TROX

life

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Office air.

For a climate of efficiency.

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Dream office, office dreams.

In Germany alone, 25% of people rush to work in an office every morning, which makes offices the no. 1 workplace. There is hardly a place surrounded by more tales, some of which we will tell on the following pages: stories that are funny or just mildly funny, absurd or plain ordinary, or downright unbelievable.

Office workers spend at least 80% of their time in enclosed spaces, which amounts to 80,000 hours in a life. That's why it is so important to provide optimum working conditions and a healthy, comfortable climate in order to win the recruitment race for top staff. As standard, virtually all new office buildings are equipped with a perfect, reliable air conditioning system. Our project report features two examples of promising air conditioning strategies; we also show outstanding building projects and inform you about the economic prospects for office buildings and about sustainable architecture.

Existing buildings are a different matter altogether. Clear indication: About 40% of the energy consumption and one third of carbon emissions in Europe are attributed to buildings, mostly office buildings. Only 5% of existing office buildings meet current energy efficiency requirements. And this is the case all over the world. In the US alone, numerous office towers that were erected in the 30s and 40s of the last century and equipped with now antiquated air conditioning systems are waiting to be refurbished and fitted with energy-efficient technology. They are a burden on the climate and the environment – and a huge potential for our industry.

This 'Office air' issue of TROX life is meant to provide an impulse to the office world, an impulse to install energy-efficient air conditioning systems. It may give you new ideas and provide a design aid such that together we can open up the huge potential that lies before us.

Enjoy this fascinating discovery tour through office buildings and offices around the globe!

Lutz Reuter
Chairman of the Board of Management of TROX GmbH

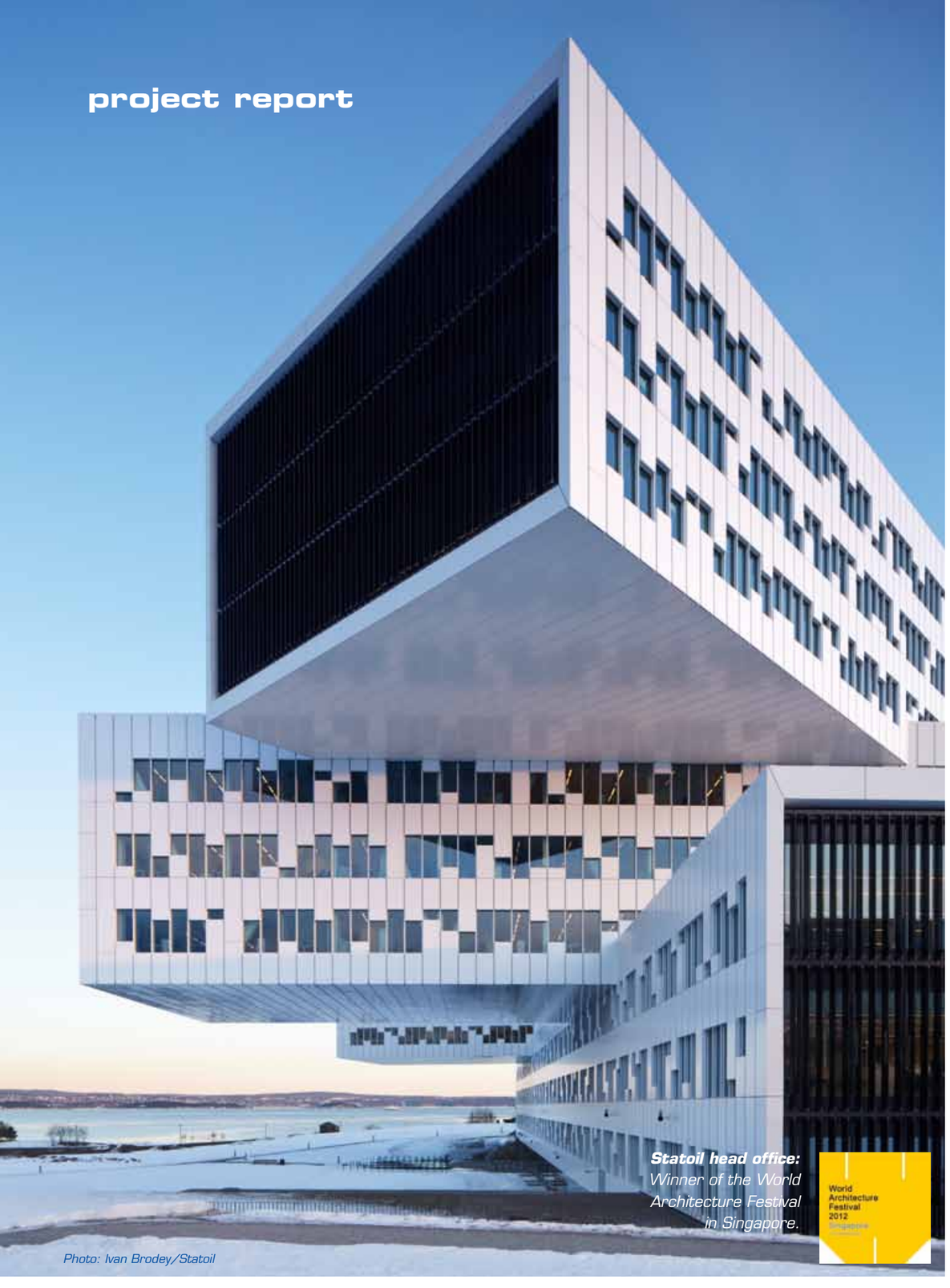
STATOIL.
Equipped with TROX air-water systems.

Photo: Ivan Brodey/Statoil

Perfect airflow, perfect workflow.

The art of handling air in offices.

The air conditioning strategy for an office building depends on many factors. It begins with the structural conditions such as architecture, orientation, location, outside climate, and the layout and sizes of rooms, to name but a few. Next, the occupancy rate, loads to be dissipated, and the usage and equipment of offices all play a role. And last but not least, the air conditioning design depends on whether it is a new building or a refurbishment project.



Statoil head office:
Winner of the World Architecture Festival in Singapore.

Photo: Ivan Brodey/Statoil

Solutions tailored to the requirements of each building.

For many construction projects the TROX engineers begin already at the concept stage working closely with specialist consultants and project developers. This is the way to design an air conditioning system that is tailored to the specific project – be it large or small, a new building or a refurbishment project. The components come from a single source, components that ideally complement each other, ensure efficient and all-encompassing air conditioning strategies and noticeably reduce the design effort.

The office solutions that TROX can provide are too numerous to be listed in this magazine. We will instead introduce just four selected projects and the respective air conditioning strategies. Two of the office buildings, a new and a refurbished one, have been provided with all-air systems; the other two, again a new and a refurbished building, with air-water systems. Clearly the most striking of the four buildings is an extraordinary project in Norway that has won international acclaim. We will not neglect smaller scale solutions, though, since they surely match the big ones when it comes to efficient room air conditioning.

Efficient combination of air and water.

In office buildings in particular, where high thermal loads caused by people, lighting, computers and other equipment prevail, air-water systems are the energy-efficient alternative to all-air systems. Air-water systems use air-water heat exchangers to cool and/or heat the room air. This means that heating and cooling capacities can be sized independent of the fresh air flow rate. An additional yet considerable advantage of air-water systems is the fact that thermal energy is transported more efficiently by water than by air such that less energy is required to provide the same heating or cooling capacity. Air-water systems can be freely suspended, or installed in suspended ceilings or intermediate floor panels.

In the case of active chilled beams, such as the ones used in the Statoil office building in Norway, fresh air is supplied to the rooms by the air handling unit in addition to water-based cooling. As the system relies on the principle of induction, the supply air flow can be noticeably reduced when compared to all-air systems. No additional fans are necessary to transport the air, which results in less energy consumption and only minimal noise.

Active chilled beams save space because they are comparatively flat and require only a compact air handling unit and smaller ducts. They can be operated in both cooling and heating mode, which means that no extra static heaters are needed. And finally, they can accommodate lighting, loudspeakers, smoke detectors and sprinkler systems, which is a huge advantage.

Example of an air-water system integrated in the façade: Capricorn office building in Duesseldorf, Germany.

Façade solutions.

