



# Compressed Air for a **Sustainable** Future

The importance of sustainable compressed air systems in greener production



IIoT

WHITEPAPER

## CONTENTS

1. Fighting climate change	3
2. Why go green?	5
3. Production sensitive environments – when quality counts	6
4. Oil-free or oil-lubricated	8
4.1. Benefits of oil-free	9
4.2. <b>ULTIMA oil-free technology</b> : delivering significant increases in efficiency and exceeding environmental targets	10
4.3. Benefits of oil-lubricated	13
4.4. <b>FourCore oil-lubricated technology</b> : sustainable design for eco-conscious business	15
5. Further ways to reduce energy costs and CO <sub>2</sub>	16

“With total greenhouse gas emissions of around 700 million tonnes per year, the industrial sector is the **third-largest climate polluter** in Europe.”<sup>1)</sup>

<sup>1)</sup> <https://carbonmarketwatch.org/publications/a-new-hope-recommendations-for-the-eu-emissions-trading-system-review/>

# 1. Fighting climate change

The Earth's atmosphere is warming, faster than ever. Global temperatures have been rising for well over a century, accelerating in recent years, and are now the highest on record.

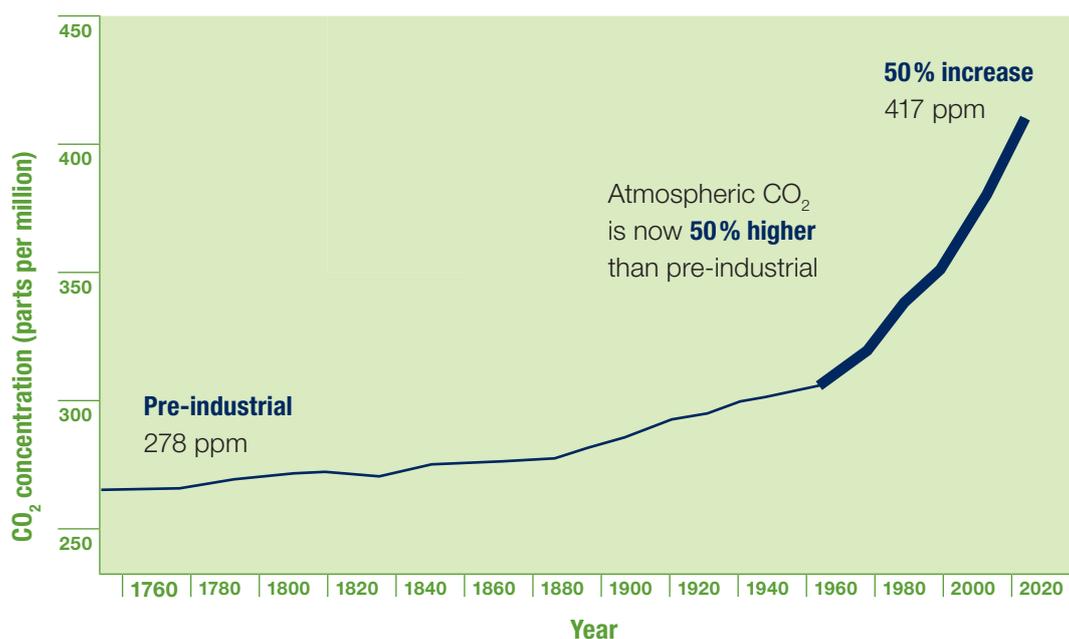
The reason? Carbon (CO<sub>2</sub>) emissions are causing the greenhouse effect, trapping heat, and making our world warmer, faster than could ever happen naturally. Reducing carbon pollution is essential if we are to keep our planet's temperature in check.

Pressure from employees, investors, and consumers, combined with ever-stricter government emissions standards has made going green the logical choice.

As a result, businesses are working towards improved green credentials and increasingly ambitious sustainability targets.

Here we explore how the right compressed air system can play a key role in contributing towards these goals.

