

Pure competence in air.

# EC+ UPGRADE RETROFIT TO THE HIGHEST EFFICIENCY



- EC+ AHU efficiencies 85%
- Energy savings of 20-50%
- Lifetime 20+
- Complete plug-and-play
- Low sound levels
- Low maintenance costs
- ROI's between 12-18 months
- Sustainable production

# GREEN AMBASSADORS OF EC+

**NOVENCO Building & Industry is a worldwide leader in design, development and manufacture of ventilation products and systems on the technological forefront of performance and durability. Together with Danfoss, we provide the most efficient EC+ system solutions, which radically reduce energy consumption, hence increase efficiencies of HVAC systems.**

## ADVANTAGES OF UPGRADING TO EC+

With overall efficiencies up to 85%, the EC+ solutions are the most efficient, profitable and up-to-date available on the market. Conceived to increase efficiencies of HVAC systems, the EC+ concept offers to radically reduce use of energy in existing and new installations. The high EC+ system efficiencies promote large economic savings and ROI's between 12-18 months. The complete plug-and-play solutions guarantee easy and fast retrofit of existing installations, lifetimes of 20+ years and zero down-times to ensure very low maintenance costs. Furthermore, the environmental impact is diminished and CO<sub>2</sub> emissions are significantly reduced. All this makes the EC+ solutions strong and capable alternatives for maximisation of the energy efficiencies of ventilation systems for the benefit of operators and the environment.

"We believe that the greenest energy is the one we do not use. The world uses enormous amounts of energy to ventilate and cool down. Imagine that all replace their old fans with NOVENCO's ZerAx® fans, and thus save half their power consumption. Compared to more contemporary fans, ZerAx® can save 15-20% of the power consumption and up to 50% for the retrofit of older fans, which has been proved in several retrofit projects around the world." - says Lars Erik Knaack, CEO at NOVENCO Building & Industry



**System efficiencies of 85%**



**Energy savings of 20-50%**



**Lifetime of 20+ years**



**Complete plug-and-play**



**Ultra low sound levels**



**ROI's between 12-18 months**



**Low maintenance costs**



**Sustainable production**

# RETROFIT WITH THE HIGHEST EFFICIENCIES

## EC+ CONCEPT FOR OPTIMISATION OF AHU SYSTEMS

The straightforward concept comprises the NOVENCO ZerAx® series of high efficiency fans, high efficiency IE4 and or high efficiency Danfoss VLT® frequency drives. The motor and frequency drive efficiencies both reach above 95%, which with the ZerAx® efficiency of 92% brings the overall system efficiency to an impressive 85%. This is 20-25% better than the closest alternative solutions such as direct-driven centrifugal plug fans with EC motors. It is the highest possible total system efficiency for AHU's available on the market.

## ZERAX® - TOP-MOST EFFICIENCY

The engineering of the ZerAx® fans is an unprecedented achievement in NOVENCO history. The ZerAx® revolutionises the design and performance of axial flow fans and is in fact an energy-saver of the future that redefines and heralds a new generation of axial flow fans with unmatched fan efficiencies, low sound levels and product lifetimes of 20+ years. This makes the ZerAx® fans best in class and ready to comply with future environmental legislation. The ZerAx® fans are strong and durable with form factors that in many cases result in smaller space requirements when replacing existing fans in AHU's. In new AHU designs, the compact form factor means that these can be smaller, less noisy and lighter. Hence, saving materials and space as well as maximising comfort levels with less sound compared to other fans. In retrofit programs, the ZerAx® ensures high levels of performance at minimum costs.



**92%**

NOVENCO ZERAX®  
HIGH EFFICIENT AXIAL FAN

x



**95%**

HIGH EFFICIENT  
PM MOTOR

x



**97%**

HIGH EFFICIENT  
DANFOSS VLT®

=

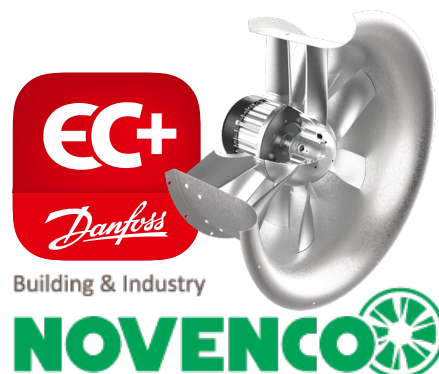


**85%**

**EC+**

## ENERGY SAVINGS WITH ZERAX® AND EC+

- AT LEAST 20% COMPARED TO BEST-IN-CLASS EC FANS
- TYPICALLY 40% BY RETROFIT OF OLD PLUG FANS
- TYPICALLY 50% BY RETROFIT OF OLD CENTRIFUGAL FANS



