for simplified logistic concepts that are even more harmonised and that are capable of bringing the product to the site faster and with greater efficiency – with respect to environmental protection and with less packaging. Tracking systems for carriers would also be helpful. More communication in the direction of logistics, retailers, manufacturers and HVAC contractors. The customer portal myTROX is already the right step here, because the customer can access all the







# TROX Mexico. New production site with potential.

Founded in 2010 as a sales company, expanded in 2019 to become a production company – TROX Mexico is now manufacturing products locally. TROX is thus using a strategically placed production site as its base for the sale of its high-quality air conditioning and ventilation products in the growth market of Mexico and beyond.





**Huejotzingo**

Huejotzingo, headquarters of TROX Mexico, is a city located north west of the Mexican city of Puebla in the wide valley basin of the Rio Atoyac, approx. 24 km north west of Puebla.

**Mexico. The strategy of a good location.**

What makes a location ideal for production? This is clear in the case of TROX Mexico. The country is one of the world's largest growth markets and has thus become one of the most attractive production locations in the world. And there are good reasons for this. There's its favourable geographical location, the government's liberal economic policy, and the country's population of 123 million, resulting in an expandable sales market. Furthermore, this production location enables exports to other Latin and North American markets.

**Local production, high quality.**

Long delivery times and high transport costs have become a thing of the past! Local production means that the large market potential of the country can be utilised quickly and flexibly. This is helped by the already well established sales network of TROX Mexico. The 4,000 m<sup>2</sup> production facility in Huejotzingo will manufacture components, such as grilles and air terminal devices, as well as air handling units.

These are good prerequisites for TROX, as the Mexican air conditioning and ventilation market is generally more quality-oriented than price-driven. TROX already enjoys a reputation there as a supplier of high-quality products.



Numerous guests of honour were present for the grand opening of the TROX production plant in Mexico (from left to right): Celso Simões Alexandre, President TROX Latin America; Olivia Salomón, State Secretary for Economic Affairs of the State of Puebla; Miguel Barbosa Huerta, Governor of the State of Puebla; Prof Hans Fleisch, Chairman of the Heinz Trox Foundation; Angélica Alvarado Juárez, Mayor of the city of Huejotzingo; Udo Jung, member of the Board of Management of TROX GmbH and responsible for Sales, Technology and Production; Thomas Mosbacher, member of the Board of Management of TROX GmbH and responsible for Finance; Tobias Lange, industry representative for the German Embassy.



The new management team for TROX Mexico: (from left to right) Celso Simões Alexandre, Ingrid Viñamata Chávez, Commercial Director, and Marco Adolph, Technical Director.

**Inauguration of the new production plant in August 2019.**

Customers and industry representatives attended the opening of the new production facility on 15 August 2019, which was also attended by Udo Jung and Thomas Mosbacher of the TROX Board of Management; Professor Hans Fleisch, Chairman of the Heinz Trox Foundation; and Celso Simões Alexandre and Pieter Jooste of the extended Board of Management of the TROX GROUP. Ingrid Viñamata Chávez and Marco Adolph from TROX Mexico highlighted the tremendous work of their team and thanked everyone for their support. Together with Celso Simões Alexandre, who was also responsible for setting up the Mexican production plant, they will both head up the new plant. TROX Mexico is TROX's 16th production site around the world.