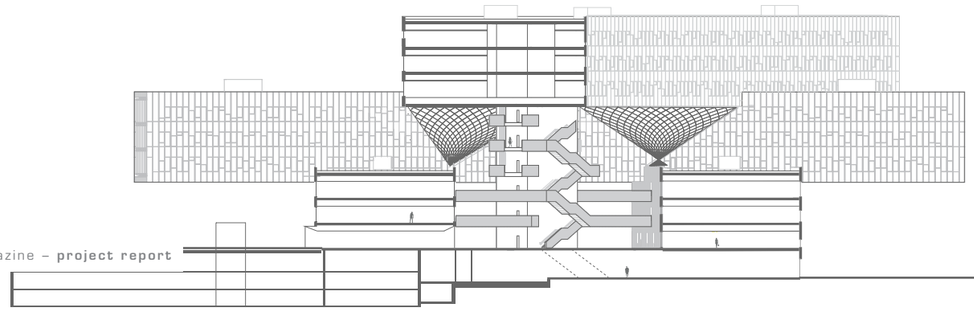
Another interesting and at the same time energy-efficient and space-saving solution are façade units, which are ideal for refurbishment projects. Such units are integrated in the façade of buildings. The choice is between sill, under sill, wall or under floor installation. Air is supplied and extracted directly through the façade, i.e. on the shortest possible route. No duct system is required, and façade units also allow for thermal loads to be dissipated with water.

1 Statoil – air-water.

NEW BUILDING

On the premises of a former airport outside Oslo a truly iconic building has been erected. It actually looks as if a giant had been playing with building blocks, piling the five cubic structures on top of each other. While the original drawing might look like the whim of a designer, the actual building proves to be a sophisticated solution with numerous intelligent and innovative details. All five blocks are arranged in such a way that optimum use is made of the daylight, and employees can enjoy the stunning views of the Oslo fjord. The skeleton of the building is a seamless steel structure, reminiscent of other constructions in the oil industry, and allows for overhangs of up to 30 metres. The space between the five blocks has been named Urban Plaza Tower and is another epitome of democratic architecture philosophy. The plaza is the social centre of this most extravagant office complex. This is from where all offices open up, which makes this atrium ideal for spontaneous interaction and casual exchange between members of different disciplines and departments.

The modular construction consists to a large degree of prefabricated members; this helped not only to control the building costs but also to complete the whole complex in a record 20 months. The 3200 active chilled beams of Type Svalbord were manufactured on dedicated production lines and custom fitted with lighting and a sprinkler system by TROX Auranor, then shipped to the construction site on special lorries just in time. The energy-efficient air-water system helps to keep the primary energy consumption down to only 100 kWh per square metre and year.



Top: *View of the Urban Tower, from where the offices are accessed.*

Right: *Active chilled beams for energy-efficient air conditioning and ventilation of the offices. Communal areas promote social encounters and the exchange of information.*

Photos: bygenytt.no/Statoil

The orientation and arrangement of the modules guarantee grand views, much light and perfect accessibility of the building from the central atrium.

Air plus water, the perfect solution. Awarded gold.

REFURBISHMENT

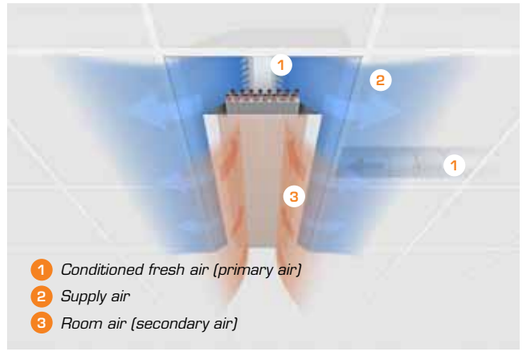
The Constitution Center, which had been home to the U.S. Department of Transportation for 40 years, underwent a complete change between 2008 and 2010. The main goal of the total revamp was the energy efficiency refurbishment of the 10-storey building.

TROX active chilled beams: *Effective cooling yet pleasantly low airflow velocities in the occupied zone.*

Focus of the ventilation and air conditioning system was a fit-for-the-future technology that will remain energy efficient and provide comfort for years to come. Here, too, active chilled beams were chosen, not least because they can be easily installed in suspended ceilings.

A special test lab was set up in Washington in order to test alternative solutions from as many as four competitors. The winner was TROX DID-600 because it provided the best performance data of all tested units. Said the SmithGroup architects, who had conceived the building: 'TROX chilled beams are the main components responsible for the reduced costs, as a result of the ability to provide required cooling capacity without running the 4,800 ton chiller plant most of the year.'

Functional principle of active chilled beams



1 *Conditioned fresh air (primary air)*
2 *Supply air*
3 *Room air (secondary air)*

The Constitution Center in Washington has won an LEED Gold rating.

TROX References

TROX air-water systems in other international office buildings

Goods Shed Melbourne, Australia

1. Vodafone Milan, Italy 2. KAM Bruges, Belgium
3. TMB Ankara, Turkey

Hypercube Moscow, Russia

Photo: Yuri Palmin, © BERNASKONI

Courtesy Skolkovo Foundation

Miele, *Gütersloh, Germany*

3 Displacement flow. There's room in the smallest of spaces.

REFURBISHMENT

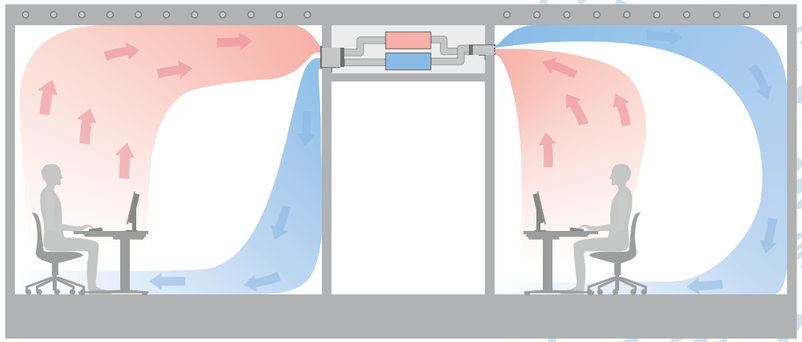
When a building without an air conditioning system and hence without any ductwork is to be refurbished, then the question is: If an all-air system is to be installed, where to put the ducts? This was the problem faced by Miele, manufacturer of domestic appliances in Gütersloh, Germany.

TROX air terminal devices for both supply and extract air provide specialist consultants with the chance to design also all-air systems. The usual situation in classic office buildings is such that offices are arranged to both sides of corridors, and suspended ceilings and walls are used to accommodate ducts and air terminal devices for supply and extract air such that the clear height of the actual offices is not impaired.

The Miele project used combined supply/extract air displacement flow diffusers of Type QLW-AZ, which ensure thermal comfort due to the only small temperature difference when compared to the room temperature, and the near turbulence-free airflow. Displacement flow is based on low-velocity air discharge and on the natural convection near heat sources (people, lighting, electrical devices). The optional cross talk silencer suppresses the transmission of noise through ducts between rooms. Employees can work in peace and quietness.

QLW-AZ
The lower part of these combination diffusers discharges the supply air while the upper part takes in the extract air.

Displacement flow ***Mixed flow***



Displacement flow *Comfortable solutions for workstations away from the corridor wall such that the displacement air can move along the wall without being obstructed.*

Mixed flow *Coanda effect means that the supply air moves along the ceiling and then towards the floor while it mixes with the room air without causing much of a draught. Workstations can be arranged along the wall.*

4 Mixed flow. From the suspended ceiling.

NEW BUILDING

For new buildings, and even more so for fairly compact new buildings, combined supply/extract air terminal devices can be the ideal solution and economic at that. For example in Karlsruhe, Germany, where the SEF Engineers combined these terminal devices with mixed flow air distribution for their own office building. The adjustable Type VSD35-3-AZ slot diffusers were installed in the suspended ceilings of the corridors.

TROX mixed flow diffusers make use of the so-called Coanda effect. Supply air is discharged from the upper slot, moves along the activated concrete ceiling and eventually fills the entire space. The airflow actually enhances the effect of the component activation.

The extract air is taken in through the two lower slots. Due to their compact size and height of only 110 mm the diffusers are ideal for rooms with very little available space. The air connections are not inside the office but outside, in the corridor. A cross talk silencer suppresses the transmission of noise between adjacent rooms. The VSD50-1-LT combination diffuser is a vertical variant with an integrated cross talk silencer for installation in stud walls.

Explains specialist consultant Michael Schmidt: 'The local conditions didn't allow for much space, neither in the height nor in the width or length, which is why we had to take the limited space into consideration when planning the air conditioning strategy. Both the architect and the specialist consultants had to aim at finding a solution that was as compact as possible.'

SEF Engineers,
Karlsruhe, Germany

TROX references

TROX air conditioning system components from a single source in other international office buildings

ADAC Munich, Germany

1. Belgrano Office, Buenos Aires, Argentina 2. European Parliament, Brussels, Belgium 3. Edificio IDOM, Bilbao, Spain

The Square, Frankfurt, Germany

The office of the future.

