



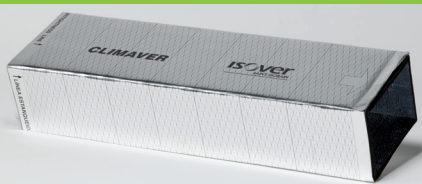
## How to make ductwork more sustainable with CLIMAVER®



## LIFE CYCLE ASSESSMENT COMPARISON OF DUCTWORK

### SOLUTIONS

#### CLIMAVER®

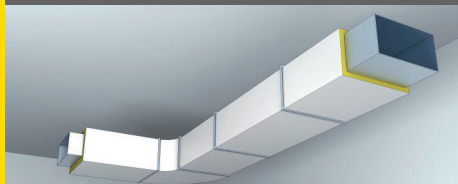


CLIMAVER® is a **self-supporting duct** for air-conditioning, ventilation and heating systems. CLIMAVER® has been designed to offer excellent acoustics, excellent thermal performance and high level of air-tightness making the system energy efficient. In one unique operation, **the insulation is fully integrated to the duct system** saving both installation time and cost on job-site.

**Insulation :** CLIMAVER®  
**Metal duct :** none

Thickness	25mm
Facing	Aluminum

#### INSULATED METAL DUCT



Insulated metal duct is made of two parts: metal duct and insulating material. The metal duct is externally insulated with a flexible glass mineral wool, designed to provide thermal insulation for ductwork.

**Insulation :** glasswool faced with aluminium  
**Metal duct :** galvanized steel 0.6 mm

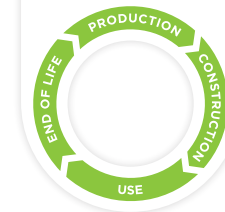
Thickness	30mm
Facing	Aluminum



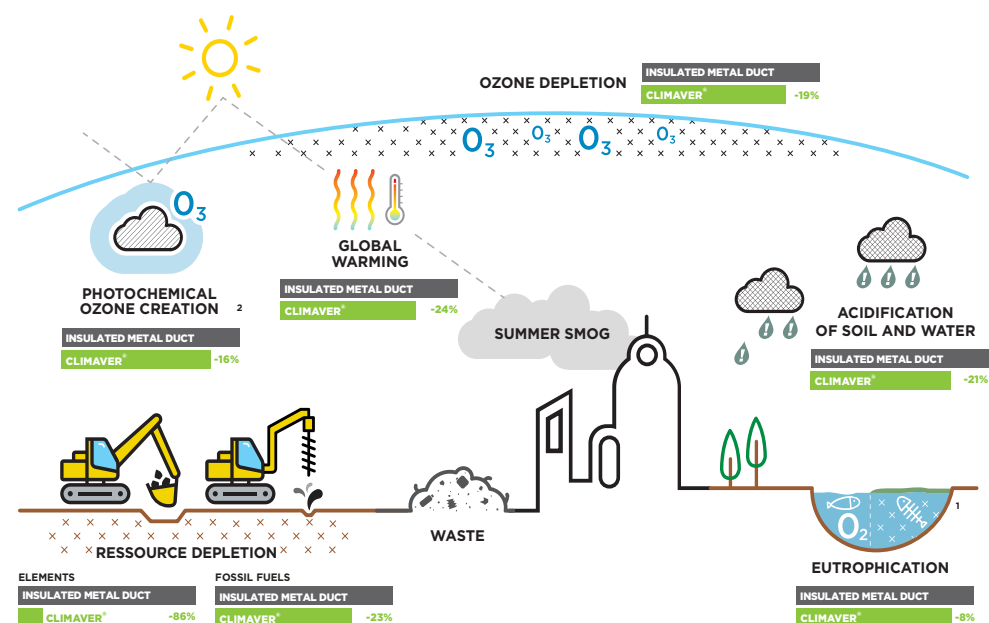
### What is a Life Cycle Assessment (LCA) ?

This is a compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. The scenario of the study is from **cradle** (raw material extraction) **to grave** (end of life) including use phase for 25 years in office building.

