



Environmental Product Declaration

EverSure™ GP cement
EverFast™ HE cement

In accordance with ISO 14025 and EN 15804

Golden Bay Cement

AUSTRALASIA **EPD**
ENVIRONMENTAL PRODUCT DECLARATION
Version 1.0 of 12 May 2019
Valid until 12 May 2024
No. S-P-01170

Golden Bay Cement

Golden Bay Cement's Portland Manufacturing Plant is the only fully integrated cement manufacturing plant remaining in New Zealand. The Plant, located on the southern shore of the Whangarei Harbour in Northland, is a contemporary world class cement production facility, with a very long successful innovative history. The Portland Plant recently celebrated a century of cement production at the present site.

Golden Bay Cement prides itself on manufacturing a cement that is tailored for New Zealand conditions and our ability to maintain a high level of quality and product consistency that our market requires. We operate a fully TELARC certified ISO 9001 Quality Management System and all testing is monitored by our IANZ accredited laboratory.

The Portland facility has a production capacity of approximately 950,000 tonnes of cement.

This EPD document refers to the Type GP (General Purpose) and HE (High Early) cement products that are produced at this facility.

From the facility the cement is distributed in road tankers, bags,

ISO containers and by coastal shipping. The majority of the cement is distributed by coastal shipping and is stored at a number of key locations around New Zealand and then road tankers deliver to our customer silos.

Golden Bay Cement strives to be better every day by reducing our environmental footprint and working proactively to respond to global sustainability issues.

We have been using wood chip and sawdust by-products from the timber processing industry as a partial replacement for coal for over a decade. More recently we have diverted construction and demolition wood from landfill by also using this waste as a fuel source.

We are currently in the process of enabling the use of end of life tyres in our kiln fuel mix known as Tyre Derived Fuel (TDF). This will further replace coal and allow Golden Bay Cement to be part of a sustainable solution to reduce tyres that are illegally dumped or sent to landfills within New Zealand.

We continue to assess the use of further alternative fuel sources as part of our overall strategy to reduce our reliance on fossil fuels and to reduce our CO₂ emissions.

Golden Bay Cement also benefit from New Zealand's unique renewable electricity generation position contributing to lower emissions than if thermal generation sources were used.

Golden Bay Cement are members of the New Zealand Green Building Council, and, as a business unit of Fletcher Building Ltd, we are a member of the Sustainable Business Council and the Sustainable Business Network.

Under the New Zealand Green Building Council's Green Star rating system, up to three points can be awarded under MAT-7 Concrete and Aggregate, Criteria A, where it can be demonstrated that all concrete used has a reduced environmental impact. Environmental Product Declarations are a recognised initiative to demonstrate this criteria.

For more information, see: www.goldenbay.co.nz/sustainability



Golden Bay Cement

EPD registration number:	No. S-P-01170
Approval date:	12 May 2019
Valid until:	12 May 2024
Revision date:	12 May 2019
Geographical scope:	International, based on manufacture in New Zealand



Golden Bay Cement

Products covered by this Environmental Product Declaration (EPD)

This EPD covers two cement products manufactured at Golden Bay Cement facilities in New Zealand. They include:

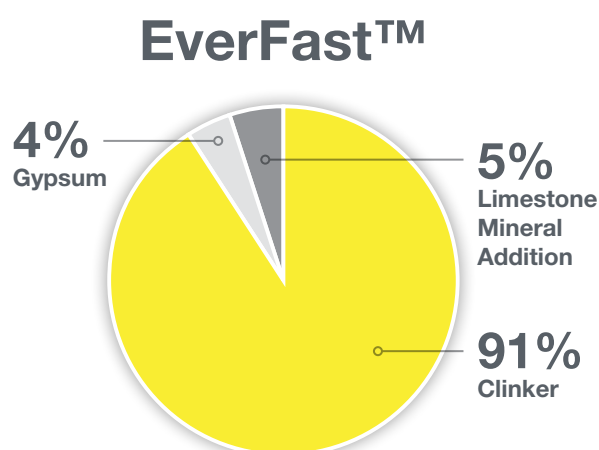
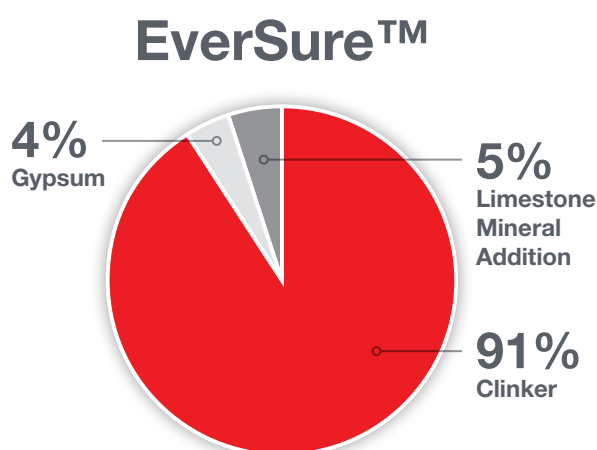
1. Bulk type cement, EverSure™ General Purpose (GP) Cement
2. Bulk type cement, EverFast™ High Early Strength (HE) Cement

Applications

EverSure™ (GP) Cement is used in commercial, industrial and residential construction, including structural concrete, mortars, renders, grouts and cement-based products. It can also be used as a general binder for applications such as soil stabilisation. EverFast™ (HE) Cement has a finer grain size and is specifically designed for precast concrete products.

Composition

Golden Bay Cement products have a typical composition as follows:



Golden Bay Cement products are compliant with the European REACH regulation (EC) 1907/2006* and do not release any hazardous substances when in use. For safe use and maintenance, refer to the appropriate product's Safety Data Sheet (SDS) at www.goldenbay.co.nz/products.

Environmental certifications

EverSure™ GP and EverFast™ HE have Declare labels and are certified Red List Free by the International Living Future Institute. For more information, visit: <https://living-future.org/declare/?manufacturer=golden-bay-cement>

Industry classifications

All products in this EPD fall under the UN CPC classification '3744 Cement' and ANZSIC classification '2031 Cement and Lime Manufacturing'.

*Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals.