A climate of creativity.

People are very sensitive to it. They feel it, suffer and quarrel with it: the climate. It affects our wellbeing tremendously. When the sun shines, we are in high spirits, feeling happy and bright. But a grey, chilly autumn day is likely to depress us, darken our mood and leave us without energy.

MetroNaps ApS
Copenhagen, Denmark

Good climate – the prerequisite for performance.

One does not have to consult scientific studies to see the relation between the climate in an office and the performance of the people, and this applies to both physical factors (temperature, humidity, airflow velocity, contaminants…) and mental factors (stress, environment…).

Providing offices with conditioned air that encourages productivity and promotes wellbeing is an increasingly decisive factor when it comes to recruit high-profile staff. The more comfortable the workplace, the greater the chance to attract qualified, motivated, excellent employees.

The office of the future is a motivation factor.

In the highly developed industrial countries more than 40% of the workforce work in an office. 'This is reason enough for us to deal with shaping office work in such a way that innovation, performance and wellbeing are equally promoted', says Stefan Rief, head of the Competence Center Workspace Innovation of the Fraunhofer IAO in an interview with the German weekly DIE ZEIT.

A nap in the office restores concentration *Power napping in the Napshell helps you fit your biological need for a break into your daily routine and activate new energy resources. [www.napshell.com]*

Whether for an impromptu meeting or for a task that requires concentration, LO Mindport by Lista Office LO offers the adequate solution.

Workplace and climate.

The office of the future will be mobile and multilocal.

'More and more people', suggests Rief, 'will use different places for their work, in offices and outside of offices.' They will work while on the road, from their homes, in co-working centres, while with friends or relatives in the country, or in trains and buses – but of course also in offices. Offices will be designed such that people can work together and also be highly productive.

Mobile internet and clouds provide unlimited flexibility and allow people to work basically everywhere. The result is an increasing migration away from the classical office. To find qualified staff also in the future, companies will have to come up with flexible and sustainable concepts to remain attractive or become more attractive to young professionals. Increasingly, employers will be selected based on how well the workplace meets a potential employee's needs and lifestyle. Ingrained practices will become undone: People will work from their homes a day or two per week – or even longer if, for example, they have to look after their old parents. So-called co-working centres will be specially established for certain projects. The more comfortable employees feel and the better they are able to use their creativity, the more efficient and productive they will be.

The office of the future will be an eco office.

In all areas, including the designing, equipping and operating of an office building, there has been a change in thinking with regard to ecological issues. Environmental awareness has become a major criterion for companies to increase their attractiveness to potential employees but also to their customers.

BRABUS iBusiness 3D *Being mobile is what counts: Auto tuners design the perfect mobile office on four wheels. [www.brabus.com]*

Room climate.

The office of the future will have an excellent air quality.

Since people spend most of their business and private life in enclosed spaces, the quality of room air is obviously much more important to them than the outside air, although that is constantly monitored and has to meet strict legal regulations.

To associate room air conditioning to the sick building syndrome, however, is totally misleading. To begin with, most surveys date back quite some time, and secondly, one should not forget that air conditioning systems in existing buildings are often old, badly maintained and generally neglected. This is the 21st century but the majority of skyscrapers in Manhattan and all skyscrapers in Detroit were built before WWII. Their room air conditioning systems are, hence, antiquated, and air hygiene and thermal comfort conditions are not state of the art, a fact much bemoaned by many scientists.

In the US of today, indoor air quality is much more of an issue than 'sick buildings'. One of the best known scientists who demand better room air quality for the high-rise office buildings in the big cities is William J. Fisk, who teaches in Berkeley. His research focuses on the interrelated issues of indoor environmental quality vs occupant health and performance, and the resulting economic benefit.

He and his research colleagues could prove that productivity rises by up to 4% depending on the supply air flow rate (fig. bottom left). By far more interesting are, however, his findings with regard to the satisfaction of room occupants since their expectations and general constitution greatly affect how they perceive the quality of the room air. The higher the supply air flow rate, the more people are satisfied, and then significantly (fig. bottom right) – this is an immensely important aspect since motivation and wellbeing but also the sick leave rates (reduction of up to 35%) correlate to a large extent with the employees' satisfaction.

Very often investments into the modernisation of mechanical ventilation systems are postponed because of the high costs, and a higher supply air flow rate is refused for fear of exponentially increasing energy consumption. Meanwhile, the industry makes extraordinary efforts (heat recovery, EC fans, flow optimisation, intelligent measurement and control systems) to further increase the energy efficiency of air conditioning systems. (See also p. 40)

The reasons given for postponing investments or for reducing the supply air flow rate are an oversimplification, though. Fisk carried out a cost-benefit analysis and has proven that the economic benefit by far exceeds the investment into good room air quality. If all office buildings in the US were refurbished (adaptation of the flow rate to 10l/s per person, room temperature of 23 °C max. in winter, further technical measures), the annual benefit in the US would amount to USD 20 billion, according to Fisk. How? As a result of better employee performance, less health issues and fewer sick days.

Left: Manhattan, New York.
Right: Downtown Detroit.
Centre: Workman on the Empire State Building, 1930

Recommended values:

Minimum illuminance

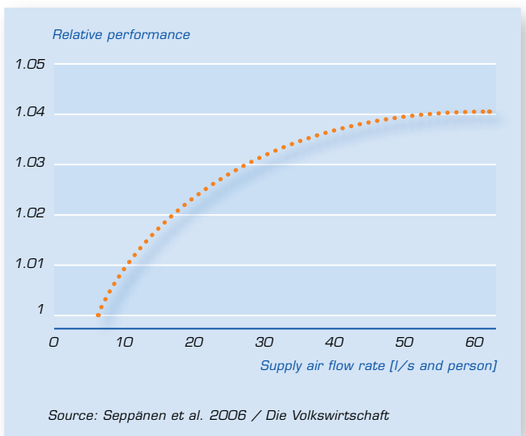
- Rooms for medium-fine work or jobs requiring simple visibility: 300 – 500 lx
- Zones for computer work: 500 – 1000 lx
- Workplaces for fine work or jobs requiring normal visibility: 500 – 1000 lx

Room climate

Temperature and humidity for offices:

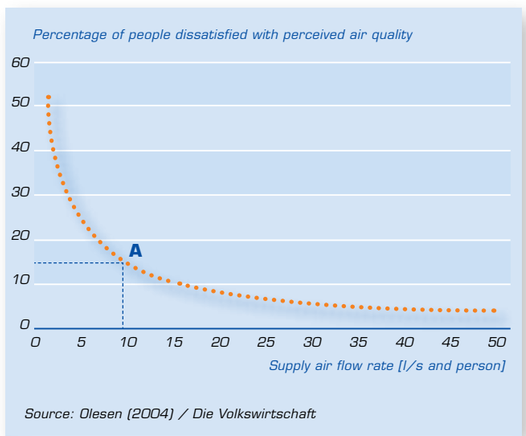
Temperature in summer:	22 – 28 °C
Temperature in winter:	21 – 23 °C
Rel. humidity in summer:	30 – 60%
Rel. humidity in winter:	30 – 50%
Airflow velocity:	< 0.2 m/s
Fresh air flow rate:	10 l/s or 36 m³/h per person

Relation between office ventilation and employee performance



Source: Seppänen et al. 2006 / Die Volkswirtschaft

Percentage of dissatisfied employees dependent on ventilation rate (evaluation by trained people)



Source: Olesen (2004) / Die Volkswirtschaft

Factors for a comfortable climate

PHYSICAL FACTORS (ROOM CLIMATE)	PSYCHOLOGICAL PARAMETERS	TYPE OF ACTIVITY/PERSON
• Air temperature	• Mental demands	• Difficulty of tasks
• Humidity	• Workplace environment (ergonomics, plants, equipment)	• Physical demands
• Airflow velocity	• Choice of workplace	• General health, clothing, age, gender
• Mean radiant temperature	• Satisfaction	
• Vertical temperature gradient	• Environmental aspects	
• Air quality		
• Contaminant content		
• Electromagnetic pollution		
• Lighting		

The spectacular evolution of the office.

From counting house to mobile office.

The Renaissance saw an increase in **overseas trade,** which gave rise to new forms of accounting and financing and therefore prompted the creation of the early office; the **counting house**. Soon the number of documents that were filed away chronologically soared to the extent that space on the merchant's desk – which also held the goose quill, the inkwell, the writing surface and the coin scales – became insufficient. The growing flood of paper was therefore stored on a **bench** beside the desk. This is the origin of the German expression for procrastinating; 'auf die lange Bank schieben' (literally: 'to place something on the long bench').