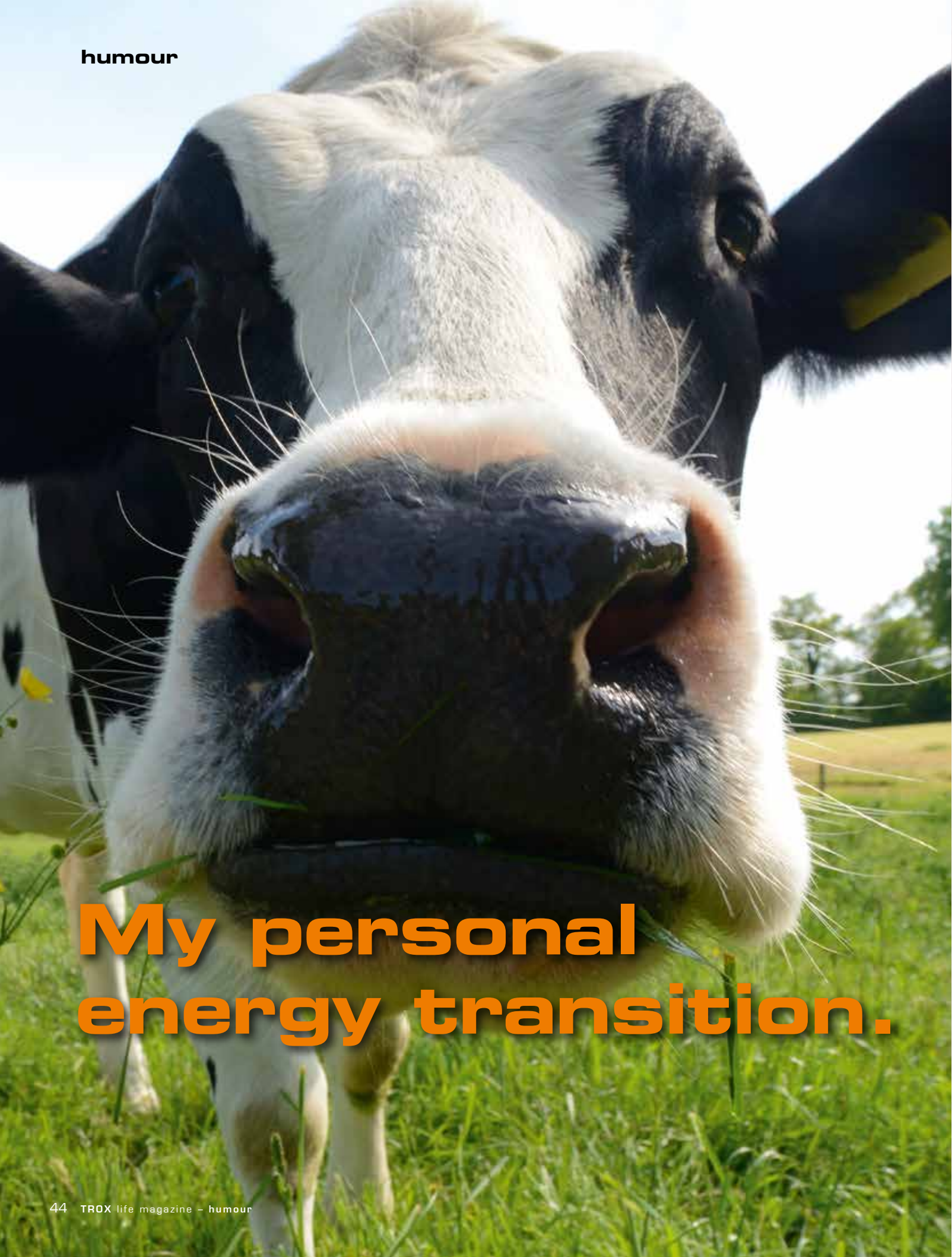


Highly motivated and dedicated: The Mexico team is looking forward to the future.



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# My personal energy transition.



The things we have to do for the energy transition. Because households (that's us) are responsible for about a quarter of the total energy consumption. However, a closer look at our ecological footprint\* would show the ecological missteps that we still seem to be taking. Every kilowatt of power that is not consumed and every gram of greenhouse gas that is prevented is a contribution to this energy transition, which makes energy saving the best way to help with the energy transition.

\* Sustainability indicator.





**I am self-powered.**

To be honest, when it comes to my personal power consumption, there's quite some energy saving potential. For example, every morning red lights show the way to the living room. Having fallen asleep on the couch (in my defence, it wasn't the most exciting of movies), I just about manage to turn off the TV – with receiver and Hi-Fi systems in standby mode, not forgetting the computer of course. By the way, did you know that standby mode in one household can consume up to 360 kWh of power a year and that you could save roughly EUR 120 annually by switching off your devices?