## ENVIRONMENTAL BENEFITS WHEN USING CLIMAVER®



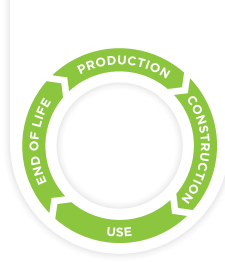
### FROM CRADLE TO GRAVE, CLIMAVER® IS 20% BETTER ON MOST OF THE ENVIRONMENTAL IMPACTS



<sup>1</sup> Eutrophication is the over-enrichment of water by nutrients that stimulates the growth of aquatic plant life usually resulting in the depletion of dissolved oxygen and therefore death of aquatic animals.

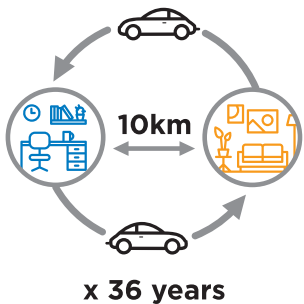
<sup>2</sup> Creation of ozone from air pollutants (VOCs, Nox, CO).

## ENVIRONMENTAL BENEFITS WHEN USING CLIMAVER®



FOR A TYPICAL BUILDING OFFICE, **USING 1000m² OF CLIMAVER®** INSTEAD OF INSULATED METAL DUCT **WOULD SAVE:**

(1000m² OF CLIMAVER® IS EQUIVALENT TO 700 LINEAR METERS OF DUCTWORK OF AN INNER SECTION OF 0,4m×0,2m)



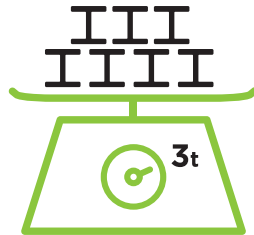
**More than 36 years driving 20km a day connecting work<sup>1</sup>**

Equivalent to 180'000 km travelled by car or 30 tons of CO2 emissions



**The electricity usage of 4000 inhabitants for 24h<sup>2</sup>**

Equivalent to 215'000 MJ of electricity consumption saved over 25 years



**More than 3 tons of steel to be installed, insulated and dismantled at the end of the life cycle**

## FOCUS ON USE PHASE



ENVIRONMENTAL IMPACT:

■ = Production, construction, end of life  
■ = Use

FOR BOTH SOLUTIONS, THE USE PHASE IS THE MOST IMPACTING

**THE USE OF CLIMAVER® INSTEAD OF INSULATED METAL DUCT WOULD SAVE:**

**-1500 kWh**



**1500kWh**

Saved in electrical consumption per FU<sup>1</sup> compared to insulated metal duct solution



**440 €<sup>2</sup>**

Saved in electrical consumption per FU<sup>2</sup> compared to insulated metal duct solution

<sup>1</sup> FU=Functional Unit : ductwork transporting 1,6m³ of air provided by an air handling unit, over 20m length with a duct section of 0,4m×0,2m (i.e. 24m²) by maintaining temperature and air-flow to ensure the thermal comfort in the office  
<sup>2</sup> Based on electricity prices in Spain, reference year 2015 with 0,237 €/kWh from European Commission report "Energy prices and costs in Europe" dated November 2016

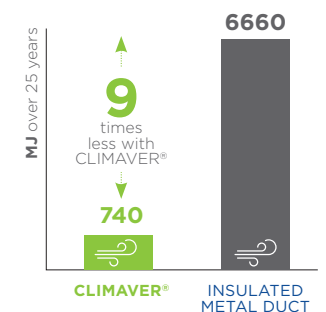
## DUCTWORK AIRTIGHTNESS OR HOW TO REDUCE AIR LEAKAGES ?

The three main sources of energy losses in a ductwork come from heat transfers (conduction, radiation), pressure drop (air friction) and ductwork airtightness (air leakage).