Copying press

The era of the ledger.

The 19th century office was organised systematically, with military discipline and correctness. The quill as a writing implement was replaced by the steel nib pen and documents were written at standing desks, where all incomes and expenses were recorded in a several feet wide **office ledger.** For auditing purposes, all transactions had to be entered on numbered pages and in chronological order, usually at the **standing desk**. The armchair and desk were reserved for managers.

The invention of the **copying press** made copying documents more efficient and led to the standardisation of various office processes.

Rationalisation made in the USA.

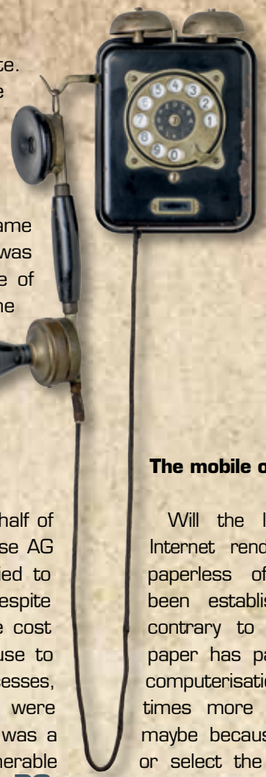
In 1874, the first **typewriter** manufactured in series appeared in the US. It made carbon copying possible. The office was increasingly divided into different departments, such as order acceptance, calculation, shipping and accounting. This development, in turn, meant a hierarchical organisation of activities (office assistants emerged to aid the clerks). The rationalisation and mechanisation of office work led to the creation of the first **open-plan offices.** In the 1920s, the 'feminisation of office work' was ushered in by the typewriter.

The Communication Age.

Once again, the military would influence office activities. Military planning staff depended on fast ways to communicate. **Telephones and telegraphs** were developed and ensured strategic success. The first commercial **telephone networks** were set up at the end of the 19th century.

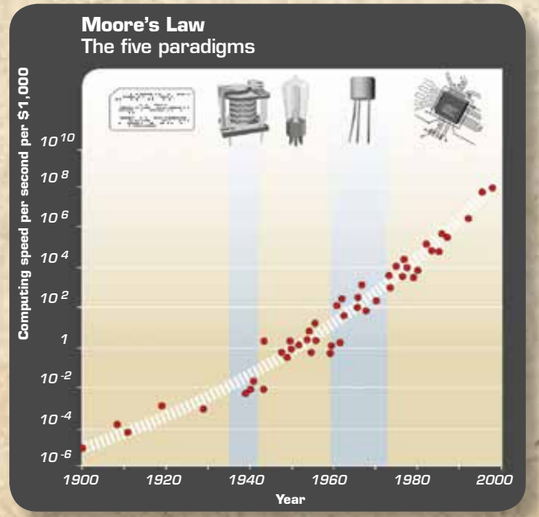
Typewriter in 1876

65 years ago, the first **car phones** became available, at a steep price: the cost of the phone was roughly half that of the car. The dawn of the age of **mobile telephony** came at the end of the 1980s and the beginning of the 1990s. In 2007, Steve Jobs introduced the first iPhone to the public, revolutionising the way we use telephones.

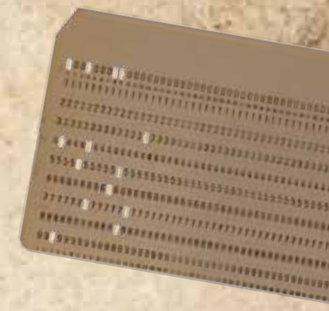


The computerisation of office work.

Computers have been around since the second half of the twentieth century. The **Z22** from Konrad Zuse AG was produced from 1957. 50 units were supplied to German buyers and 5 units were sent abroad. Despite their very bulky construction and the considerable cost of acquisition and staffing, they were of limited use to administrations. The results of the computational processes, which were controlled by **punched cards**, were printed on paper strips and stored in binders. It was a stream of data equally cluttered to that of the innumerable entries in the office ledger. It all changed with the **PC**. Thanks to this 'second desk', anyone can store and access huge amounts of data. The speed of communication as well as the number of storage and editing options have been increasing at a dizzying pace.



Punched card



The mobile office.

Will the laptop, mobile phone and Internet render the classic office obsolete? The paperless office and non-territorial office have been established concepts for years, however, contrary to all predictions, the consumption of paper has paradoxically exploded with progressing computerisation. Nowadays we use approx. seven times more paper than we did in the 1950s; maybe because you only need to press Ctrl + P or select the copier to produce copies or maybe because it seems we get a sense of tangible achievement by printing our work.

The office clerks and assistants of old may have become mobile, but we are still a long way away from the disappearance of the stationary office altogether. Their new mobile independence supposedly means that employees today can be reached and are able to work wherever they are, at all times. But, are they comfortable with this?

Moore's Law

According to Gordon E. Moore, the storage capacity and processing speed of computers will double in 18 months, while the costs are cut in half.

Today's smartphones demonstrate the breakneck speed at which computer technology continues to develop. In 1969, the computational capacity of a smartphone would have been more than sufficient to land Apollo 11 on the moon.

Office, office, office.

Some interesting facts on the number one job.

As a result of bureaucratisation, it now takes two administration employees to manage one job in production. According to Swiss author Hans Peter Treichler, office employees in 1888 made up no more than four per cent of the total staff in the industrial sector. This figure had risen to just over ten per cent by the beginning of the 20th century, and to twenty per cent by 1950. In just twenty years, the percentage of non-production employees rose to a staggering 32 per cent. However, this trend seems to have virtually reversed. We have gathered and outlined a few interesting facts on the topic of office work.

The ten biggest lies in the office:

1. *'I don't want to be promoted'.*
2. *'I don't earn any more than you'.*
3. *'I don't have anything against you'.*
4. *'I had nothing to do with that mistake'.*
5. *'No, we are not seeing each other'.*
6. *'I will tell the boss what I think'.*
7. *'I'll take responsibility for this'.*
8. *'I don't need this job'.*
9. *'I am happily married'.*
10. *'You can do it!'*

Heard any of these before?

We have decided not to comment on these statements, as they will no doubt be interpreted differently by everyone depending on personal experiences and they are certain to trigger a multitude of feelings in readers!

We do, however, want to make one small comment, and that is that most matches are not made in heaven as the saying goes, but in the office!

Burj Khalifa
Dubai, United Arab Emirates; construction period: 2004–2010; height: 828 m; height to roof: 829.8 m

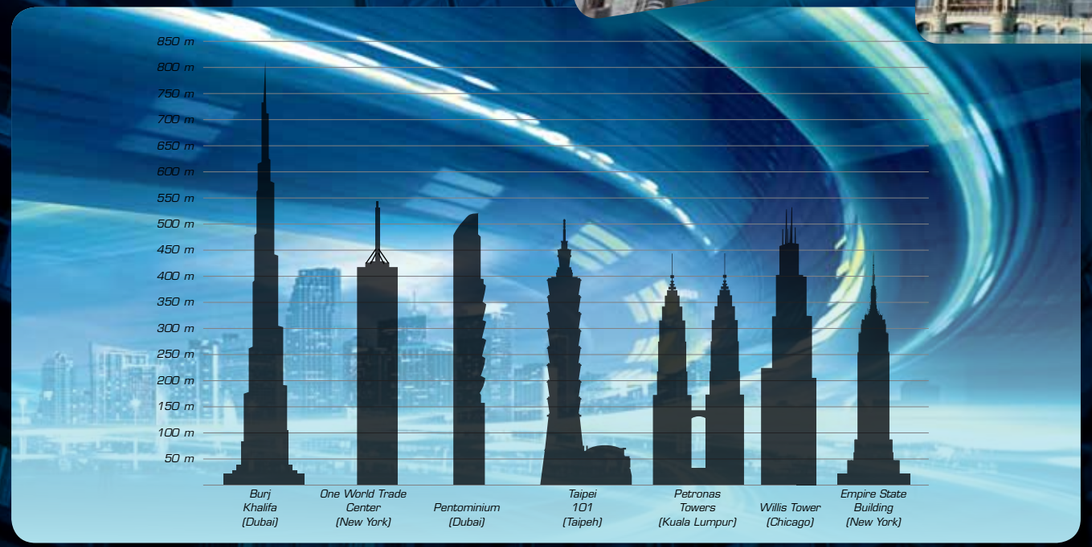
View from the ***Burj Khalifa***

The world's most expensive office space

Gross peak rents per square metre/month*

1.	***London West End***	***€ 2,137***
2.	*Hong Kong CBD***	*€ 1,505*
3.	*Rio de Janeiro Zona Sul*	*€ 1,343*
4.	*New Delhi Connaught Place*	*€ 1,324*
5.	*Tokyo CBD*	*€ 1,274*
6.	*Moscow CBD*	*€ 1,141*
7.	*Beijing CBD*	*€ 1,074*
8.	*New York Midtown*	*€ 1,054*
9.	*Sydney CBD*	*€ 992*
10.	*Paris CBD*	*€ 915*
…		
19.	*Munich*	*€ 43*