I drag myself to bed. The end of the movie, which I only half-caught, is still lurking at the back of my mind causing sleep to evade me. So I grab a book. The result is that I wake in the morning with a feeling of pressure in my back (the book still under me) and my bedside lamp still on. (Perhaps a timer switch would help me here.) However, I am comforted by the knowledge that I have still played my ecological part, with the bulb being an energy-saving one and all. Mind you, I haven't really got

the hang of energy-saving light bulbs yet. Yes, I can read half asleep under the cold light of the lamps, but they weren't exactly designed with relaxation in mind. As for LEDs and the like, I'm in the dark. Luckily, my stock of conventional warm white bulbs has seen me through so far.

**Meat is my vegetable.**

Cooking is my passion. I pay culinary homage to this passion on my weekly Saturday trips to the local market. The market offers top-quality fresh products, all locally

sourced – a fact that soothes my ecological conscience as the vegetables and meat have only travelled a short distance to reach me. The market is also a popular meeting point for catching up on gossip. I discuss football with my greengrocer, and the origin of my steak with my trusted butcher. He recommends a French speciality, the base cote, a beef saddle between the entrecote and the neck of the cow, tastier than a rump steak.



**Burping cows.**

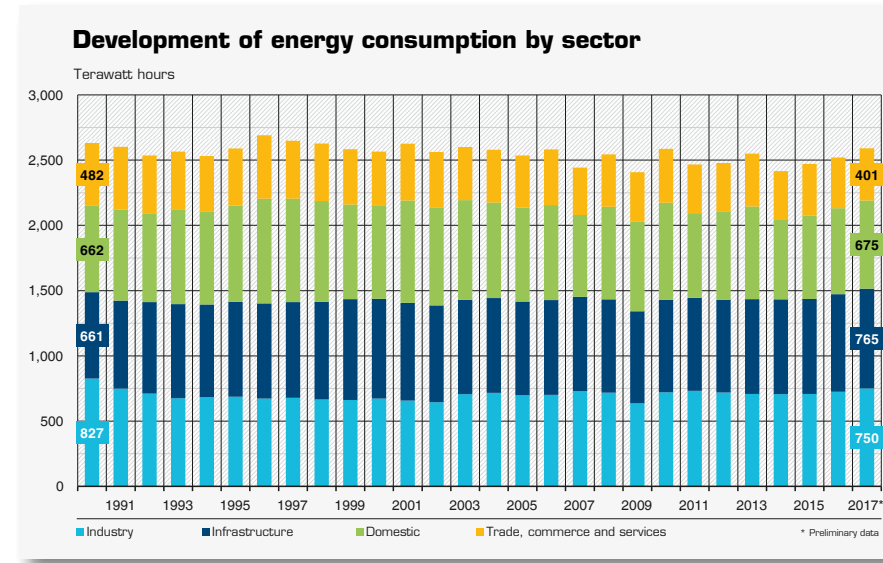
I experience a tug on my conscience when frying this prime cut of steak. Sure, I had said no to the Argentinian steak, its path to my frying pan being much too far. But one and a half billion cows in this world produce the frequently underestimated colourless and odourless greenhouse gas methane while ruminating. Cows burp this greenhouse gas into the atmosphere, and every molecule of methane is 23 times more potent than carbon dioxide. This means that methane is responsible for at least 26 percent of climate-changing gases. According to the WWF, about seven percent of emissions could be prevented with conscious nutrition.

However, preventing waste (naturally I separate and avoid unnecessary plastic packaging) plays a far greater role in climate protection than renouncing meat – a comforting



thought for my conscience. Projecting this to the country, up to 67 million tonnes of emissions could be saved. This corresponds to about seven percent of all German emissions or the entire greenhouse gas emissions of Portugal\*. \*WWF.

Energy transition? We all have to pull ourselves up by the scruff of our own necks. It is not always easy to do this. We turn our heating up to the highest level, even though a degree below this would hardly be noticeable. We forget the standby function of our electrical devices and we opt for the wrong product, from an ecological perspective, when shopping.



Source: Federal Environment Agency on the basis of AG Energiebilanzen, evaluation tables for energy balance in Germany 1990 to 2017, revised 07/2018.

**Examples of standby power consumption (older devices)**

Unit	Standby (watts)	kWh per year*	Euros per year*
PC, monitor and printer	10	80	23
DSL router	8	64	18
LCD TV	14	112	32
DVB-T receiver	10	80	23
Mini Hi-Fi system	11	28	25

\*With an average standby duration of 22 hours per day [source: CO2online.de].



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