Energy losses by heat transfers and by pressure drop are comparable in this study and show significant difference in terms of air leakage: **CLIMAVER® reduces it drastically.**

Ductwork airtightness : Class D according to EN 1507

### Energy losses by air leakage



<sup>1</sup> <http://eco-calculateur.aviation-civile.gouv.fr/> (160g CO2/km for a medium car)

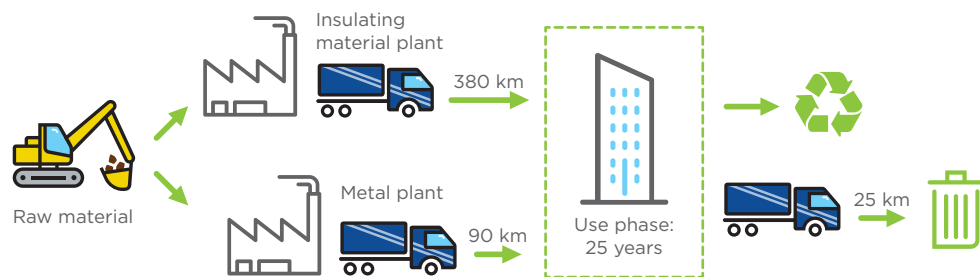
<sup>2</sup> Electric power consumption (kWh per capita in Spain) <http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC>

## METHODOLOGY OF THE STUDY

### LIFE CYCLE ASSESSMENT SCENARIO

Life Cycle Assessment (LCA) is the clearly accepted scientific methodology for quantitative assessment of product, system, building over their entire lifespan. LCA calculates in a rigorous and scientific manner the use of energy, water and natural resources, the emissions to air, soil and water and the waste generation.

The scenario is from **cradle to grave** including raw material supply, transport to manufacturing site, manufacturing, transport to construction site, installation, waste at construction site, use as ductwork for 25 years in building office located in Valencia, recycling or disposal at the end of life.



The study has been done according to international LCA and EPD standards, **ISO 14040** and **ISO 14044**.

### PROCESS OF CRITICAL REVIEW

This comparative LCA was conducted by a third-party: Solinnen. It has been critically reviewed. Therefore **input** and **comment** has been received from **interested parties, external to LCA, through a panel of recognized experts** in their fields.

### FUNCTIONAL UNIT

Transporting a certain volume of air ( $m^3$ ) provided by an air handling unit, on a given distance by maintaining its temperature ( $^{\circ}C$ ) and its flow ( $m^3/s$ ) in order for the complete HVAC system to ensure the thermal comfort requirement in a room.

## METHODOLOGY OF THE STUDY

### SYSTEM BOUNDARIES

The system boundaries are the the following:

**Air volume:** 1.6  $m^3$

**Air velocity:** 6 m/s

**Distance:** 20 m

**Straight duct with rectangular section**

(internal dimension: 20 cm x 40 cm)

**Operating lifespan:** 25 years

**Utilisation profile:** 10h/day, 252 working days/year

**Temperatures:** in-duct 14 $^{\circ}C$ , in-room 22 $^{\circ}C$

### DATA MODELLING

For CLIMAVER® and insulating materials, data was taken from Saint-Gobain Environmental Product Declaration (EPD). For metal duct, data was taken from WorldSteel association. The two main sources of data are Ecobilan and Ecoinvent v2.2.

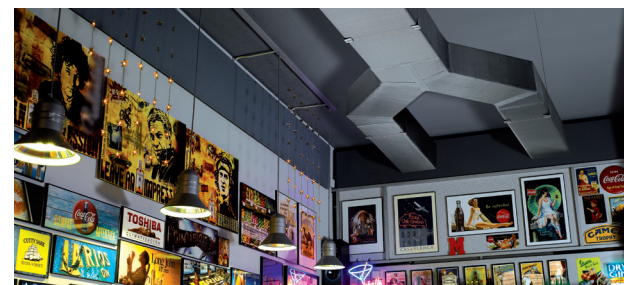


### CONCLUSION

CLIMAVER® environmental performance is about 20% better than insulated metal duct. The comparison remains stable with the sensitivity analysis showing that the final results and conclusions do not depend on the operating time, TechCalc® uncertainty, steel recycling rate or specific climate data. Such conclusion can be extended to a complete HVAC system with a similar air handling unit (the one considered is representative of the unit commonly used in office building in Spain), in any city of Spain (since the results are similar with a more or less variable climate) and to any realistic operating lifespan (up to 50 years).

Additional work will be necessary to ensure that such conclusion will be similar for other utilisation profile and other countries.

In this document, we only compare CLIMAVER® to externally insulated metal duct but the conclusions are similar versus internally insulated metal duct.



The complete report is available upon request to the author

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