Embodied Energy
for saveBOARD Products

Introduction

Embodied energy (EE) is the non-renewable energy used to extract, refine, process, manufacture, transport and dispose of a material. EE calculations generally follow cradle to gate system boundaries, which includes energy outputs starting from extraction (cradle) and finishing with transport (gate) to the building site.

In addition, the system boundary can be extended to disposal (grave) if end of life data is available. EE is measured as the quantity of non-renewable energy per unit of building material, component or system. It is expressed in megajoules (MJ) or gigajoules (GJ) per unit weight (kg or tonne) or area (m2). Different construction machinery, climate conditions, and economic frameworks can influence EE outcomes.

Calculations By:

Environmental Solutions Research Centre, UNITEC Institute of Technology, May 2022

Prepared For:

Upcycled Building Materials Ltd, trading as saveBOARD

Manufacturing Locations:

30 Sunshine Ave, Te Rapa, Hamilton 3200, New Zealand. www.saveboard.nz

15 Production Ave, Warragamba, NSW 2752, Australia. www.saveboard.com.au




About saveBOARD

saveBOARD is focused on building a circular economy by turning composite packaging waste back into products that re-enter the local supply chain eliminating future waste. We have two plants; one in Hamilton New Zealand and one in Western Sydney, Australia.

The core of the product is made from shredded and compressed composite packaging, giving the user a sustainable and superior performing product. It is for use with timber or steel framing.

Finished with either a recycled facing paper (Paperfaced), fibreglass face (betterBRACE) or transparent top surface (Exposed, Ceiling Tiles, Multi-use). All products have a recycled facing paper on bottom surface. saveBOARD products are alternatives to plywood, OSB or plasterboard.

Summary of Sizes and Uses

	INTERNAL		CEILING	EXTERIOR	MULTI USE	Notes
Board Type	**Paperfaced**	**Exposed**	**Tiles**	**betterBRACE**	**Exterior/ Internal**	
Thickness	10mm, 12mm	10mm	10mm	10mm	6mm, 12mm	
Width (mm)	1200	1200	1195	1200	1200	
Density (kg/m3)	750	750	750	800	950	
Edge	TE/SE	SE	SE	SE	SE	*Tapered (TE) Square (SE)*
2400mm	√	√			√	
2450mm				√		
2700mm	√	√			√	
2750mm				√		
3000mm	√	√		√	√	
595mm			√			
BRACING	*YES*	*YES*	–	–	–	*Refer to Table 1*
FIRE SPREAD	*YES*	*YES*	*YES*	*YES*	*YES*	*Group Number 3 AS 5637.1*
FIRE STOP	*NO*	*NO*	*NO*	*NO*	*NO*	*Not Suitable*
IMPACT	*YES*	*YES*	*YES*	*YES*	*YES*	*Refer to Table 1*
AQUA	*NO*	*NO*	*YES*	*YES*	*YES*	*Refer to Table 1*
THERMAL/B	*YES*	*YES*	–	–	–	*R Value -0.13*
ACOUSTIC	*YES*	*YES*	*YES*	*YES*	*YES*	*STC 26dB, IIC 23dB*
VOC FREE	*YES*	*YES*	*YES*	*YES*	*YES*	*Refer to Table 1*
MOULD R-	*YES*	*YES*	*YES*	*YES*	*YES*	*Refer to Table 1*

Table 1: saveBOARD product summary of sizes and uses.




Technical Information

This document covers the different saveBOARD products listed in Table 1. No differentiation is made between different edge finishes (TE/TE, both tapered; TE/SE, 1 tapered, 1 square edge) as production processes are identical, apart from forming of the taper. The calculated average board weight, which varies +/- 10% depending on the feedstock being processed.

The ingredients list below and associated % of each component which vary depending on product being manufactured.

COMPONENT	INGREDIENT NAME	CAS#	%
Paperboard	Wood Fibres	No RN	59.3-85.19%
Polyethylene	Polyethylene	9002-88-4	12.12-29.83%
Kraft Paper	Cellulose	9004-34-6	2.08-6.49%
Aluminium	Aluminum	7429-90-5	< 5.2%
Fibreglass	Glass, oxide, chemicals	65997-17-3	< 3%
Polypropylene	Polypropylene	9003-07-0	< 1.5%
Inks	Undisclosed - Various	Undisclosed	0.27-0.29%

Table 2: Ingredients list of saveBOARD products.