# FAST AND EASY EC+ UPGRADES

Non-EC+ fans installed in HVAC systems occupy up to 60% of the total energy consumption. NOVENCO's complete plug-and-play solutions guarantee easy and fast retrofit of existing installations without unnecessary replacement of whole AHU's or HVAC systems. An upgrade to EC+ solutions with ZerAx® fans radically reduces energy consumption and maintenance costs, hence increases the efficiency of the whole HVAC system.



## STEP 1 site study

The site study describes the customer's existing HVAC system installations to best understand the requirements. The study is free of charge and can give the customer an indication of the number of benefits, including potential savings and ROI's.



## STEP 2 estimation

The detailed estimates summarise the potential savings in energy consumption, the carbon footprint and the Total Cost of Ownership (TCO) that are achievable by retrofitting plug fans installed in existing AHU's with highly efficient ZerAx® axial fans. The estimates also include an indication of the cost of the EC+ solution.



## STEP 3 proof of concept

An external and independent consulting company conducts the Proof of Concept (POC). The feasibility is verified in an initial trial installation to confirm the estimates and includes the following:

- measurement of the existing fans in the HVAC system and removal
- installation of ZerAx® axial flow fans
- operation and measurement of the new fans

If the POC does not meet the estimates, the trial is free of charge.



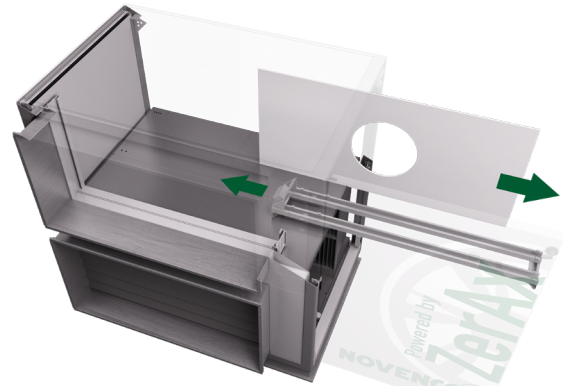
## STEP 4 site upgrade

After completion of the POC with convincing results, a detailed plan with savings and cost for the entire retrofit project is drawn up. The upgrade is usually completed in one go or in stages.

# RETROFIT IN LESS THAN 10 HOURS



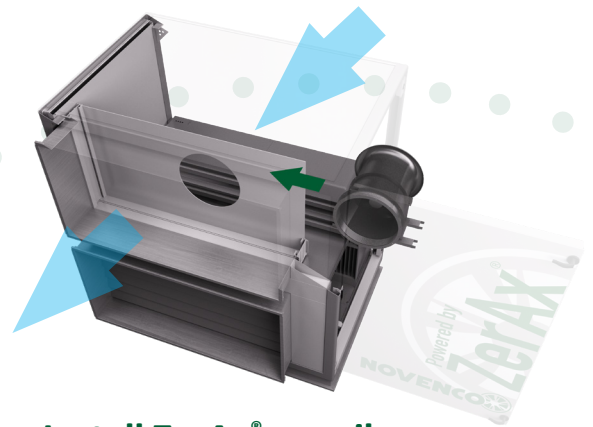
**1** Remove old plug fan



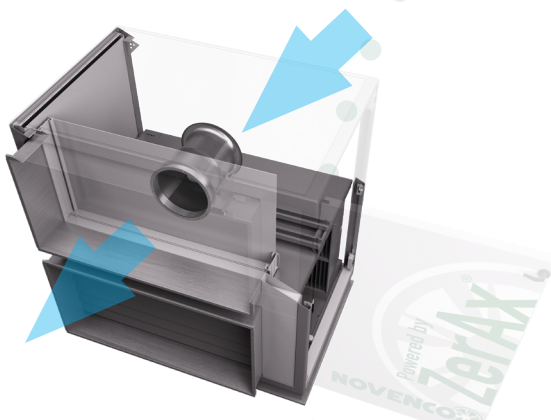
**2** Remove internal panel and install rails