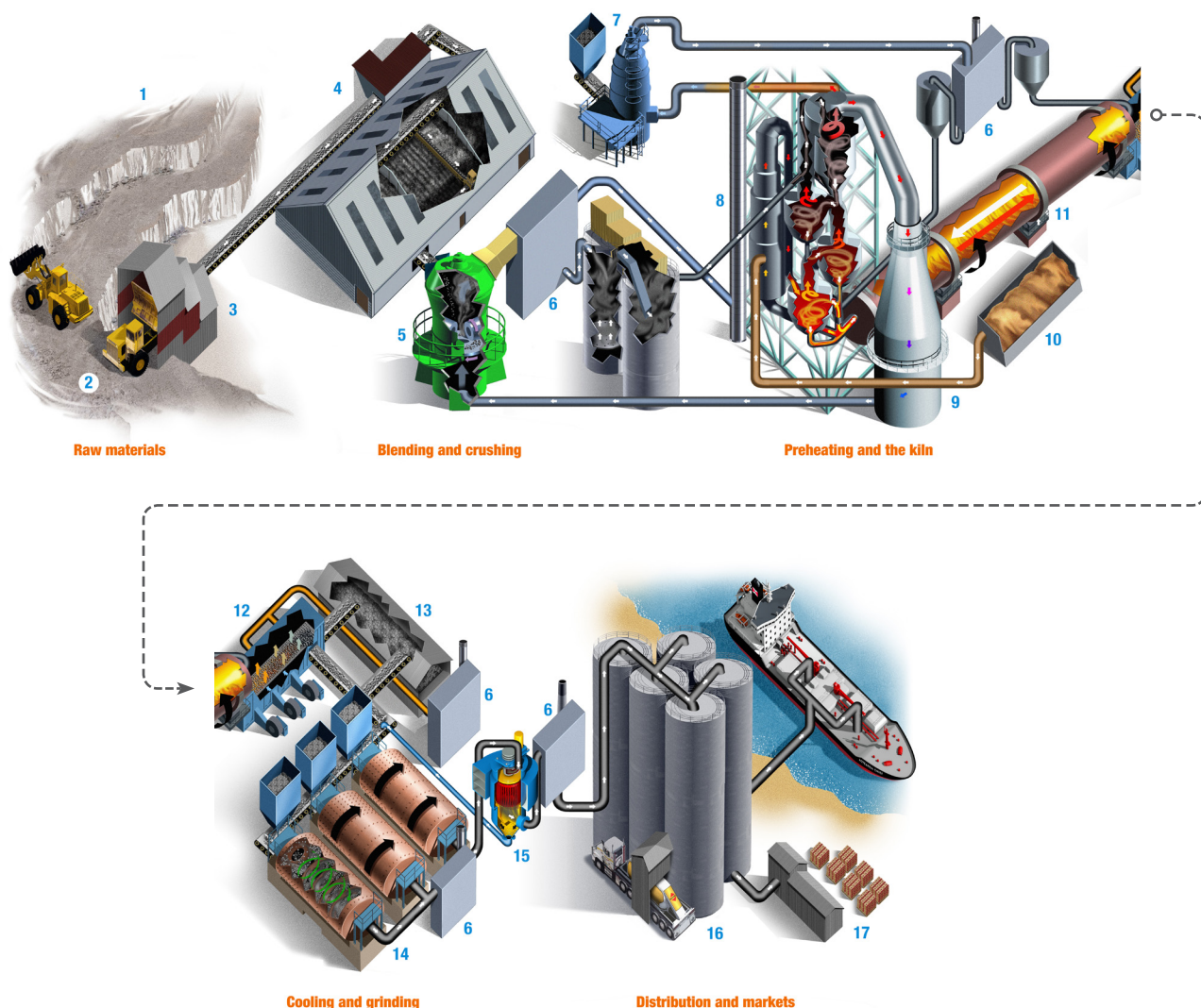
Manufacturing of Golden Bay Cement

Cement rock and limestone are quarried at the Portland and Wilsonville quarries respectively. Explosives are used to blast the rock apart, then mobile plant (loaders and dump trucks) transfer the rock. Road trucks are used to transport the limestone to Portland quarry. Rock is loaded into a crusher and onto a conveyor belt leading to the manufacturing plant. A portion of high quality limestone is processed by a mobile crusher for use as an extender. The crushed cement rock and limestone are fed into the raw mill along with iron sand. The raw meal produced is then blended and fed into the precalciner and kiln where clinker is produced at high temperatures by firing coal and alternative fuels, followed by cooling in the clinker cooler.

Bulk type cements, EverSure™ GP and EverFast™ HE, comprise of clinker, gypsum and extender rock (limestone with a higher purity of calcium carbonate extracted at Wilsonville Quarry). These are milled in the cement mills by steel grinding media. EverFast™ type HE cement is milled for a longer period in the cement mills to achieve a smaller average particle size relative to the EverSure™ type GP cement.

1. Quarry
2. Mobile plant
3. Crusher
4. Raw materials reclaimer
5. Raw mill
6. Baghouse dust collector
7. Coal mill
8. Preheater/precalciner
9. Gas conditioning tower
10. Alternative/bio fuels
11. Kiln
12. Clinker cooler
13. Clinker storage
14. Cement mills
15. Classifier
16. Bulk cement storage and loading
17. Bagging plant

Manufacturing Plant Process



Scope of EPD

This is a 'cradle-to-gate' EPD covering modules A1 to A3 from European Standard EN 15804 (see Table 1). Modules A4-A5, B1-B7, C1-C4 and D are excluded from this EPD as they are dependent on how the product is used and should be developed as part of holistic assessment of specific construction works.