The world's highest offices:



Sources: Heinz Nixdorf MuseumsForum, Hans Peter Treichler, Spiegel Online, Manfred Wehrle, 'Am liebsten hasse ich Kollegen' (I love to hate my colleagues)

**Source: Cushman & Wakefield 'Office Space Across the World' 2012*
***CBD – Central Business Disctrict*

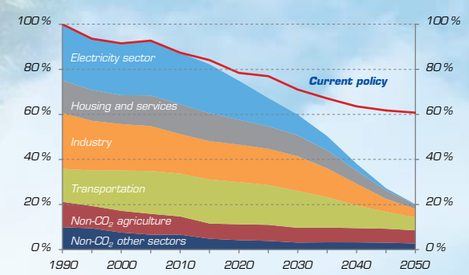
Green building.

Efficiency becoming the order of the day.

Roughly 40 % of power consumption and 1/3 of CO_2 emissions in Europe are attributed to its building sector. If the world wants to fulfil its ambitious climate change objectives, there is a lot still to be done in terms of energetic refurbishment. Only about 5% of buildings meet current recommendations in terms of energy efficiency.* In new construction, the sustainability of a building has become one of the most important competitive advantages.

* GEEA Allianz für Gebäude-Energie-Effizienz (alliance for building energy efficiency)

EU climate change objectives



Source: Roadmap for the reduction of greenhouse gases (GHG) in the EU by 80 % (100 % = 1990), Information from the European Commission

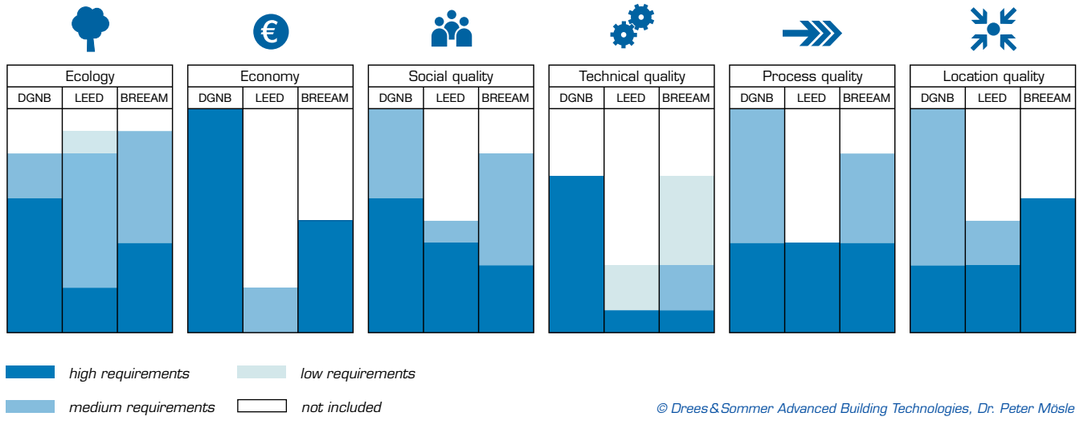
Sustainability as a competitive advantage.

Location, location, location! This has been the motto of the real estate industry up until now. However, another factor is now claiming priority: sustainability. Building green has become the order of the day and corresponding sustainability certificates are therefore in huge demand. Due to the rising price of energy, the growing ecological requirements of tenants and the higher quality of use attributed to green buildings, sustainability certificates have become extremely important in the marketing of commercial real estate property.

According to recent US studies, higher sales revenues of between 16% and 35% and higher yields of between 3% and 6% are being generated with sustainable buildings. It is no wonder, therefore, that investment in green buildings has virtually doubled in the US since 2000.

The strong building activity associated with energy-efficient buildings also leads to a growing demand for certification. The reason for this is the 'sustainability megatrend' combined with rising demand and competition in the real estate industry. Furthermore, investors regard the proof of sustainability as a valuable marketing tool.

A comparison of certification systems



© Drees&Sommer Advanced Building Technologies, Dr. Peter Mösle

Sustainable buildings generate higher rental prices and better yields.

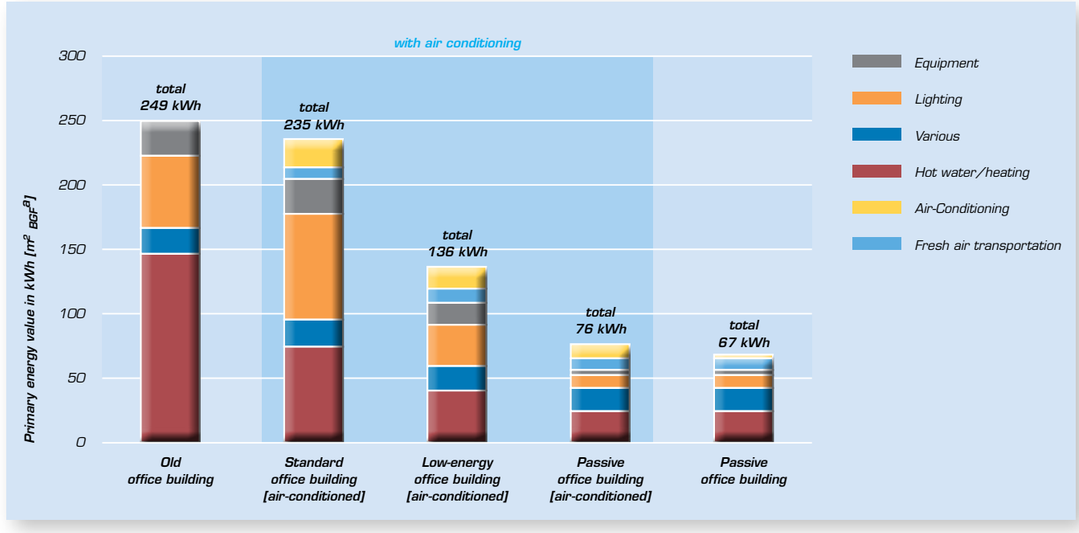
***TROX** is a member of the German Sustainable Building Council (DGNB)*

As there are many different approaches to assessing sustainable buildings around the world, it is difficult to objectively compare the results. If you look at the most well-known certification procedures, i.e. the LEED, DGNB and BREEAM methods, there may be a number of differences (see graph on page 26) but all three have one thing in common: **they all challenge the construction industry to build sustainable and energy-efficient buildings, which will benefit their users and our climate.**

Sustainability as a competitive factor.

From intelligent flow-optimised façade structures to the use of geothermal energy and waste heat, e.g. in-house data centres, and energy-efficient heating and ventilation systems: the list of innovative building services is extremely long. And the ingenuity of many engineers is still a long way from being fully exploited. For example, an office building recently had a wind power station integrated into its façade.

Primary energy values of a sample building with different energy performance qualities



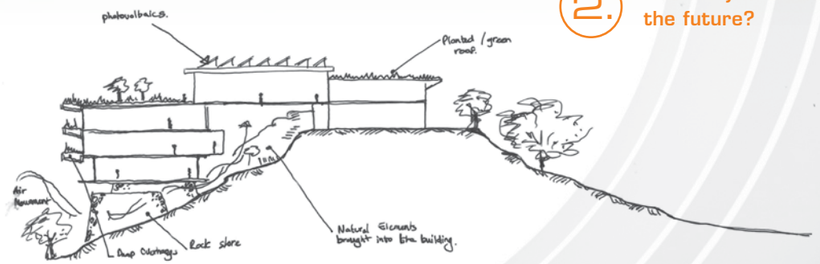
interview

Views and visions:

The future of the office.

We asked architects, specialist consultants and investors in different parts of the world to give us their assessment on how administration buildings will be built and what they will look like in the future. All were asked the following questions.