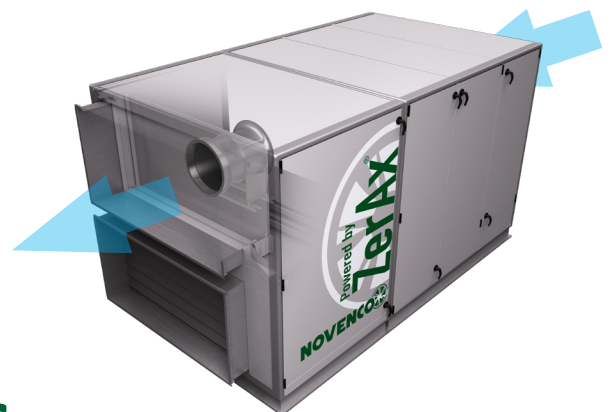
**3** Insert internal panel



**4** Install ZerAx® on rails



**5** ZerAx® installation complete



**6** AHU upgrade done



# EC+ FANS VS. EC FANS

Although plug and centrifugal fans are tempting due to the simple and flexible construction they offer, when compared to axial fans, they are expensive choices in the long run – both in terms of operating costs and environmental impact. A high efficiency axial fan consumes less energy and reduces both costs and carbon emissions.

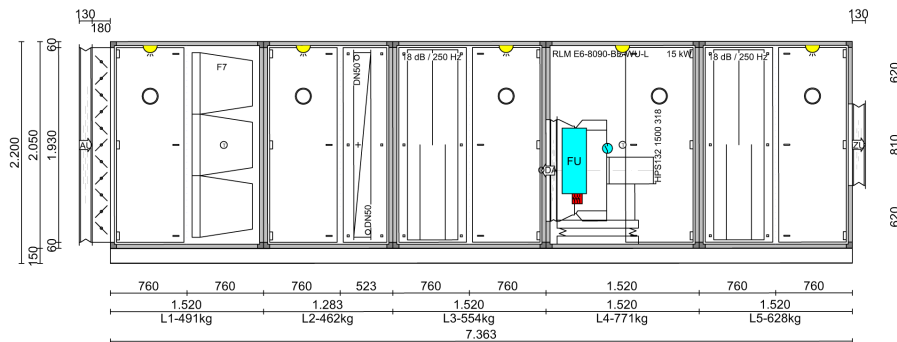
## ZERAX® PROVES BEST IN TEST

NOVENCO Building & Industry has conducted comparative performance tests in the TÜV Süd Test Laboratory. The tests were conducted with identical installation points, measure points, measure units, but with two different fans - one with a premium plug fan from an unspecified fan manufacturer and another with the NOVENCO ZerAx® axial flow fan.

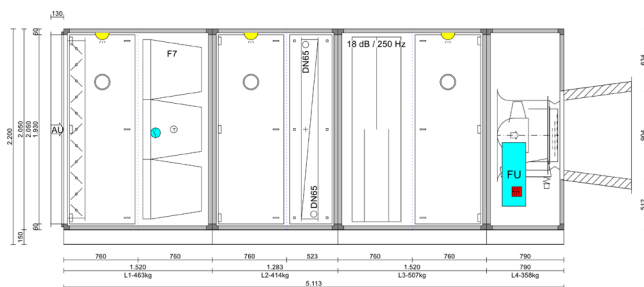
A framework of corresponding test series gave very convincing results - energy saving of 20% and 30% shorter and lighter AHU with the ZerAx® fan than comparable system with plug fan, when compared to the plug fan system.

**ZERAX® EC+ FAN INSTALLED MOTOR CAPACITY IS LOWER THAN EC FANS, WHICH MEANS SMALLER:**

- CABLE SIZES
- ISOLATORS AND ELECTRICAL COMPONENTS
- CONTROL AND STARTER PANELS
- BACKUP POWER SUPPLIES



**AHU with plug fan**



**AHU with ZerAx® axial fan**

**COMPLETE AHU LENGTH WITH ZERAX® FAN IS 30% SHORTER AND 30% LIGHTER, AND ELECTRIC CONSUMPTION IS 20% LOWER THAN THE PLUG FAN SYSTEM**

# EMPLOY THE HIGHEST EFFICIENCIES AND SAVE ENERGY

**To maximise the energy efficiency of any ventilation system, fans must use both the static and dynamic pressures. The result is higher efficiencies, lower energy consumption, reduced operating costs and lower carbon emissions.**