Table 1 - Scope of EPD

Product stage			Construction process stage		Use stage						End of life stage					Recovery stage
Raw material supply	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport	Waste processing	Disposal	Future reuse, recycling or energy recovery potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

X = module declared; MND = module not declared (such a declaration shall not be regarded as an indicator result of zero)

The scope of the study includes all processes from the mining of natural resources ('cradle') to the production of cement that is ready for transport to customers at Golden Bay Cement's factory gate. This includes mining of raw materials, such as cement rock and limestone, transport to and within the manufacturing sites, clinker manufacture, ancillary service operations and cement production, up to the point where the final cement is ready for dispatch to customers at the exit gate of the manufacturing site. Packaging of cement is excluded since bulk type products are loaded directly onto the distribution vessel.

The system boundary also includes manufacture of other required input materials, transport between processing operations, the production of external services such as electricity, natural gas and water, and the production of co-product materials within the cement manufacturing process. Waste and emissions to air, land and water are also included where appropriate.

Declared unit

The declared unit is one tonne of cement, ready for distribution at the outbound gate of the respective manufacturing site. The gate for bulk cement is Portland, Whangarei.

LCA methodology and data

This EPD has been produced in conformance with the requirements of PCR 2012:01 Construction Products and Construction Services v2.2.

Data

Primary data was used for all manufacturing operations up to the factory gate. Data for manufacturing of the cement types was provided by Golden Bay Cement. All relevant and available data was collected. All raw materials inputs and flows have been captured to produce cement.

Background data from GaBi Databases 2017 (thinkstep 2017) or literature was used when no site-specific data was available for upstream (A1) inputs. Most upstream datasets are representative of Europe, particularly Germany. The use of such proxies is due to the lack of New Zealand-specific datasets. Use of background data was not required within the gate-to-gate (A3) scope.

Period

The base year for the LCA is the financial year from 1 July 2013 to 30 June 2014. Updates have been made to account for the most important process changes since 2014.

As required by EN 15804, all primary data has been updated within the last five years and all background data has been updated within the last 10 years.

Cut-off criteria

Cut-off criteria according to EN 15804 has been used:

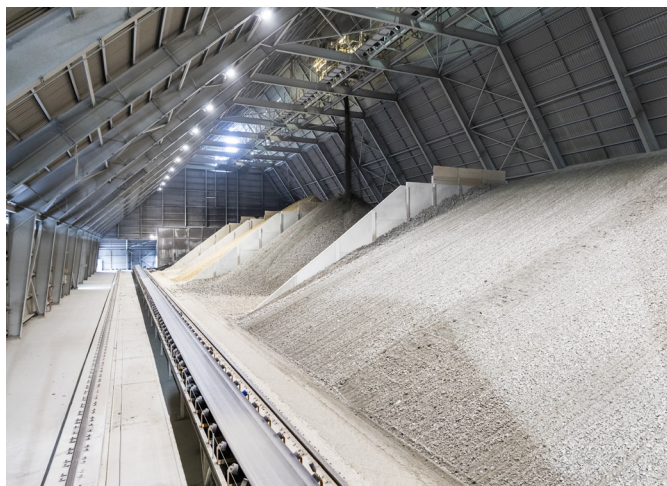
- <1% of total mass or energy inputs to any unit process are excluded.
- <5% of the total energy or mass flows are excluded.

Allocation

Allocation was carried out in accordance with PCR 2012:01 section 7.7. Co-product allocation was carried out based on physical relationships in any cases except for wood waste, where economic allocation was applied due to a large difference in economic value between co-products.

Key assumptions

- **Upstream data:** With the exception of data for energy, which correctly reflect New Zealand conditions, most upstream data used were European due to a lack of consistent LCI data for New Zealand at the time this study was conducted.
- **Electricity:** New Zealand electricity is assumed to be the 2013 national average with a Global Warming Potential of 192 g CO₂e/kWh, made up of 74% renewable (53.32% hydro, 14.84% geothermal, 4.67% wind, 0.91% biomass, 0.55% biogas) and 26% fossil fuels (20.14% natural gas, 4.03% hard coal, 1.48% coal gases, 0.04% lignite) (thinkstep 2017).