System Boundaries

Defining system boundaries is essential for calculating EE data that can be compared fairly with other data from similar building products. Options available include cradle to cradle, cradle to gate, well to wheel, cradle to site and cradle to grave although this list is not exhaustive. Our saveBOARD products are designed to be 100% recyclable both for offcuts and at the end of life. For this reason, a cradle to cradle approach would provide the best assessment of the EE however there are two reasons why this boundary definition has not been chosen.

Firstly, as SaveBOARD is a new product in New Zealand and Australia, the logistics and transportation data for waste products from homes (at end of life) is not reliable enough to include. Secondly, most of the competing products are not designed with full recycling in mind and therefore the scope of their calculations is narrower, generally cradle to gate, cradle to site or cradle to grave.

This Embodied Energy report is of the 'cradle-to-gate' type with options, as shown in Figure 1. The options include transport to customer (module A4).




Life Cycle Stages for saveBOARD

Based on a nominal production of 2,000 tonne per year of saveBOARD products, we have mapped out the following simplified flow diagram.

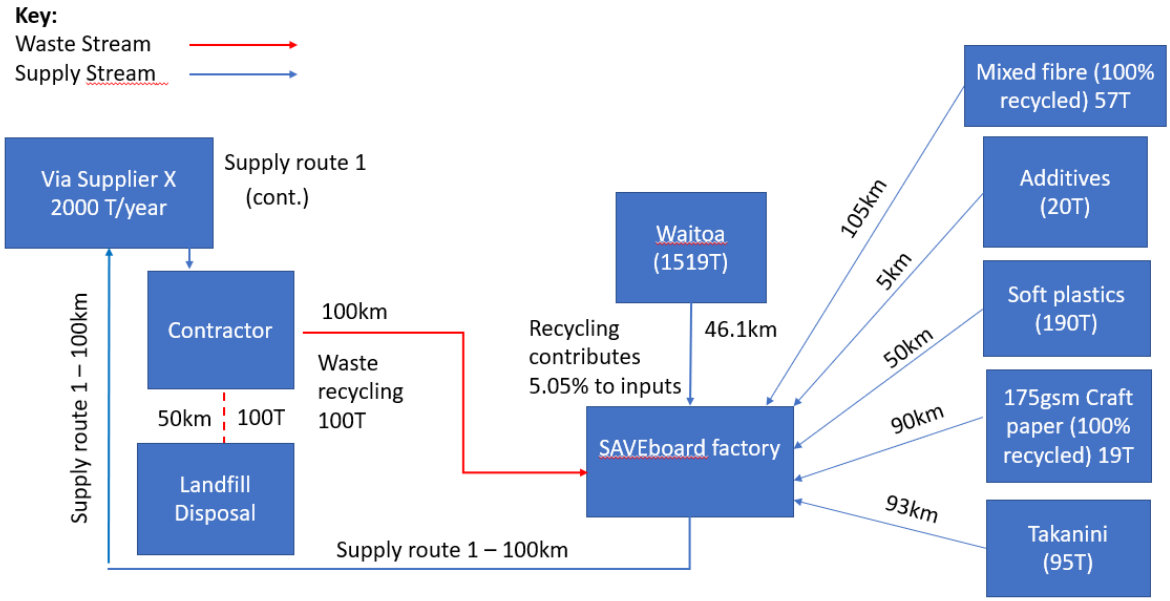

Figure 1: Simplified Flow Diagram for Cradle to Grave approach

PRODUCTION STAGE

Energy from Extraction (Module A1)

With the exception of the LDPE film (50microns thick for which the EE has been adjusted for), all of the materials used to make saveBOARD products are recycled. For this reason, the assumption has been made that the energy for extraction = 0, as justified below.

SaveBOARD production is unique in that no energy is required for the extraction of materials. The recycled materials are delivered directly to SaveBOARD. This means the original EE values for the recycled materials used to produce EIL are redundant from the new EE calculations to produce EIL. The concept of Circular Economy supports this statement. The Ellen MacArthur Foundation states 'In our current economy, we take materials from the Earth, make products from them, and eventually throw them away as waste – the process is linear.

Re-using materials to generate new products plays a part in the continuous flow of materials within the economy. According to the Ellen MacArthur Foundation butterfly diagram (Figure 2), this topic falls into the technical cycle (blue), whereby 'products are kept in circulation in the economy through reuse, repair, remanufacture and recycling. In this way, materials are kept in use and never become waste'. The Ellen MacArthur Foundation describes that re-




manufacturing materials of an old product to generate new goods uses less energy than ones made using raw materials. By deterring used products from the path to waste, materials are kept in the continuous system, saving money, resources, and energy.