1. **Where do you see the major design challenges for future office buildings?**
2. **How do you envision the office of the future?**



© Sarah Byrne

South Africa

Johannesburg _ Sarah Byrne, GLH & Associates Architects

1. *New technologies will significantly change the way we work; there will be new modes, methods and places, e.g. co-working spaces. The working environment of the future will be in flux, constantly changing, and will be characterised by the mobile, dynamic employees' ability to adjust to this environment and to collaborate.*

2. *Condensed, collaborative, multifunctional work spaces. More energy-efficient and healthier work environments that form a seamless bond with nature.*

Spain

Madrid _ Rafael de la Hoz, Rafael de La-Hoz Arquitectos

1. *New technologies are offering unprecedented mobility – office work can be carried out in the most remote locations and in different time zones – generating time, work and cost savings. Companies are striving to enhance the productivity of their employees by providing open and flexible office spaces, with many opting for hybrid work spaces. Virtual forms of cooperation are possible through computer technology, video and audio conferences.*

Planned and built based on sustainability criteria: LEED gold certification, the REPSOL Headquarters in Madrid.

© Rafael de La-Hoz Arquitectos

2. *Many futurologists predict that head offices will disappear in the future, with employees communicating with one another using technology instead. We are sceptical that virtual communication can fully replace person-to-person meetings, though they are certainly capable of offering enormous benefits in terms of frequency, speed and the flow of information. Moreover, the benefits of collaborative meetings are too valuable.*

Brazil

São Paulo _ FGMF Arquitetos

1. *Personally, we don't see those sterile super high-tech buildings anymore. What we do see, however, is cosy offices, integrated with nature, sports, recreation and a sense of community.*

   Right now sustainability and the quality of usage are not yet sufficiently integrated with architecture. The office of the future will no longer be characterised by gadgets alone, but by innovative concepts which aim to connect users and architecture with their environment.

   Green buildings are the future – in two respects: resource saving technologies and an increasing integration of green and non-built-up areas.

2. *As far as room air conditioning is concerned, we believe in innovative, sustainable solutions such as energy-efficient air-water systems. New developments will meet the high requirements for individual control, flexibility, comfort and environmental friendliness.*

   The office of the future will be characterised by an informal, open atmosphere that stimulates creativity. Smallish, enclosed and characterless rooms will be a thing of the past. Instead, aspects of wellbeing and quality of life will play a major role.

FGMF's Edificio Corujas project epitomises a triad philosophy of harmonious integration, quality of usage, and sustainability.

Italy

Milan _ Vittorio Jacomussi, Studio de Ferrari Architetti

1. *The first thing that springs to mind: environmentally friendly and sustainable. But this is not even remotely sufficient. There are enough energy-efficient buildings but they lack a local context and hence don't blend in with their surroundings. This is why the true challenge is a combination of 'genius loci' (socio-cultural and architectural factors, quality of usage) and 'genius vivendi' (a novel euphemism for modus vivendi, which indicates the unique contribution of each and every individual into his or her social environment, freedom, and an increased quality of life, even in an immaterial world).*

2. *Genius loci + genius vivendi + technology - in exactly this order: Technological progress is the prerequisite; we take it for granted.*

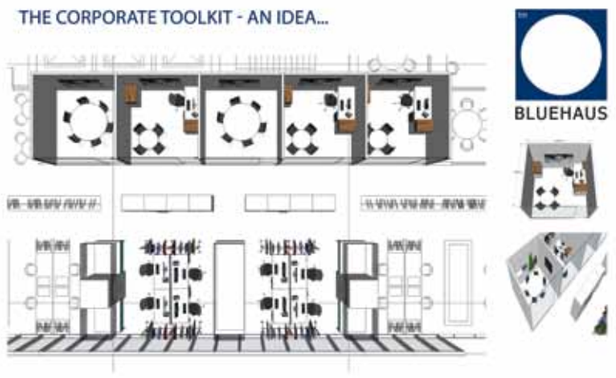
UAE

Dubai _ Ben Corrigan, Bluehaus Group

1. *Interior designers will have to face two challenges. To begin with, their vision needs to be a long-term vision. We call this 'day-2 scenario' and are committed to intensive consultancy with regard to the workplace. This is to ensure that a customer's goals and orientation will be met not only in the short term, but also in the medium term and long term. It all revolves around a non-stationary, more mobile and technology-driven office environment that provides more flexibility.*

   Another aspect is that we always need to keep up with current developments. Given the speed of technological progress, this is a constant challenge due to constantly changing trends and demands.

2. *The office of the future is a modular tool kit that allows for installing, changing or demounting single offices or larger, open plan areas in no time. We need multifunctional systems for both common spaces and retreat areas that are built from sustainable, recycled or recyclable materials. Themes, sports, nature and even cafés will be much more represented in the office of the future.*



Modular tool kit for all areas

Russia

Moscow _ Boris Bernaskoni

1. *The most difficult task for modern architects is to find a balance between really high-quality office areas (aesthetic, ergonomic, safe and supporting communication) and reasonable building and operating costs.*

2. *The office of the future must first and foremost meet the requirements of the user: Two aspects are important here:*
   - *Easy-to-use: Work places with a high level of aethetics and comfort, flexible layout, and pleasantly lit*
   - *Economic efficiency: economic, ecologic and energy-efficient*

In other words: Efficient office space with intelligent systems that are demand-based with regard to aethetics, energy and water consumption, and with a healthy room climate. The office of the future is a place that encourages communication and renders fruitful results. With our Hypercube project we have tried to fulfil such requirements.

Design of the future

At TROX, 'form follows function' is no longer the only concept for developing new products; 'form follows emotion' is the new trend, and it means that our products must do more than simply meet the technical requirements of fluid mechanics; they must also emotionally enhance rooms.

The TROX X-GRILLE has won the Interior Innovation Award 2014. The ventilation grille distinguishes itself by its unusual two-colour look and its excellent aerodynamic performance.

interior innovation award 2014
Winner

X-GRILLE

Business climate.

There is light on the horizon.

In the past five years, construction activities in the office building segment have hardly given cause for celebration. The reason for the strong decline is doubtless the global financial crisis and the associated property bubbles.

However, according to economic scientists, there is light on the horizon. Euroconstruct* predicts that the downward trend in office construction will come to a halt during 2014 and that 2015 will even see moderate growth (1 %). This means that more offices will be built. A recent survey by PATRIZIA Immobilien AG looking at new construction activity, trends in vacancy rates and investment opportunities in 27 markets for office space, points in the same direction. Further positive signs are the rising number of office employees and general economic outlook. According to the forecasts, crisis-stricken countries, such as Spain and Ireland, are the only exceptions.

The reason for high vacancy rates all over the world – in Dublin one in five offices sits vacant; in Frankfurt the figure is one in 7 and in Dubai, one in 2 – is usually more complex: poor marketability of outdated real estate or an unattractive or distant location in combination with greedy speculation. Indeed, the demand for high-quality office property, particularly in global metropolises is still buoyant.

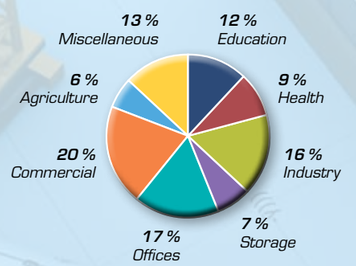
Redevelopment.

There is an emerging trend for old and obsolete office buildings: change of use to residential. With underused offices on the one side and a growing demand for housing on the other, what could make more sense than converting offices into flats, especially in large cities suffering from a housing shortage? Renovating an old property in the current market climate, with the tenants having more pull, could be very risky.

The number of project developers showing an interest in redevelopment is increasing, as is the number of investors, although some bureaucratic obstacles associated with converting offices into living space have to be overcome. Redevelopment is around 20 per cent cheaper than new development. Obsolete office buildings are usually stripped down to the shell. Inside the ‘old’ skeleton, modern, energy-efficient buildings can be quickly constructed to alleviate the dire housing situation in the city centres.

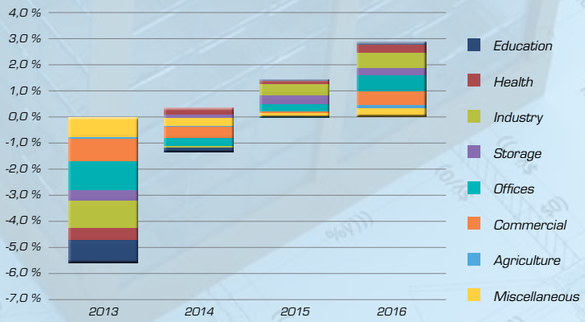
** Euroconstruct 75th Conference, Dec. 2013*

Share of segments in non-residential construction (2012)



Source: EUROCONSTRUCT (74th Conference)

Contribution of segments to annual growth in non-residential construction



Source: EUROCONSTRUCT (74th Conference)

Despite the weak economy, office buildings – as the largest segment in non-residential construction – offer great potential especially for the building services industry.