Glossary

Global Warming Potential (GWP)

-> Climate Change

A measure of greenhouse gas emissions, such as carbon dioxide and methane. These emissions increase absorption of radiation emitted by the earth, intensifying the natural greenhouse effect.

Ozone Depletion Potential (ODP)

-> Ozone Hole

A measure of air emissions that contribute to the depletion of the stratospheric ozone layer, causing higher levels of ultraviolet B (UVB) to reach the earth's surface with detrimental effects on humans, animals and plants.

Acidification Potential (AP)

-> Acid Rain

A measure of emissions that cause acidifying effects to the environment. Acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H^+) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline and the deterioration of building materials.

Eutrophication Potential (EP)

-> Algal Blooms

A measure of nutrient enrichment that may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. It includes potential impacts of excessively high levels of macronutrients, the most important of which are nitrogen (N) and phosphorus (P).

Photochemical Ozone Creation Potential (POCP)

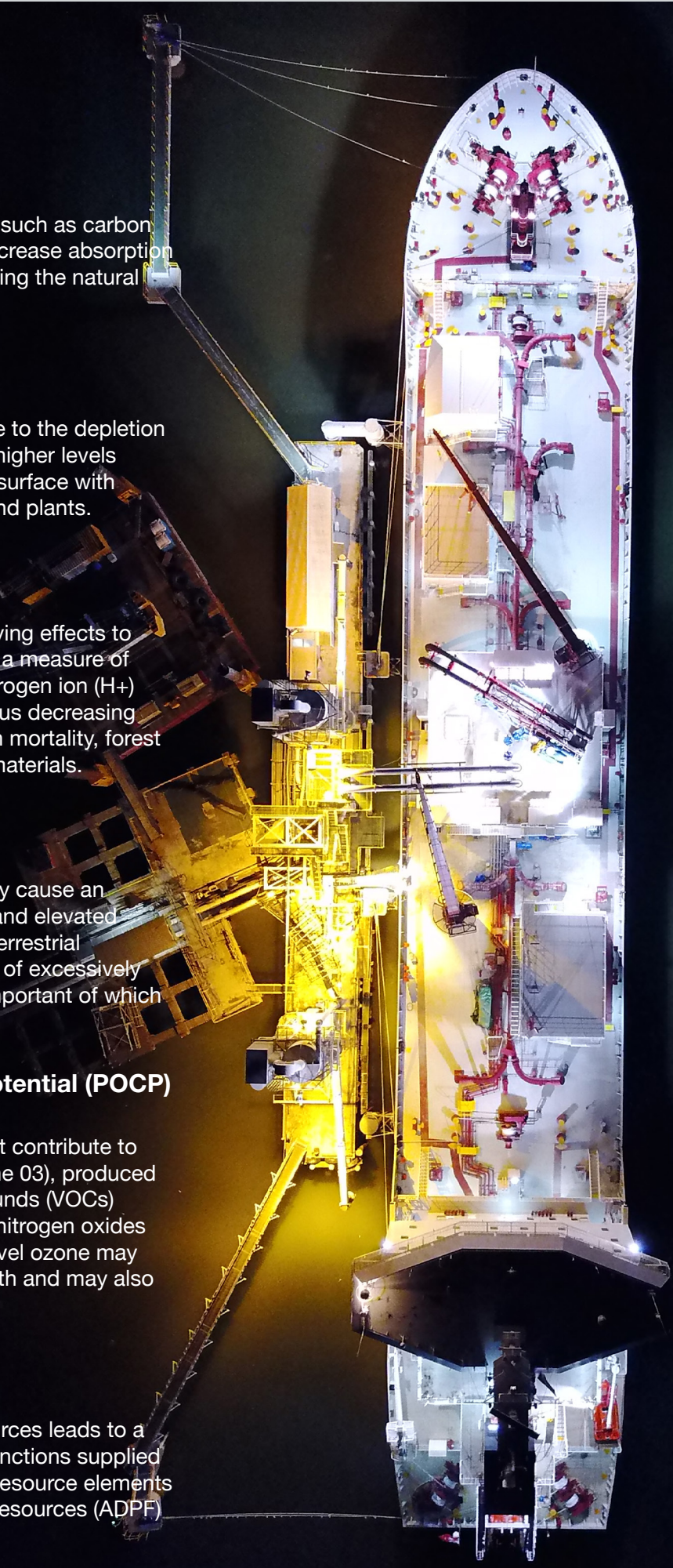
-> Smog

A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone O_3), produced by the reaction of volatile organic compounds (VOCs) and carbon monoxide in the presence of nitrogen oxides under the influence of UV light. Ground level ozone may be harmful to human and ecosystem health and may also damage crops.

Abiotic Depletion Potential (ADP)

-> Resource Consumption

The consumption of non-renewable resources leads to a decrease in the future availability of the functions supplied by these resources. Depletion of mineral resource elements (ADPE) and non-renewable fossil energy resources (ADPF) are reported separately.



Results of assessment

Table 2: Life Cycle Impact Assessment (LCIA) indicators

Indicator	Unit	GP, EverSure	HE, EverFast
Global warming potential (GWP)	[kg CO ₂ -Equiv.]	732	734