Global atmospheric CO<sub>2</sub> concentrations from 1760 to 2021



Ice core data from MacFarling Meure et al. (2006), Mauna Loa data from the Scripps CO<sub>2</sub> program. 2021 forecast from Met Office.  
Credit: Met Office

## EU and international measures currently exist to reduce greenhouse gas emissions. These include:

### Green Deal

This is the European Union's main new growth strategy to transition the EU economy to a sustainable economic model. Presented in December 2019, the overarching objective of the Green Deal is for the EU to become the first climate neutral continent by 2050. As a milestone towards this goal, the EU Commission has proposed a 2030 target to reduce greenhouse gas emissions by 55 per cent, compared to 1990.

### EU Climate Law

The above 2030 target is reflected in the European Climate Law. It sets a limit on the levels of CO<sub>2</sub> removal that can count towards the 2030 target, to ensure that states actively lower emissions, rather than removing them from the atmosphere through forests, for example.

### The Paris Agreement

Agreed by 196 parties in the French capital in December 2015, the Paris climate deal aims to keep the rise in global temperatures this century „well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C.“ Every one of the signatories had to lodge a climate action plan with the UN to spell out what steps they are taking to curb carbon.



## 2. Why go green?

Carbon footprint reduction is not only the right thing to do but also good for business.

Compressed air accounts for a significant part of total energy costs for Europe's industrial manufacturers – typically about 10% and as high as 40% in some plants.<sup>2)</sup> That equates to more than 10TWh of electricity every year and some 4.3 million tonnes of CO<sub>2</sub>.

Energy costs make up 80% of a compressor's total cost of ownership so investing in environment-friendly machines, and optimising existing systems that use less energy, can significantly reduce the production cost of compressed air and a company's carbon footprint.

<sup>2)</sup> [https://pwemag.co.uk/news/fullstory.php/aid/4276/The\\_hidden\\_value\\_of\\_compressed\\_air\\_heat\\_recovery.html](https://pwemag.co.uk/news/fullstory.php/aid/4276/The_hidden_value_of_compressed_air_heat_recovery.html)



### Remember

While environment-friendly compressors are all about efficiency, choosing the right model for your compressed air needs is still vital. How much airflow do you need and for which applications? Will the compressor run constantly or intermittently? So, for example, will the demand for compressed air fluctuate due to shift work, or seasonal demand? How important is air quality? These factors should always be key considerations when specifying a compressed air system.

# 3. Production sensitive environments

In production-sensitive environments, such as pharmaceuticals, electronics, and food and beverage industries, there are stringent standards in place to ensure these manufacturing sites are pollutant-free.

## When quality counts

The pharmaceutical industry is one of the most strictly regulated industries in the world. Companies manufacturing medicines must abide by:

- Good Manufacturing Practice (GMP) protocol
- The European Pharmacopoeia
- Various guidelines from the Food and Drug Administration (FDA)
- Recommendations from the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH3)

Compressed air is also a key utility supporting processes in the food and beverage industry, and strict standards and laws governing hygiene in food production apply. Under European food hygiene regulation 852/2004, for example, manufacturers have a duty of care to protect consumers from harmful or dangerous contaminants including oil and particles.

## Remember

All compressed air systems will require components such as filters, valves, seals to be replaced.

To assure the efficiency of a compressor, however, it is important to invest in genuine spare parts. Non-genuine filters, for instance, are more likely to have reduced dust and dirt-holding capacities, which means contaminants can easily enter a system. A non-genuine lubricant can place extra demands on the filter element, resulting in dust and other particles encountering internal compressor components, invariably leading to mechanical performance deterioration. In both cases, blocked filters also cause deterioration in energy efficiency performance.

Having a compressor serviced by the manufacturer – and therefore an approved technician – will give further peace of mind. This can also ensure that operators don't encounter any problems with machine warranty.