Happy hour.

After-work drinks.

The inventor of happy hour can no longer be traced. Some people give the credit for it to the Irish of New York, who were fond of drinking and who, with the growing emergence of administrative tasks in the 1920s, wanted to wash down the dry office air – air conditioning was not yet available.

Happy hour is the hour of the day when the consumption of alcohol after office hours is permitted, as the social term suggests. According to the general work practice of 'nine to five', happy hour usually starts at 5 pm and ends at 6 pm.

Don Winslow describes the atmosphere of this boozy hour at the bar very aptly in his novel 'Isle of Joy': 'As usual P.J.'s was packed with serious drinkers, among them writers, professional Irishmen, and husbands who were working late and taking a later train home.' Winslow refers to P. J. Clarke's, one of the most traditional after-work bars, as the 'most masculine of watering holes': 'Walter had secured himself a place at this allegorical campfire, at this ritual that is as old as human society. When the men sit down together by the flames and tell the day's hunting stories.'

Speaking of bars, the origin of the word can be traced back to the drinking habits of Irish Americans, but also to the German settlers. In the period of colonialisation, men drank at the counter of the drugstore to have a chat. Often, they had a bit too much to drink, which mostly ended in a full-blown brawl. To protect their goods and the counter, store owners set up a barrier (English: bar). Drugstores later developed into saloons, the origin of the modern bar.

In addition to beer, over the decades the cocktail also became increasingly popular as an after-work drink during happy hour. Its name is shrouded in the wildest stories. One of the legends says that the mixed drink took its name from the ritual of cockfights! The owner of the winning cock was allowed to pull out the loser's colourful tail feathers, and the trophy was then toasted with a drink 'on the cock's tail'. The following attempt at an explanation also seems far-fetched: in an American bar there was a large, empty ceramic cockerel. At the end of the day, the barkeeper shook all the leftover drinks into the cockerel. This resulted in a mixture with a high percentage of alcohol, which was poured from the tail of the cockerel and offered at a special price. Word spread quickly and more and more people ordered the mixed drink from the cock's tail.

In any case, the after-work bar is now an indispensable part of office life. Every year, the best ones compete for the title of 'The World's Greatest Bar'. Here, we introduce you to some of the nicest bars in the metropolises around the globe and give you recipes for famous cocktail classics.

A small selection of after-work bars

NEW YORK

- ***Brass Monkey***
  55 Little West 12th St, New York, NY 10014
  Phone: +1 212-675-6686
- ***P.J. Clarke's***
  915 3rd Ave, New York, NY 10022
  Phone: +1 212-317-2044

LONDON

- ***The Owl & Pussycat***
  34 Redchurch Street, Shoreditch London E2 7 DP
  Phone: +44 20-3487 0088

SINGAPORE

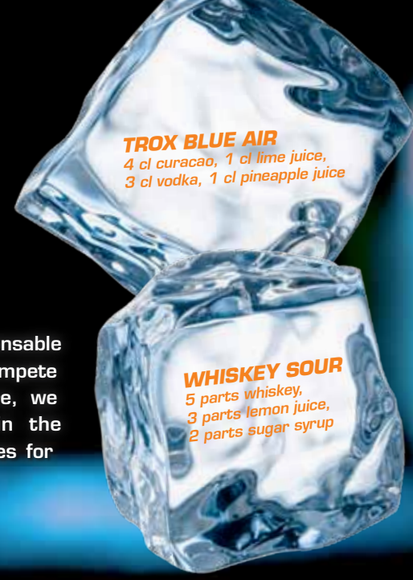
- ***LeVel 33***
  8 Marina Boulevard, #33-01 Marina Bay,
  Tower 1, 018981 Singapore
  Phone: +65 6834-3133

BERLIN

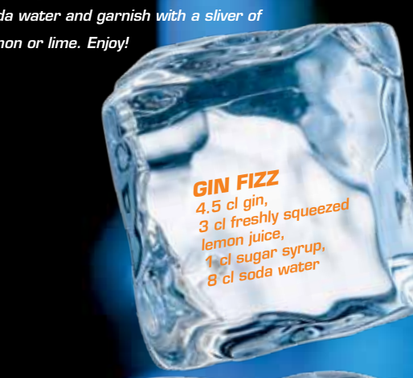
- ***Quasimodo***
  Kantstrasse 12a, 10623 Berlin
  Phone: +49 3 31804560
- ***Die Ständige Vertretung (StäV)***
  Schiffbauerdamm 8, 10117 Berlin
  Phone: +49 3 2823965

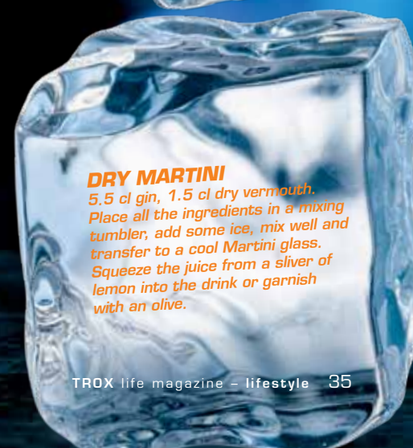
MADRID

- ***Mariana***
  Calle Juan de Mariana 14, 28045 Madrid
  Phone: +34 91 527-6535



TIP!!! *Mix together all the ingredients with the exception of the soda water and juice, add some ice and shake well. Transfer to a cocktail glass, fill to the top with the juice and soda water and garnish with a sliver of lemon or lime. Enjoy!*





Hurley Headquarters
Designed by Hurley (Adrian Nyman), photo: Brandon Shigeta.

Office life.

A ramble through some rather unconventional offices.

Grey walls, grey desks, grey filing cabinets, grey suits. Grey on grey! A look that is still the drab norm for many offices today. There are some companies, however, who want their employees to work in an atmosphere that promotes their wellbeing and inspires them to fully develop their creativity and potential. Life in these offices looks very different, with colours and shapes bursting through the grey canvas that has long characterised office life in all their splendour.

WorkScape

Companies redefine work space.

Offices today are following a whole new set of rules. The working environment should be inspiring and motivating, and those boring, classic office boxes we are all familiar with should be filed away as yesterday's trend. The concept of cubicles is now being shelved and the monotonous colour schemes of black, white and grey are being dispensed with. In their place, what we are now seeing in modern offices are organic contours, lively colour displays, olfactory and haptic experiences – all made possible by combining natural, innovative and exciting materials.

Sofia Borges travelled around the globe to find the most exciting office complexes. WorkScape, the title of her book, is a wonderful read with impressive photographs, all demonstrating the tremendous potential of life in the office. Take a wander through three dozen office buildings, including the Internet giants Google and AOL, sporting goods designer Hurley or the dream factory of DreamWorks, and one thing will become immediately clear: these very different and extraordinary offices all have one common denominator – their emphasis on natural light, the great variety of organic shapes and the use of creative colours.

Hayden Place
Architect: Cuningham Group, photo: Christiane Ingenthron.

WorkScape
New Spaces for New Work
Publisher: Gestalten
Editors: Sofia Borges, Sven Ehmann, Robert Klanten
Price: €39.90 / CHF50.50 / $60 / £37.50
ISBN: 978-3-89955-495-3

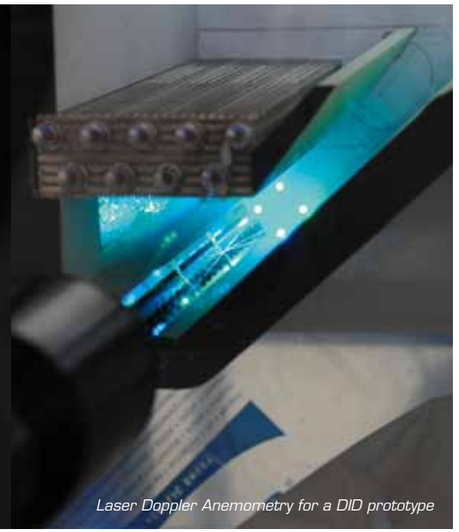
The classic nine-to-five job is a thing of the past. In the office world of tomorrow, a working culture is converging with one of leisure and home decor. Plush sofa corners invite people to sit and reflect, while fitness and wellness facilities ensure a healthy balance between activity and stationary work. And with facilities such as day-care centres, vegetable gardens or bike-sharing, the office world of tomorrow offers an environment that is as relaxed as it is familiar – one could even go as far as calling it a home away from home.