Ozone Layer Depletion Potential (ODP)	[kg R11-Equiv.]	5.29E-12	5.57E-12
Acidification Potential (AP)	[kg SO ₂ -Equiv.]	0.823	0.838
Eutrophication Potential (EP)	[kg Phosphate-Equiv.]	0.207	0.208
Photochemical Ozone Creation Potential (POCP)	[kg Ethene-Equiv.]	0.0683	0.0691
Abiotic Depletion Potential (ADP elements)*	[kg Sb-Equiv.]	9.99E-06	1.30E-05
Abiotic Depletion Potential (ADP fossil)	[MJ]	2860	2870



* Results for 'Abiotic depletion potential (ADP elements)' have been calculated using the GaBi software. GaBi includes characterisation factors for ores such as gypsum based on their elemental composition. This leads to a characterisation factor of 3.59E-05 kg Sb-equivalent per kg of gypsum ore. This is a conservative approach and one that differs from other implementations of CML's impact assessment methods (as adopted under EN 15804) where the characterisation factor for gypsum is 0. This general approach follows CML's 2002 'Handbook on life cycle assessment: Operational guide to the ISO standards: Part 2A: Guide', which states "A general guideline given for extended LCAs is to calculate, estimate or extrapolate missing characterisation factors." See page 70 (chapter 4.3.3.17) of <https://media.leidenuniv.nl/legacy/new-dutch-lca-guide-part-2a.pdf>.

Table 3: Resource indicators

Indicator	Unit	GP, EverSure	HE, EverFast
Renewable Primary Energy as Energy Carrier (PERE)	[MJ]	698	903
Renewable Primary Energy Resources as Material Utilisation (PERM)	[MJ]	0	0
Total use of Renewable Primary Energy Resources (PERT)	[MJ]	698	903
Non renewable Primary Energy as Energy Carrier (PENRE)	[MJ]	2860	2880
Non renewable Primary Energy as Material Utilisation (PENRM)	[MJ]	0	0
Total use of non renewable Primary Energy Resources (PENRT)	[MJ]	2860	2880
Use of Secondary Material (SM)	[kg]	9.25	9.25
Use of Renewable Secondary Fuels (RSF)	[MJ]	714	714
Use of Non Renewable Secondary Fuels (NRSF)	[MJ]	0	0
Use of net Fresh Water (FW)	[m3]	2.01	2.56