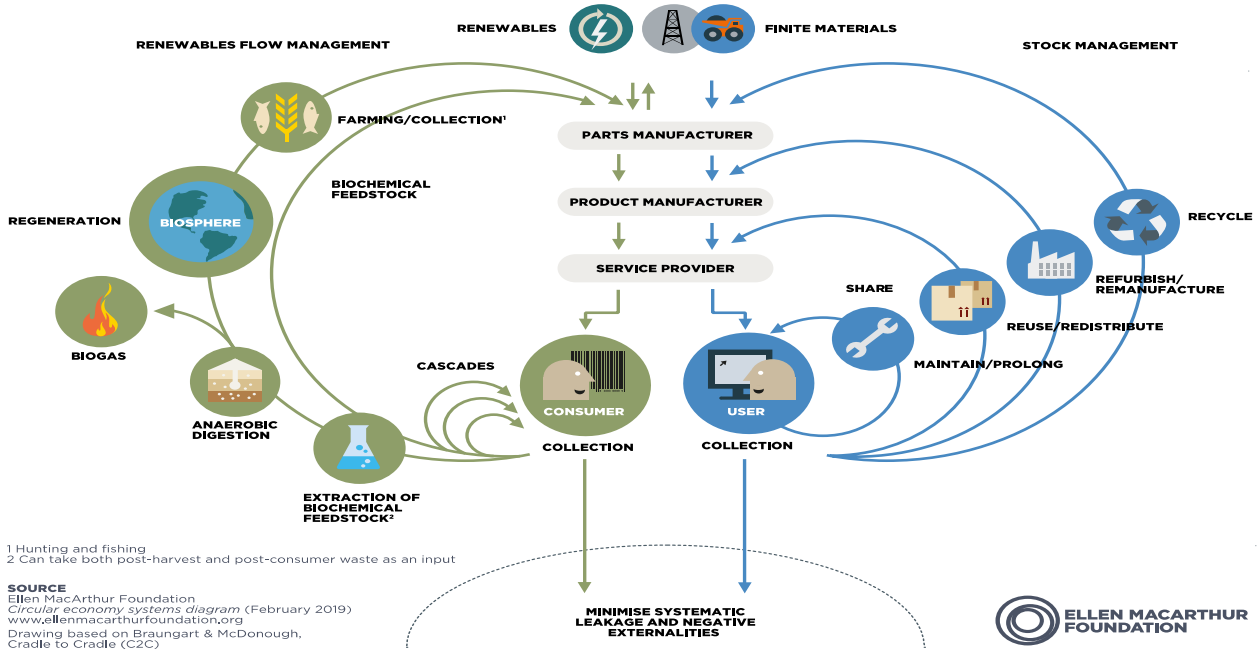

Figure 2. Circular economy systems diagram, Ellen MacArthur Foundation

Due to zero extraction energy, the EE involved in the life cycle of EIL can be determined by combining the energy from its production with the energy required to transport the product (cradle to site). Energy required for installation has not been included.

Processing/Manufacturing Energy (Module A3)

There are two main processes contributing to the overall EE during this life cycle stage as seen in Figure 3. The 2x hot presses are heated to 200degC and the cold press uses a closed loop cooling circuit and associated chiller uses 53kWh. whilst the main hydraulic unit for all presses uses 37.5kWh.