## **DYNAMIC PRESSURE IS THE KEYWORD**

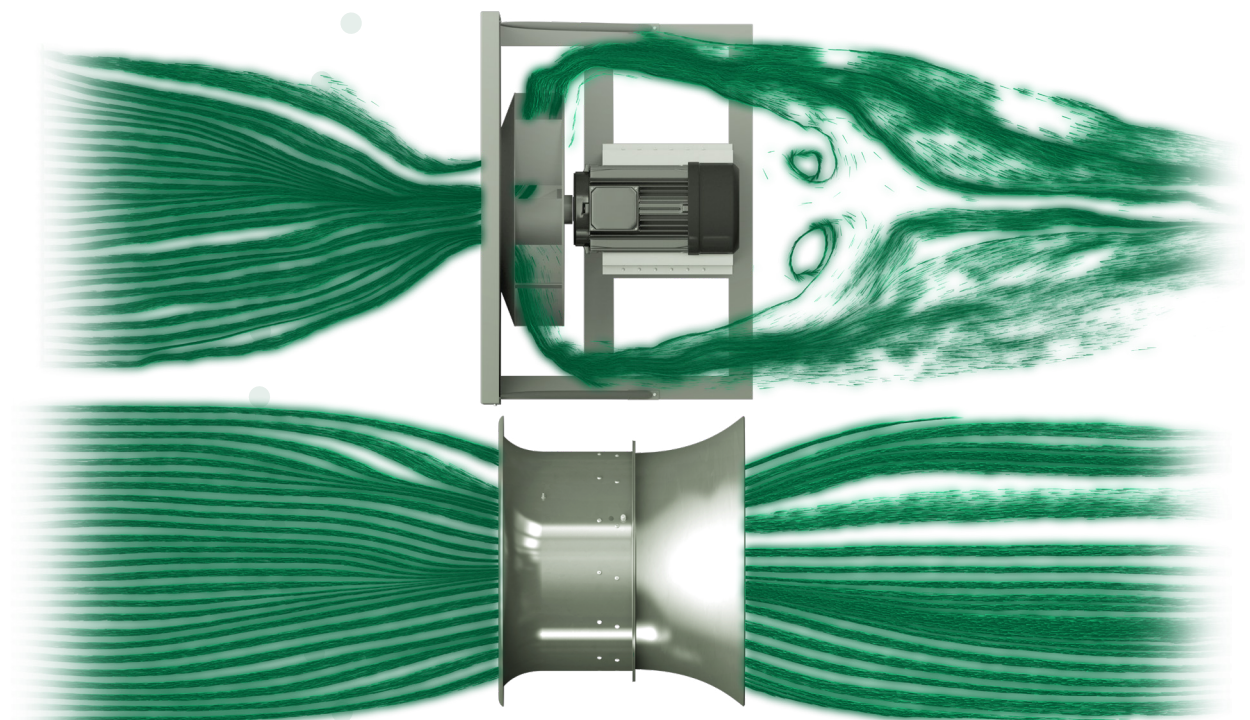
HVAC systems, which only utilise the static pressure, cannot achieve efficiencies above 90%, as the dynamic pressure goes to waste. To achieve the most energy-efficient ventilation system, fans that use both the static and dynamic pressures are required. The efficiency of plug and centrifugal fans is calculated solely on the basis of the static pressure. This is because these systems are unable to utilise the dynamic pressure, which they literally throw away. But, axial fans utilise both the static and dynamic pressures, which means that the efficiencies are based on the total pressure, which makes them capable of achieving efficiencies above 90%.

## **ZERAX® - GROUND-BREAKING EFFICIENCY**

The majority of centrifugal fans may at best reach efficiencies between 65-70%, while axial fans can perform up to approximately 80%. A main reason for the significant difference is in the way the air moves through the fan. In axial fans the air flows parallel to the fan axis, whereas it flows perpendicular to the fan axis in centrifugal fans and causes loss of velocity energy.

In axial fans, the loss is minimal due to the aerodynamic design that ensures straight airflows with little or no turbulence compared to centrifugal fans. This difference in design generally provides the higher efficiency levels of axial fans.

The NOVENCO's ZerAx® axial fans can reach unmatched efficiencies of 92%. This is ground-breaking new levels for axial fans and lowers the overall power consumption and sound. This makes the ZerAx® the most energy-efficient fan on the market today.