“Compressed air is vital to manufacturing processes. **If contaminated**, it can lead to **reduced performance, product spoilage** and **damaged production equipment**, resulting in additional costs and unexpected downtime. In addition to any health implications, exposing customers to potential risk through product contamination can **damage a company’s reputation.**”

# 4. Oil-free or oil-lubricated?

Beyond adhering to industry standards there are further steps site owners operating in production-sensitive environments can take to guarantee clean and reliable compressed air supply with environmental benefits.

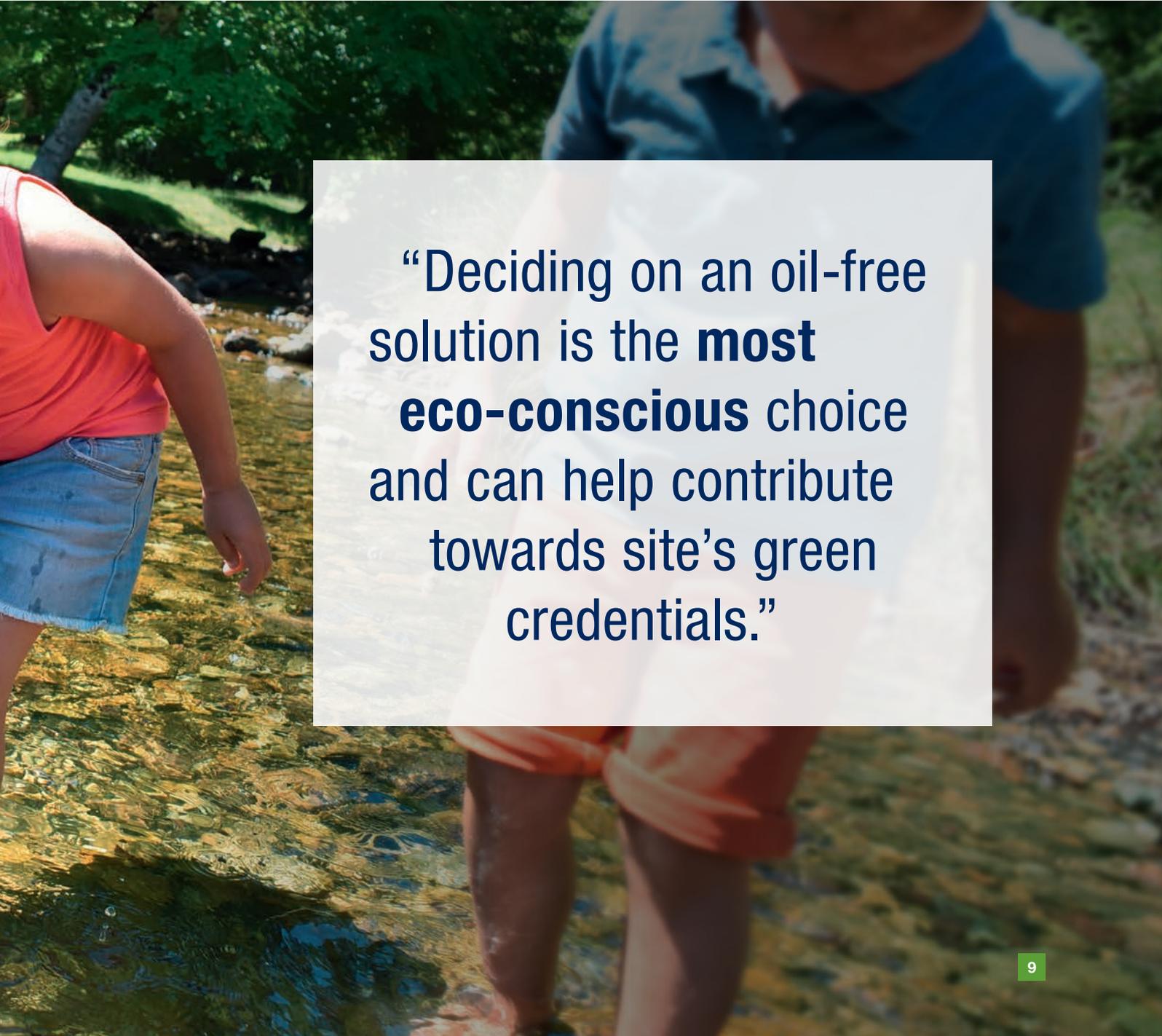
In the past, high-quality air and energy savings have been achieved by using oil-lubricated compressors that rely on filtration to protect products and equipment from the effects of

contamination. However, for a growing number of operators seeking absolute assurance that there is **no risk of contamination, oil-free solutions** are the preferred option.