Table 4: Wastes and other outputs

Indicator	Unit	GP, EverSure	HE, EverFast
Hazardous Waste Disposed (HWD)	[kg]	1.25E-06	1.29E-06
Non hazardous Waste Disposed (NHWD)	[kg]	0.130	0.166
Radioactive Waste Disposed (RWD)	[kg]	4.58E-04	4.76E-04
Components for Re-use (CRU)	[kg]	0.0271	0.0271
Materials for Recycling (MFR)	[kg]	0	0
Materials for Energy Recovery (MER)	[kg]	0	0
Exported Electrical Energy (EEE)	[MJ]	0	0
Exported Thermal Energy (EET)	[MJ]	0	0



Interpretation

Care should be taken when comparing EPDs

While this EPD meets all requirements for reporting in PCR 2012:01, it is important to recognise that Life Cycle Assessment is not a complete assessment of all environmental or sustainability issues of the product system under study.

When comparing EPD results, note that:

- EPDs of construction products may not be comparable if they do not comply with EN 15804.
- EPDs within the same product category, but from different programmes or utilising different Product Category Rules (PCR) documents, may not be comparable.

Impact category results

The cement kiln is the source of most 'cradle-to-gate' environmental impacts of the different products covered by the study. Energy consumption (coal, electricity and wood waste), and emissions at the kiln stacks, are particularly important.

Global warming potential: Emissions from the kiln processes contribute more than 90% of the impacts. This is due to carbon dioxide emissions from the combustion of coal and wood waste, and from the calcination process of calcium carbonate in the kiln.

Ozone depletion potential: Coal and electricity consumption for all processes are the main contributors, along with the ammonia mix in the explosives used at the quarries.

Acidification potential, eutrophication potential and photochemical ozone creation potential: The highest contributions to environmental impacts come from nitrogen oxides and sulphur dioxide emissions from the kiln; coal and electricity consumption; and the combustion of fuel oils for the transport of materials via sea. Acidification potential is also driven by on-site combustion, through the release of SO_x, NO_x and other emissions in combustion processes.

Abiotic depletion (elements): Natural gypsum, which is added during the cement milling process, contributes more than 99% of the impacts.

Abiotic depletion (fossils): The use of hard coal within the kiln contributes more than 90% of the impacts.

Green Star compliance

This EPD meets the requirements of the New Zealand Green Building Council's Green Star rating tool as it:

- Follows ISO 14025 and EN 15804;
- Is independently verified;
- Has a cradle-to-gate scope; and
- Is product-specific.

References

IEPDS. (2017). PCR 2012:01, Construction products and Construction services, Version 2.2, 2017-05-30. Stockholm: International EPD® System. Available: <http://www.environdec.com/en/PCR/Detail/?Pcr=8098>.

Hon, Q. and McArthur, J. (2015). Life Cycle Assessment for EverSure™, EverFast™ and Enviro Choice type Cement Manufactured by Golden Bay Cement. Golden Bay Cement, Fletcher Building Infrastructure Group. Critical review by B. Canaguier of Catalyst Ltd against ISO 14044:2006, EN 15804:2013 and PCR 2012:01 completed 17/06/2015.

ISO 9001:2015. Quality management systems – Requirements. Geneva: International Organization for Standardization.

ISO 14025:2006. Environmental labels and declarations — Type III environmental declarations — Principles and procedures. Geneva: International Organization for Standardization.

EN 15804:2012+A1:2013. Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products. Brussels: European Committee for Standardization.

thinkstep (2017). GaBi database 2017 life cycle inventory documentation. Leinfelden-Echterdingen, Germany: thinkstep AG. Available: <http://www.gabi-software.com/support/gabi/gabi-database-2017-lci-documentation/>.



Verification and Contacts



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CEN standard EN 15804 served as the core PCR

PCR

PCR 2012:01 Construction Products and Construction Services,
Version 2.2, 2017-05-30

PCR review was conducted by

The Technical Committee of the International EPD® System.

Chair: Massimo Marino.

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Independent verification of the declaration and data, according to ISO 14025

☐ EPD process certification (Internal)

☒ EPD verification (External)



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