Difference in air flow between centrifugal fans and ZerAx® axial fans

# GIGANTIC ENERGY SAVINGS

## CASE - JK TYRES, INDIA

### JK TYRES

With 9 large factories across the country, JK Tyres is one of Indian leading tyre manufacturers. The company pioneered the manufacturing of radial tires and offers a wide range of tyres for different vehicle types.

### THE PROJECT

The high cost of energy and the increasing level of environmental awareness, spurred JK Tyres to search for modern and more efficient solutions in the field of energy saving for their tyre manufacturing plant in Chennai. After a large and exhaustive research of available solutions on the market, including EC fans, JK Tyres chose the market's most efficient and innovative solution known as the EC<sup>+</sup> concept, which has the potential to deliver efficiencies up to an impressive 85%. Not only the numbers, but also the most modern technology of the EC<sup>+</sup> concept, convinced JK Tyres to retrofit an old centrifugal fan in an existing air handling unit with an EC<sup>+</sup> solution consisting of a high efficient ZerAx<sup>®</sup> axial flow fan, a high efficiency PM motor and a Danfoss VFD - grade EC<sup>+</sup>.

### THE NUMBERS SPEAK FOR THEMSELVES

The original project expectations of 30% energy savings and an achieved implementation of more than 50% is pure proof of concept. It proves the magnitude of energy savings that is achievable by retrofitting centrifugal fans with ZerAx<sup>®</sup> axial flow fans and the EC<sup>+</sup> concept.

### ENVIRONMENTAL EFFECTS

Not only have JK Tyres reduced their energy consumption, but by using NOVENCO EC<sup>+</sup> technology, they have also significantly reduced their carbon dioxide emissions, which complements the environmental responsibility initiatives at the Chennai plant.



### FACTS

- ACHIEVED ENERGY SAVINGS > 50%
- 20+ YEARS LIFETIME
- VERY LOW SOUND LEVELS
- REDUCTION IN CARBON FOOTPRINT



Before retrofit



After retrofit



JK Tyres plant in Chennai

"AHUs in a very significant way contribute towards the present fixed power consumption of the Chennai Plant. We have taken a trial with replacing the conventional centrifugal fan with ZerAx axial flow fan and the savings in power consumption is immense for the same comfort levels of the operative team. Based on the actual savings recorded, it is decided to take up the project of 100% replacement existing AHU fans with the ZerAx axial fans. This project is under implementation." says Unni Nayar, Vice President of JK Tyres India



# QUICK RETROFIT WITH VAST ENERGY SAVINGS

## CASE - KEPPEL BAY TOWER, SINGAPORE

### KEPPEL BAY TOWER

Singapore's only waterfront business hub, Keppel Bay Tower is an exceptional commercial building, matched only by its unparalleled location. The 18-storey Keppel Bay Tower is expected to become the most energy-efficient high-rise building in Singapore.

### THE PROJECT

Over 50 applicants applied to take part in the Green Buildings Innovation Cluster (GBIC) competition, arranged by the Singapore Buildings and Construction Agency (BCA), which is part of the Ministry of National Development of the Singapore Government. The objective of the GBIC program was the large scale demonstration of novel energy efficient technologies in actual buildings, in this case the Keppel Bay Tower. The tower had already achieved Singapore Green Mark status as a low energy building and the aim with the GBIC initiative was to reduce the energy consumption by a further 20%. Out of the original 50 applicants, BCA chose 5 technology partners for the trial at the tower. NOVENCO Building & Industry's proposal to retrofit an existing plug fan in an AHU with a high efficiency ZerAx® axial fan was chosen due to the significant energy reduction potential indicated by simple measurements and verification techniques. The ease of the retrofit work was a further contributing factor.

### RETROFIT IN LESS THAN 10 HOURS

For this project the most modern technology of the EC+ concept with a highly efficient ZerAx® axial flow fan, high efficiency motor and Danfoss VFD was used. The retrofit work was completed in an impressive time of less than 10 hours. The energy savings, as verified by Nanyang Technological University (NTU), who were appointed as independent adjudicators, were at least 43%. The Keppel Land company is now in the process of replacing all 25 additional AHU plug fans with high efficiency NOVENCO ZerAx® fans at the Keppel Bay Tower.



### FACTS

- ENERGY SAVINGS OF 43%
- 20+ YEARS LIFETIME
- VERY LOW SOUND LEVELS
- REDUCTION IN CARBON FOOTPRINT



Before retrofit



After retrofit



Keppel Bay Tower - one of the most desirable addresses in Singapore

"We are excited to be piloting these new and emerging technologies at Keppel Bay Tower, with a view to replicate the implementation of these technologies to rejuvenate other commercial buildings," says Ng Ooi Hooi, Keppel Land's President for Singapore.