## 4.1. The benefits of oil-free

- In many cases, whole life costs are reduced, with businesses able to save on the cost of oil replacement
- Additional equipment to clean and separate oil from air, such as oil separators, filtration equipment, and condensate treatment, is not required
- While oil-lubricated compressors mean oil or oil-contaminated condensate will need to be disposed of, impacting the environment, this is not a concern with oil-free technology
- Zero risk of oil contamination caused by damaged filtration systems at any time
- Possibility to apply Heat-of-Compression (HOC) dryers for lowest pressure dew points without additional energy consumption



“Deciding on an oil-free solution is the **most eco-conscious** choice and can help contribute towards site’s green credentials.”

# 4.2. ULTIMA oil-free technology

**Delivering significant increases in efficiency  
and exceeding environmental targets**

ULTIMA compressors from CompAir are 100% oil and silicone-free and meet the ISO 8573-1 Class Zero standard (2010), making them the ideal choice for stringent oil-free applications e. g. within food and beverage, pharmaceutical, and electronic industries.



## **ULTIMA uses variable speed drive for ultimate efficiency**

A major drawback that traditional two-stage oil-free compressors have is their reliance on a gearbox; not only does this consume large amounts of energy but requires high volumes of oil to lubricate the gears. ULTIMA has two permanent magnetic motors that replace this gearbox design. The variable-speed motors can achieve speeds of up to

22,000rpm and efficiencies greater than IE4, also allowing the airends to be driven at different speeds dependant on demand.

Also, while conventional models still use oil to lubricate and cool a system's motors and airends, ULTIMA uses water in a closed-loop circuit to cool these components. This allows greater heat transfer and cooling efficiencies,

as well as ensuring as little oil as possible is used in the system for assured air purity.