Let yourself be inspired by the photographs and immerse yourself in the spectacular office world of WorkScape.

Top: One Size – Box in a Box
Designed by Origins Architecten, photo: Stijn Poelstra/Stijn Stijl.
Bottom: AOL Headquarter
Designed by Studio O+A, photo: Jasper Sanidad.
Right: ANZ Centre
Designed by Hassell and Lend Lease Design, photo: Peter Bennetts and Earl Carter.
All photos from WorkScape, Copyright Gestalten 2014.

State-of-the-art measuring techniques.

For a high level of efficiency.



Laser Doppler Anemometry for a DID prototype

Optimised flow conditions in air conditioning components such as active chilled beams can improve output, efficiency and acoustic properties. For this reason, TROX – in close cooperation with the E.ON Energy Research Center of RWTH Aachen university – is continually striving to achieve an aerodynamic optimum for its innovative products. In doing so, the scientists use effective, state-of-the-art measuring methods to analyse the flow properties.

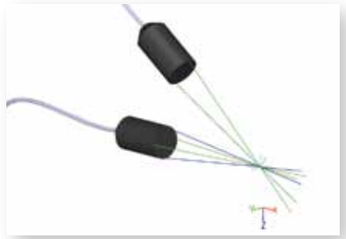
Measurements using light.

Precise knowledge of certain flow characteristics such as velocity, direction or intensity of turbulence is the main prerequisite for ensuring the effectiveness of ventilation and air-conditioning components.

In this article we will introduce you to a non-contact measuring technique known as Laser Doppler Anemometry – an optical measuring method for determining airflow velocities using light. To scatter the light, the fluid, in this case air, is 'contaminated' with tiny particles. These particles follow the flow. Due to the scattering of light the airflow is made visible and can be measured. What happens is that the frequency of a laser beam changes when it hits a moving particle, and this frequency shift depends on the velocity of the particle. The frequency shift can thus serve to determine the velocity.

Laser Doppler Anemometry (LDA).

The LDA method is used to measure velocity and turbulence values as well as to determine the direction of a flow at a single point. Three laser beam pairs of different wavelengths are focused at a single point. The velocity data can be determined by measuring the frequency of the light that is scattered by a particle passing this point of intersection. A photo detector converts the frequency of the scattered light into an electric signal, which is then 'translated' into the relevant velocity components by super fast computers and transformation algorithms.



The flow properties are analysed using three laser beam pairs of different wavelengths crossing at a single point.

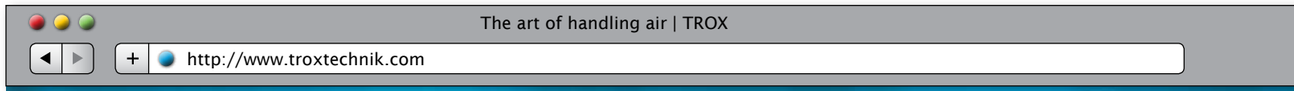
Use in active chilled beam component development.

Taking the example of an active chilled beam, different optimisation applications can be explained. Active chilled beams are used for the ventilation and efficient cooling or heating of internal spaces. For applications with high thermal loads and low to medium air change rates, a high energy efficiency is achieved while the space requirement is low.

The characteristic feature of active chilled beams is the **induction principle:** The primary air is pre-conditioned by the air handling unit and discharged into the mixing chamber of the active chilled beam through a series of nozzles. As a result of this, secondary air is induced – it is sucked into the chilled beam, passes through a heat exchanger into the mixing chamber, where it is mixed with the primary air and then supplied to the room. Typically, one part of primary air is mixed with four parts of secondary air (room air) and is heated or cooled depending on the set water temperature.

The primary-secondary air ratio, or induction ratio, depends on the flow characteristics in the active chilled beam. A favourable (high) induction ratio can be achieved when the airflow within the active chilled beam is not obstructed in any way. Techniques such as LDA help to measure the airflow velocities and develop units that allow for optimised airflows.

TROX engineers are working with RTWH Aachen university on the improvement of room air conditioning components, units and systems.



world wide web. New TROX Internet site.

Launched in January, the new TROX website is now online. The objectives of the new website can be defined by two terms from the online professional world: user-centred and responsive design. What do web designers actually mean by these terms?

User-centred design.

It's quite simple: 'Our users are now at the very centre of our interactive system concept, not least due to the innovative technical possibilities of website programming and modern, better-structured screen design,' says Klaus Stöckel, IT expert at TROX. This is expressed in the logical, transparent user guidance which is primarily oriented towards the target group. For instance, the users choose their field of activity – such as designer, architect or installation engineer – from the menu item 'Expertise fields'. This filter takes him quickly to the information that has been compiled specifically for people in his occupational category.

Searching for specific information is also designed to be more simple and convenient thanks to the integrated Google search technology and the new intelligent filter function, e.g. in the product finder. Moreover, optimising website operation and user guidance means that it is possible to provide highly detailed product information while nonetheless making it easy to find.

State-of-the-art, informative, faster and above all user-relevant: the TROX Internet site.

Responsive design.

A new programming technology ensures that the contents of websites are automatically adapted to the size of the browser window. The support of mobile terminal units like smartphones and tablets makes TROX information mobile, which means it can be used wherever it is needed.

The mechanics of bureaucracy.

Parkinson's Law.

Over 50 years ago, the sociologist Cyril Northcote Parkinson formulated his Parkinson's Law, which today has lost nothing of its currency and absurdity.

The growth of bureaucracy.

'Work expands so as to fill the time available for its completion.'

Bureaucracies, according to Parkinson's experiences in His Majesty's service, steadily expand over time, regardless of the scope of the work. According to Parkinson's wondrous observations, the number of staff increased each year by between 5.2% and 6.6%. He was convinced that even the removal of core tasks would not diminish the volume of administrative tasks. This may remind you of business and process mapping, controlling or procurement and, not least, of never-ending PowerPoint presentations – all things which need to be administered.

Working as a civil servant in the British Royal Navy, Parkinson found that the number of administrative staff in the British Colonial Office grew and grew. By his estimates, the number of staff in each administration increased according to the following formula:

His formula was based on how the staff of the British administration developed. Parkinson showed that in 1914 the admiralty had 62 capital ships, while in 1928 they only had 20 to manage.

$$x = \frac{2k^m + L}{n}$$

k = number of employees who seek promotion by appointing new subordinates.

m = number of working hours per person to produce minutes of internal office business

L = difference between the ages of appointment and retirement

n = number of administrative units that are actually handled by office staff

x = number of new employees who have to be hired each year

While the number of ships decreased by 67.74 per cent and the number of crews by a third, the number of employees in shipyards increased by a staggering 40.28 per cent in the same period. In the British admiralty, the number of staff even increased from 2000 to 3569, that is, no less than 78.45 per cent.

Although the territory of the British colonies had drastically reduced between 1935 and 1954, in the British Colonial Office the staff had more than quadrupled.

The curious proliferation of work.

Work increases in miraculous ways. Is this the trivial flight of fancy of a British humorist? Far from it, if you think of today's flood of e-mails. Read the following typical everyday office situation (on the right) according to Parkinson's Law.

Well, anyone might think: I've always said that the growing amount of e-mail correspondence together with the unspeakable custom of copying people in is the real reason for decreasing efficiency. Personal conversations are much more effective since they are dedicated exclusively to essential matters.

Far from it, Parkinson would answer with his theorem for meetings culture: ***'The time spent on an agenda item is inversely proportional to the amount of money involved.'***

For this hypothesis, Parkinson describes a finance committee meeting which involves: • the signing of a contract to build an atomic reactor ($ 10 million, duration of discussion 2½ minutes) • a bicycle shed ($ 2350, 45 minutes) and • coffee for another committee's meetings ($ 4.75 per month, 5¼ hours).

Incompetence in important issues is compensated for by lengthy contributions about trivial points, resulting in disastrous decisions and the waste of resources time and time again.

This is reminiscent of a quote from Adenauer: ***'The Ten Commandments are so clear and unequivocal because they were not decided on at a conference.'***

A manages a department of seven employees. An email is received by all seven employees of the department. **E** decides that the mail is the responsibility of **F**. He drafts a brief reply, before **C**, having made extensive changes to the draft, forwards the matter to **D** for consultation, who in turn suggests that **G** should take care of the matter. **G** goes in and **B** is on vacation. So **G** sends the draft to **H**, who writes a brief statement on the matter and sends it to **C** with **D** in cc.. **C** edits the text and sends the new version to **A**, who undoes all the changes and reverts back to the text written by **F**.

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The art of handling air

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