# SUSTAINABLE VENTILATION TECHNOLOGY

## CASE - VOLKSWAGEN GROUP, SPAIN

### THE VOLKSWAGEN GROUP

The Volkswagen Group is Europe's largest automobile manufacturer with production sites in seven European countries. With the group-wide future program "Strategy 2025", Volkswagen wants to get fit for the future with the vision of becoming a world-leading provider of sustainable mobility.

### THE PROJECT

Since the beginning of 2017, Volkswagen has been intensively investigating the technical possibilities of high-efficiency axial fans and has carried out a whole series of tests, measurements and practical trials. At the beginning of 2018 it was time for the next step - implementation of the obtained results and knowledge in new air handling technology. For the renewal of the ventilation system for one of the largest production buildings of the factory at Volkswagen Navarra in Pamplona, Spain, the EC<sup>+</sup> technology with highly efficient axial fans was chosen.

### TECHNOLOGY THE BEST IN CLASS

The high demands from the Volkswagen Group could only be met by the latest generation of air handling units equipped with the highly efficient ZerAx<sup>®</sup> axial fans from NOVENCO. The full potential of the EC<sup>+</sup> system is unleashed through the optimal interaction of the EC<sup>+</sup> technology components with ZerAx<sup>®</sup> axial flow fans, high efficiency permanent magnet motors and intelligent Danfoss VFDs.

### ENVIRONMENTAL EFFECTS

The Volkswagen Group assumes daily responsibility for the environment, whereby emissions receive special attention. Through innovation and impressive planning, the goal is to continuously reduce energy consumption and CO<sub>2</sub> emissions. For this strategic interest, the new device technology with the ZerAx<sup>®</sup> axial fans fits perfectly.



### FACTS

- ENERGY SAVINGS OF 20%
- AHUs 30% SHORTER AND LIGHTER
- 20+ YEARS LIFETIME
- VERY LOW SOUND LEVELS
- REDUCTION IN CARBON FOOTPRINT



Roof-installed AHUs with ZerAx<sup>®</sup> axial fan



NOVENCO ZerAx<sup>®</sup> axial fans in parallel operation

"The demands placed on the air conditioning of buildings increase steadily. Axial fans can make a significant contribution to combining technical requirements with sustainable building design. The new trend-setting AHU technology has fully met all expectations," says Asier Matorell, Factory Planning Manager at Volkswagen Navarra



# ENERGY SAVINGS OF 30%

## CASE - CARLSBERG, DENMARK

### THE CARLSBERG GROUP

Established in 1847 by brewer J.C. Jacobsen, the Carlsberg Group is today among the three leading breweries in the world with production in about 35 countries.

### THE PROJECT

Carlsberg Group has stated a goal to optimise energy consumption in order to reduce CO<sub>2</sub> emissions and cut energy costs. The ventilation constitutes nearly 25% of the total energy consumption at the brewery in Fredericia, Denmark. Therefore it was decided to replace the old centrifugal fans installed in the 1970's with new ZerAx® axial fans in very humid surroundings, in one of the bottling halls that works 24/7. The purpose was to exhaust the moist air and inject dry, warm air.

### ROI OF 2 YEARS

The calculations show that the ROI of the task comprising the consultancy work and the replacement of the entire system including fans is two years. The replacements began in one end of the brewery in Fredericia and will, when complete, cover 20 ventilation systems. The prerequisite is that the investment on the entire replacement should be recovered within two years.

### ENVIRONMENTAL EFFECTS

As the result of replacement of the old centrifugal fans with high efficiency ZerAx® axial fans, Carlsberg Group reduces CO<sub>2</sub> emissions by 160 tons per year, which has a significantly positive impact on the environment.



### FACTS

- ENERGY SAVINGS OF 30%
- 20+ YEARS LIFETIME
- VERY LOW SOUND LEVELS
- CO<sub>2</sub> EMISSION REDUCED BY 160 TONS/YEAR



Before retrofit



After retrofit



Production line at Carlsberg Brewery in Fredericia

"We have checked that the savings promised by NOVENCO Building & Industry are actually achieved. And so far that seems to be the case." says Bjarne Pedersen, Carlsberg's energy consultant

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