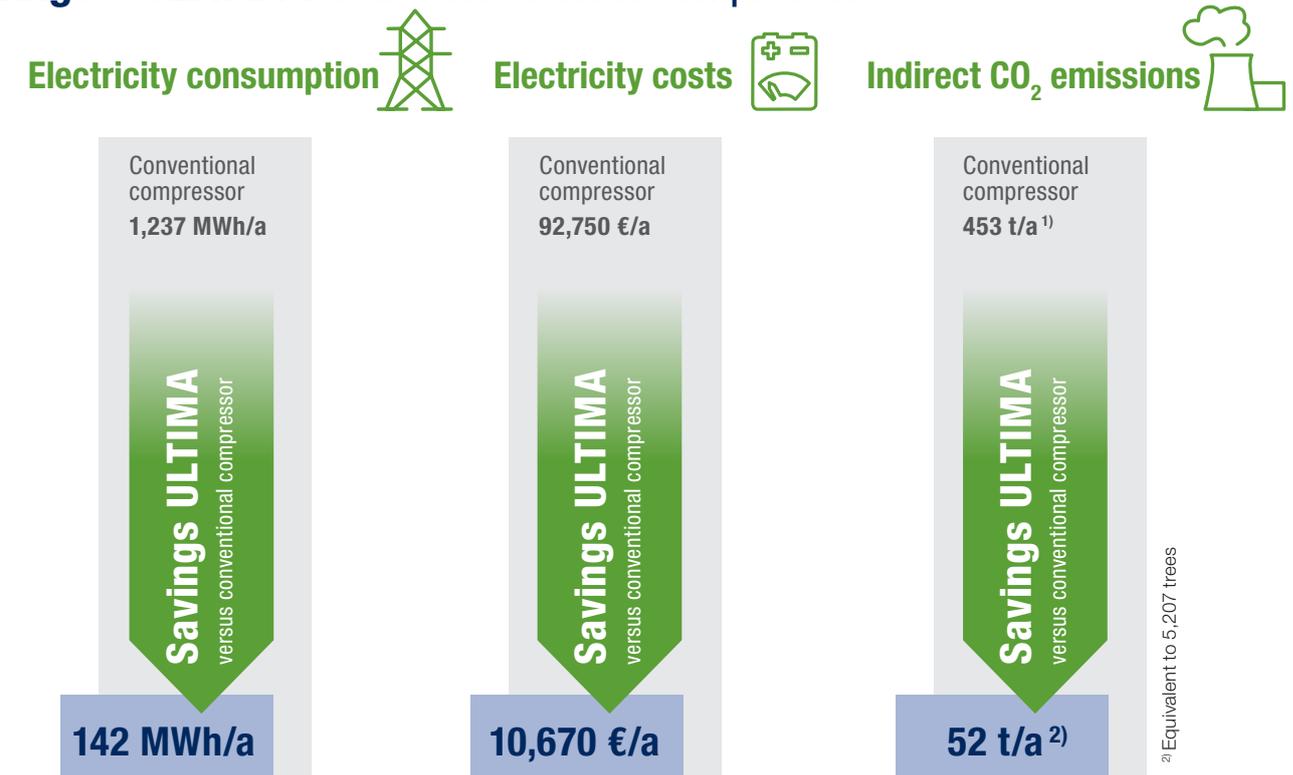
**For more information – click here:**



“Installing an **ULTIMA air-cooled** compressor is calculated to result in an annual reduction of 52 tonnes of indirect CO<sub>2</sub> emissions compared to a conventional oil free variable speed compressor. **That’s equivalent to 5,207 trees!**”



# Savings – ULTIMA versus conventional compressor <sup>1)</sup>



<sup>1)</sup> Based on 8.000 operating hours per year and an average demand of 20 m<sup>3</sup>/min

## The key benefits: 10 reasons why you cannot ignore ULTIMA

- 1.** Digital drive concept. Up to **13% savings** versus traditional 2-stage oil-free technology
- 2.** Best in class footprint. **37% smaller** than industry standard
- 3.** Ultima is by far **best-in-class** in terms of noise level
- 4.** **Greater planning reliability** – upgradeable between 75 & 160 kw
- 5.** **Optional heat recovery** on both, air-cooled and water-cooled models
- 6.** **Hybrid cooling – maximum flexibility** with air- or water-cooling or a combination of both
- 7.** Heat-of-compression **lowest pressure dew points** without additional energy consumption
- 8.** Six year extended warranty – **free of charge!**
- 9.** Free of charge **iConn compressor service** inside – **as standard**
- 10.** Proven air-end excellence made in Germany – **high performance year after year!**



## 4.3. The benefits of oil-lubricated

■ They are reliable and efficient compressors that can be installed alongside a variety of air tools and accessories to maximise profitability.

■ They come in a variety of designs including lobe, screw, liquid ring, scroll and vane. Oil can later be removed from the compressed air using

downstream equipment. This is good for a variety of industrial applications, such as manufacturing, building work, waste management, quarrying and recycling.

**A precise analysis** of the current situation and calculation of the current compressed air demand and pressure level, along with that expected in the future, should always be used as the **basis for any decision**. If the system components, including treatment, are coordinated and maintenance expenses have been determined, running costs and energy costs can be estimated more accurately and carbon footprint reduced.

### Impartial planning

It is best to approach planning without pre-conceived opinions, such as, 'It has to be a screw compressor/piston compressor/oil-free compressor' or 'we need a 75kW machine' and consider all options. In some instances, for example, an **oil-lubricated compressor** may be the most suitable option to **achieve desired running costs and energy savings**.