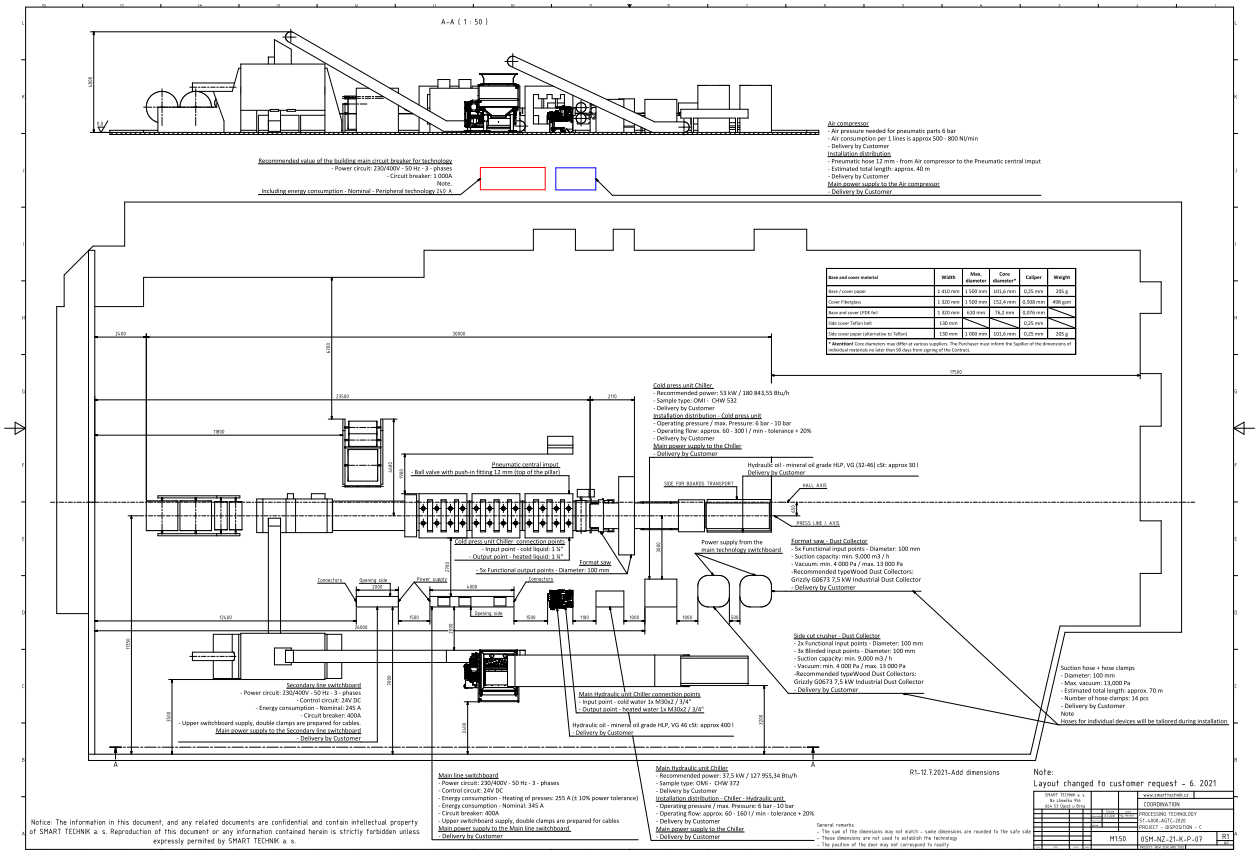

Figure 3. SaveBOARD EIL manufacturing energy.

Embodied Energy for Transportation (Module A2 & A4)

Once the EIL has been produced and ready for transport saveBOARD uses subcontracted logistics companies to transport their finished products around New Zealand and Australia. These companies use primarily diesel-powered trucks either 6m or 9m curtain-sider trucks. Assuming all trucks are carrying other products at the same time to maximise cargo volumes (16 Tonnes and 45 tonnes respectively).

End of life (module C2 and C4)

Our saveBOARD products are designed to be 100% recyclable both for offcuts and at the end of life. For this reason, a cradle-to-cradle approach would provide the best assessment of the EE however the logistics and transportation data for waste products from homes (at end of life) is not reliable enough to include at this point in time.




Environmental Impact of saveBOARD

Table 3: A1-A4 'Cradle to Gate' embodied energy calculations.

Energy Source	A1-A3 saveBOARD (Mj/board)	A4 saveBOARD (Mj/board)
Total use of renewable energy	8.0	0.3
Total use of non-renewable energy	11.7	19.0
Total energy	**19.7**	**19.3**

Although the energy for transportation to customers between saveBOARD and traditional building products are comparable, it is clear that the energy for cradle to gate (A1-A3) is considerably less for saveBOARD products as shown in Table 3.

A simplified comparison of saveBOARD vs Plasterboard is shown below based on cradle to gate. * Embodied energy (kgCO2/kg material) taken from BRANZ Study report 150 (2006).

	kwh/Board	$kgCO_2$/Board	Btu/Board	$kgCO_2$/kg material
saveBOARD	2.21	0.52	7,541	0.11
Plaster board*	7.86	1.83	26,828	0.42
Plywood*	4.02	0.95	13,709	0.20

Additional Environmental Information

At saveBOARD we are always looking to increase the transparency of our manufacturing processes to architects, designers and consumers. We welcome our clients to visit our manufacturing facilities to see first-hand what we do. Like all certifications, they come at a cost to both complete and maintain. Over time we expect to have a full complement of documents to back up our cradle-to-cradle manufacturing process.

Declare

Declare is a database of non-toxic, sustainably sourced building products that meet the stringent requirements of the International Living Future Institute's Living Building Challenge.

Considered the most advanced sustainability certification in the built environment, Declare is like a nutritional label for building products, offering specifiers, contractors and building users insight into the ingredients used in the manufacture of building products. Click on the following link to see our current Delcare label https://declare.living-future.org/products/saveboard