With the push for increasing environmental sustainability and the need for products that deliver a higher level of protection from fire and extreme weather events, we are now witnessing a renewed interest in materials that, for decades, held largely a niche or at best curiosity value opposed to gaining common place recognition and use.

This has led to research into information that has been archived for centuries which document the vast uses and benefits of magnesium oxide as a sustainable building material.

The result of this is that MgO-based cements, integrated with more recent advancements in modern manufacturing technology, higher levels of 3rd party quality control and proven infield performances of high performance magnesia cement products has industry leaders focusing more on the utilization of magnesia cement products to future proof their projects.

MAGNESIA CEMENT PRODUCTS VS PC CEMENT BASED PRODUCTS

Magnesia (MgO) Cement:

The carbon footprint of MgO cement is not dependent on carbonation during use.

Its footprint is achieved during manufacture by the combination of the following features:

– Use of magnesium silicates minerals, which eliminates the CO2 emissions from raw materials processing.
– Use of a production process that not only requires less energy but also lower temperatures and allows the use of fuels with low energy content or carbon intensity (i.e. biomass).
– Use of hydrated magnesium carbonates in the cement composition that absorb CO2 during their production and therefore have a carbon negative footprint.

Current calculations estimate that the carbon footprint will be in the range of **-100kg CO2 to +100 kg CO2**/tonne magnesia (MgO) cement

Portland Cement:

The ongoing search for alternative materials to that of PC because of its large CO_2 emissions footprint of around **8% of global anthropogenic greenhouse-gas emissions** has led to Magnesia Cement being identified as a potential low-CO_2 alternative to PC

CONTINUE

This section presents the carbon footprint and carbon uptake information for all the products (50pcs) of this report. Each of the products are presented in more detail in the following chapters of this report.

The following table shows the carbon footprint and carbon uptake information for building boards.

Table 6. Carbon footprint and carbon uptake information for building boards.

Building board	CO_2e g/kg	CO_2 uptake g/kg
Fibreboard (porous) – Finland	425	1531
Chipboard (Raw) – Europe	409	1564
Chipboard (Melamine faced) – Europe	467	1527
Gypsum plasterboard – Europe	1967	–
High Density Fibreboard (Raw) – Germany	661	1437
Medium Density Fibreboard (Raw) – Germany	652	1418
Medium Density Fibreboard (Raw) – Sweden	340	1466
Medium Density Fibreboard (Melamine Faced) – Germany	788	1458
Oriented Strand Board (Raw) – Germany	208	1692
Plywood (Standard Birch) – Finland	718	1188
Plywood (Standard Conifer) – FInland	605	1708
Plywood – Sweden	229	1731

CONTINUE

Magnesium Oxide Board Ratings

	Best 1 2 3 4 5 6 7 8 9 10 Worst	Notes
Environmental Impacts		Manufactured in mainland China and exported globally
Embodied Energy		N/A
Waste Generated		Based on typical single sheet wall lining. Reduction in up to 50 to 67% materials for FRL protection was not calculated
Energy Efficiency		Sheets are an effective air control layer and resist the loss of energy through shrink and expansion
Material Costs		Base material cost is higher than common gypsum. Cost is greatly reduced to that of multi layer wall systems
Labor Inputs		Base labor is simular to gypsum with greater benefits being applied when calculating MgO single layer applications
Skill Level Required by Homeowner		Simular applications to gypsum and FC sheet with ability to gain class 5 finishes with professional skilled trades
Sourcing and Availability		Direct sourcing through manufacturer and import of goods that are distributed by local companies
Durability and Longevity		Very high multipupose durability and longevity in building and construction with resistance to fire, mould and impact
Building Code Compliance		Limited access to high quality independant 3rd party certificed and compliant manufacturers
Indoor Air Quality		Materials are inert, non nutrient and non toxic. Use of toxic jointing compounds will negatively affect IAQ

THERMAL MASS CO-EFFICIENCIES PLAY A MAJOR ROLE IN SUSTAINABLE PROJECTS AND ARE CRITICAL IN DELIVERING HIGHER LEVELS OF FIRE PROTECTION:

There is a strange word that is overlooked in many cases throughout global building codes and is rarely used in the assessment of sustainability of projects:

The Word is **CALORIFIC VALUE**

CALORIFIC VALUES are applied to materials based on "the amount of heat released by a unit weight or unit volume of a substance during complete combustion"

With ZERO being the best the following graph shows where **ResCom High Performance** magnesia cement boards sit to that of other building materials;

TABLE 1:

HEAT OF COMBUSTION OF VARIOUS MATERIALS

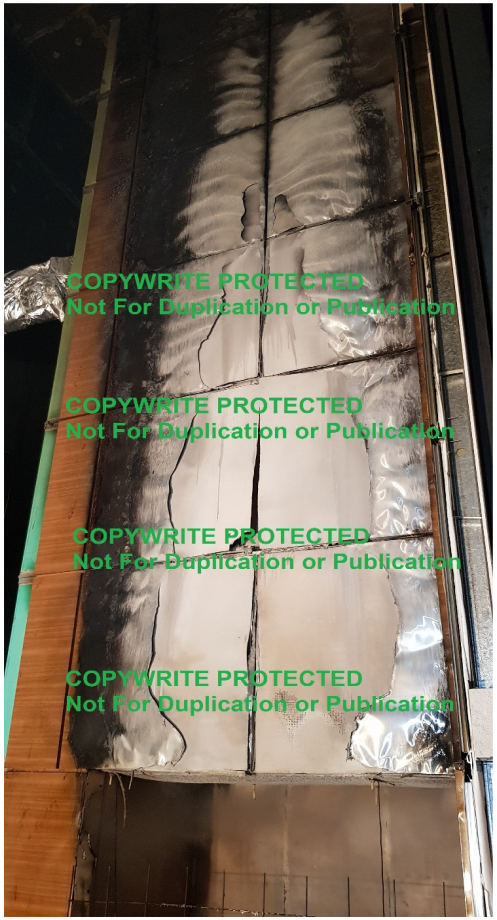
Material	Calorific Value MJ/m^2
Stone, concrete, glass	~0
ResCom MgO Board	0.1 to 0.25
Stonewool	1.1 to 1.3
A2 category mineral/PE core	~2.5
Flexible sarking type material	~2.5
Glasswool insulation	~6
Dupont Corrian (acrylic polymer and alumina trihydrate)	9
"FR" category mineral/PE core (70/30 mix)	~13
Wood	16
High Pressure Laminate	18
Glass Reinforced plastic	21
Rigid Polyisocyanurate (PIR)	24
Rigid Polyurethane (PUR)	24
Phenolic	29
Expanded Polystyrene (EPS)	38
Polyethylene (PE)	43
Petrol	44

Source: International Fire Engineering Guidelines 2005 | CSIRO | Various ISO 1716 test results

CALORIFIC PERFORMANCE of products has come under scrutiny with Independent Testing carried out in CANBERRA ACT Australia of leading suppliers of Fibre Cement barrier protection boards.

These test further highlighted the risks associated with products that have medium to higher Calorific Value Scores:

- Test Rig 1: Failed in just under 7min
- Test Rig 2: Failed in just under 8min



Whereas independent testing on the same rig (picture to the right) of ResCom High Performance 6mm magnesia cement board lasted over 35min without catastrophic failure.

When you look deeper into the science and performances that surrounds the importance of Calorific performance in various products it opens up a new and exciting world of innovative applications when combining these **Zero to Low** score value products into holistic building systems:

High Level Structural Fire Engineers have accumulated structural information that is extremely damming on systems **that have a higher CALORIFIC value of more than 13** and are now looking to have the finding benchmarked around the world.

The risks associated with using these products in construction is extremely high due to the failure of the products to structurally perform when exposed to a heat source.

Example 1: TRADITIONAL

- Dens Glass has a CALORIFIC value of 10
- Glass Wool Insulation has CALORIFIC value of 6
- System Value = CV of >16

Example 2: Innovative Disruptive Technology

The combination of ResCom High Performance Magnesia Cement board in a wall system will deliver a lower CALORIFIC value therefore delivering a greater level of all round protection.

- ResCom Magnesia Cement Board has a CALORIFIC value of <0.25
- Glass Wool Insulation has CALORIFIC value of 6
- System Value = CV of <6.25
- ResCom Magnesia Cement Board has a CALORIFIC value of <0.25
- Rockwool Insulation has CALORIFIC value of <1.3
- System Value = CV of <1.55