**“FourCore: A L200e model<sup>1)</sup>  
reduces greenhouse gas emissions  
equivalent to 70,000 miles driven  
by a passenger car in 12 months.”**

<sup>1)</sup> Running 8000 hours/year, compared to a conventional two-stage compressor

# 4.4. FourCore oil-lubricated technology

Sustainable design for eco-conscious business



## FourCore: reduced manufacturing materials and waste

In the case of the L200e model, compared to a conventional two stage 200kW compressor:

- Reduces material used by 22 %
- Reduces waste by 19 %

CompAir's new 160, 200 and 250 kW **FourCore compressor** has been designed with reducing waste and improving sustainability throughout the entire product lifecycle in mind. This has resulted in a system that not only runs more efficiently than alternative compressor technologies, but one that has been created with sustainability at its heart.

For example, a L160e model running 8,000 hours/year, compared to a conventional 160 kW compressor delivers reduced greenhouse emissions equivalent to that of 32 passenger cars, or

371,800 miles driven by a passenger car in a single year, and carbon sequestered by 181 acres of forest. While a L200e model running 8000 hours/year, compared to a conventional two-stage compressor delivers reduced greenhouse gas emissions equivalent to that of 6 passenger car, or 70,000 miles driven by a passenger car in 12 months.

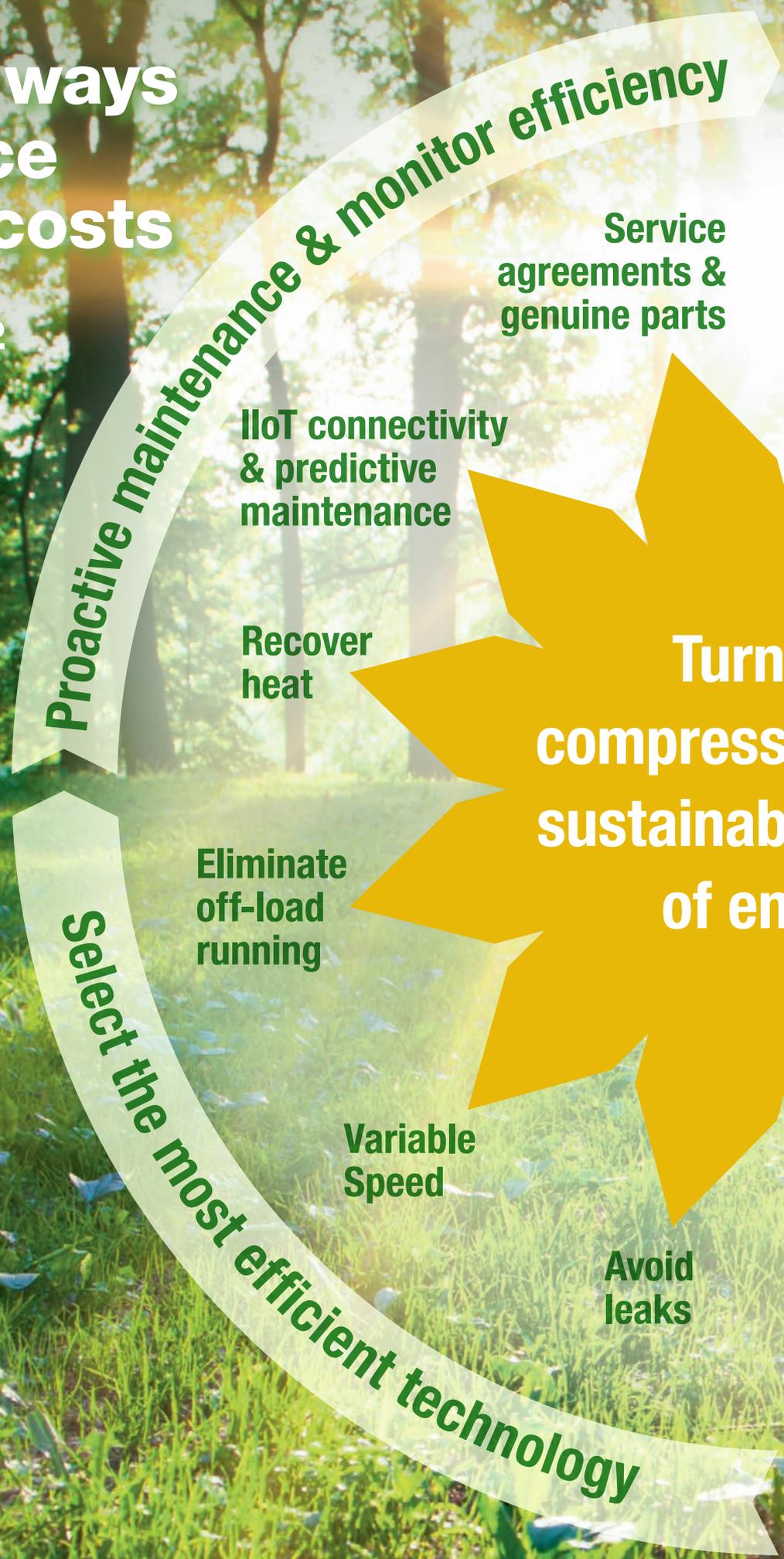
The FourCore range also offers all the capabilities of a two-stage compressor, but with only the footprint of a single-stage unit, providing businesses, who might not have previously had the on-site

space available, the opportunity to take advantage of the capabilities of two-stage technology. When compared with previous single-stage compressors in this size range from CompAir, the new models are up to 8 per cent more efficient, offering a best-in-class oil-lubricated solution.

For more information – click here:



# 5. Further ways to reduce energy costs and CO<sub>2</sub>



# Understand your application

Use the right technology for your application

Eco-friendly technologies

The complete package

Specify the correct air receiver size

Carry out an air audit

# Analyze current usage

Size downstream equipment correctly

your  
or into a  
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# Turn your compressor into a sustainable source of energy

## ▶ Use the right technology for your application

It is vital that any compressed air system is correctly sized and specified to a site's demands. Parameters to be considered include operating pressure, volume flow and the required compressed air quality according to ISO 8573-1:2010.

## ▶ Eco-friendly technologies

Manufacturers are under increased pressure to 'do more with less' and reduce waste. Therefore it is essential for operators to choose sustainable compressed air solutions that use innovative methods to reduce waste. For example, the CompAir DH series of air compressors feature a high efficiency water purification system. This tried and tested reverse osmosis filtration provides high quality purified water to lubricate, seal and cool the compression process. Using a permeate pump the water required is reduced to a minimum.

## ▶ The complete package

Compromises should not be made on downstream equipment, such as dryers, as these products are a key means of ensuring the quality and efficiency of the whole system and therefore reducing the cost to the environment. Designed and manufactured at our dedicated air treatment sites, CompAir's new air treatment solutions are quality controlled to the highest standards, while optimising logistics and therefore CO<sub>2</sub> emissions.

This also means customers benefit from faster product lead times.

## ▶ Specify the correct air receiver size

The air receiver size has a direct impact on reliability and energy efficiency. Therefore, make sure the air reservoirs are correctly sized for the application. As a rule, the better the control system of the compressor is matched to demand (speed-controlled systems), the smaller the compressed air receiver can be. Load/idle running-controlled systems require larger container volumes to reduce the switching operations of the compressor drives. This reduces wear and improves energy efficiency

## ▶ Carry out an air audit

When buying a new compressor or choosing to upgrade an existing system, it's important to have an energy audit carried out. With industry averages suggesting that energy costs represent more than 80% of a compressor's whole life costs, data-logging equipment can help pinpoint inefficiencies and manage equipment performance. The results will show the exact pressure and volume flow of the entire system, ensuring that properly sized compressors are installed. This allows system efficiency to be optimised, helping to reduce energy consumption and improve sustainability, while ensuring the reliability of the overall system.

## ▶ Size downstream equipment correctly

When selecting filters, not only is the validated separation efficiency (ISO12500-1) important, but the lowest possible flow resistance must also be achieved, as this directly affects the energy requirements of the compressor. Also, be aware of network pressure. The higher the operating pressure, the higher the energy consumption. Therefore, the entire network with all its components should be optimised for low differential pressure. With filter elements, the differential pressure increases with service life, so they must be replaced regularly.

## ▶ Avoid leaks

In a compressed air network that is only moderately maintained, up to 20% or even 30% of the generated compressed air can be lost due to leaks. Regular leakage detection is, therefore, a must. There are many reasons for leaks, from shut-off valves to manual condensate valves being left open, as well as leaking hoses, couplings, pipes, flanges, and pipe joints. Such oversights and deterioration over time can result in large additional costs; the Carbon Trust found that just one 3 mm leak could cost a company over £1,000 a year in wasted energy, with an energy loss equivalent to 16 tonnes of CO<sub>2</sub> emission. The cost of detecting and eliminating leaks pays for itself within a few months.

## Eliminate off-load running

No-load operation requires special attention, as the compressor continues to run and consumes energy without producing compressed air. In addition, the compressor is stopped and restarted, which leads to increased wear and tear on components and increases operating costs due to higher maintenance outlay and energy consumption. Proper sizing of the system, or the installation of an intelligent compressor control system to ensure the most suitable configuration for the application, will ensure highly efficient and reliable operation.

## Variable Speed

Variable speed drive compressors use an intelligent drive system to continuously alter the motor speed to match the air demand. This drive controls the speed of the unit depending on the demand, fluctuating the amount of power that is used to match the output required. When the demand slows, the compressed air system will reduce motor speed and power consumption.

### The Benefits of variable speed compressors

- Using a variable speed compressor can easily result in energy savings of up to 30% compared to the use of a fixed speed compressor
- Reduced power surges – avoid peak currents from starting air compressor motor.

- More energy efficient – improves on energy used by a typical fixed-speed compressor.
- Precise electrical control – motors can be slowed down, stopped, or revved up.
- Leaks minimised – lower system pressure reduces the risk of leaks.
- The right variable speed compressor in the right application delivers significant energy savings of up to 35% and a stable air supply at constant pressure.

## Recover heat

70% to 94% of the energy consumed by air compressors is recoverable, but without energy recovery this heat is lost. Recovering heat from compressed air generation reduces the need for purchasing energy, and it is this reduction that results in lower CO<sub>2</sub> emissions and operating costs. Due to the high cost of energy, these savings can be significant in terms of helping companies to meet their carbon reduction targets and improve manufacturing plant profitability. ULTIMA's innovative and patented closed package cooling system allows for the collection and recovery of up to 98% of the heat generated during the compression process.

## IIoT connectivity & predictive maintenance

Industry 4.0 technology is creating a real opportunity for compressed air users to consider how data can help improve compressor performance. These insights not only help highlight immediate issues, but also enable operators to forecast potential future problems. Furthermore, predictive maintenance models based on real-time data can be established to help reduce energy consumption and wastage, improve process efficiencies, and limit risks.

### iConn monitoring from CompAir

provides compressed air users with comprehensive, real-time machine data. Alarms and warnings reduce the risk of downtime, while remote sites can be easily monitored, and performance optimised.

For more information – [click here](#):



**iConn**

## Service agreements & genuine parts

The largest operating cost for a compressed air system is electricity consumption. Our Assure Service Agreements help maintain compressor efficiency by ensuring that genuine parts like filter and fluids are kept in optimal condition, and controls are tuned for peak performance.



Management  
Comp. Analysis  
Eng.  
Accounting  
Quality  
Marketing  
Strategy  
Production  
Research  
Applics  
Development  
Equipment  
Manufacturing  
Training



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