



Innovations that work.

## ASX Quarterly Report

For the Quarter Ended 31 March 2019

### SALES DURING THE QUARTER & UNFILLED ORDERS

	Sales 31 Mar 2019 A\$000's	Sales 31 Mar 2018 A\$000's	Sales % Change	Unfilled Orders (Approx) 31 Mar 2019 A\$000's
EdenCrete®	416	19	2,136%	-
OptiBlend®	113	84	35%	56
Total	529	103	416%	56

### HIGHLIGHTS

#### **EdenCrete®**

##### **USA**

###### **Georgia**

- First Federal funded GDOT highway repair project using EdenCrete® completed using US\$722,000 worth of EdenCrete® in total.
- Next Federal funded GDOT repair project has been advertised for tenders and includes specifications suitable for use of EdenCrete®- likely to commence in Q3 or Q4 of 2019.
- First three GDOT State funded repair projects for 2018-2019 awarded and a fourth project is scheduled to be advertised for tender in current quarter.
- EdenCrete® successfully completed the 12 months' field trial for the GDOT new concrete road pavement.
- Many upcoming commercial trials in Georgia including for new bridge construction, bridge deck rehabilitation and warehouses and hard stand areas.

###### **Colorado**

- Regular repeat sales of EdenCrete® increasing for a range of applications including for driveways, shotcrete for tunnels and swimming pools, and warehouse floors.
- Many further commercial and CDOT EdenCrete® trials planned for a range of applications.

###### **Texas**

- Trials continuing with the prestressed concrete manufacturer with which Eden has been working with since 2017 to develop new low cost mixes.

###### **New York**

- Following successful truck trials with a significant ready mix operator, follow up, confirmatory trials of a high strength commercial concrete mix are scheduled with an independent laboratory.

## **AUSTRALIA AND NEW ZEALAND**

- Parchem Distributorship – Product training was undertaken during the quarter and the first Australian commercial trials were held in April 2019.

## **KOREA**

- Highly encouraging trial results achieved in Korean university trials of EdenCrete® HC and EdenCrete®Pz in two different concrete mixes (for concrete pavement and for precast concrete applications) tested for overall durability by analysing a wide range of performance characteristics.
- Discussions with a number of possible Korean companies that may be interested in using or distributing EdenCrete® are being undertaken.

## **EUROPE**

- Interest in EdenCrete® received from a large construction company - discussions are continuing.

## **INDIA**

- Initial discussions concerning EdenCrete® with a number of relevant parties in India have taken place and will be followed up.

## ***OptiBlend®***

- Sales of OptiBlend Dual Fuel Systems worth A\$113,229 were invoiced during the quarter, with growing market interest in both the USA and India.

## ***EdenPlast™***

- The research project with University of Queensland continued, focusing on moving the production of CNT enriched plastics towards commercialisation.
- Eden starting to investigate possible commercialisation of EdenPlast™

## ***Hydrogen***

- Interest in Eden's hydrogen production process grows, with laboratory trials planned with an international company.

## DETAILS

### **EDENCRETE®**

During the quarter, total EdenCrete® sales (A\$416,000) increased significantly as compared to the March quarter last year (A\$18,605), increasing 2,136% year on year.

Details of the geographic progress are detailed below.

### **USA**

#### **GEORGIA**

##### **First Federally Funded GDOT Repair Project - Interstate Highway I-16 Twiggs County**

During the quarter, this project was completed and in total US\$721,975 of EdenCrete was used.

This project was the first joint Georgia Department of Transportation (GDOT) / Federal Highway Administration (FHWA) project in which EdenCrete® has been used. The tender specifications for this project included a number of additional performance requirements for the concrete, all of which EdenCrete® had previously met. The completed testing of the EdenCrete® enriched concrete used on this project again confirmed that the addition of EdenCrete® resulted in the concrete exceeding these additional performance requirements.

Whilst EdenCrete® was not named in the tender specifications for this Federal project (although it is named in the standard specifications for State funded highway repair projects in Georgia), the addition of EdenCrete® was selected as the most cost effective method for the contractor to meet all of these additional performance requirements.

The best available cost/benefit analysis of what EdenCrete® will deliver to future projects, based upon the actual tendered prices for the current Twiggs County Federal funded project, is that the addition of the EdenCrete® may increase the total project cost by between 4-5%.

For this modest increase in costs, based upon the observed performance of EdenCrete® in highway and pavement field trials in Georgia over the past three and a half years, a very significant increase (and perhaps even a doubling) in the service life of the concrete is anticipated, resulting in a very compelling economic case for EdenCrete® to be added to the concrete.

##### **Next Federal /GDOT Funded Highway Repair Project- I-285**

The next Federal funded GDOT repair project in Georgia, that will involve a wide range of repairs along a 17.35 miles section of Interstate highway I-285 was advertised for tender early in April 2019 and includes specifications suitable for use of EdenCrete®.

The project, that the invitation to bid estimates will require the replacement of more than 5000 cubic yards of concrete that would require in excess of \$250,000 worth of EdenCrete®, is likely to be commenced late in the third quarter (Q3) of 2019 or early in Q4 of 2019. For the purpose of delivering a longer service life of the concrete, the invitation to bid includes in the specifications additional performance specifications for the concrete, similar to those that were included in the invitation to bid for the I-16 Twiggs County project, and in which EdenCrete® was successfully used to satisfy similar specifications.

Whilst there is no certainty that EdenCrete® will necessarily be used in this new project, based on its performance in the recently completed Twiggs County project, Eden has high hopes that this will eventuate and also that these additional performance specifications will continue to be included in future Federal/ GDOT funded highway repair projects in Georgia.

## **GDOT - Repair Projects – Year Ending 30 June 2019**

Contracts have been awarded for the first three GDOT State funded repair projects for the financial year July 2018 - June 2019, which will use in total US\$124,250 worth of EdenCrete®. All of these projects require the concrete to incorporate EdenCrete® as provided in S504 of the GDOT specifications for its 24 hour full depth highway concrete repair mix (as announced ASX:EDE 27 January 2017). A fourth such GDOT project is scheduled to be advertised for tender between April and June 2019.

These four projects will use, in aggregate, approximately US\$224,000 worth of EdenCrete®. Details of further GDOT State funded repair projects that will be put out to tender are expected progressively over the coming months.

## **GDOT – Successful Completion of Field Trial for Use in New Concrete Pavements**

EdenCrete® has successfully completed a 12 months field trial for use in new concrete pavements that was previously announced (see Eden ASX announcements- EDE: ASX 30 March 2017 and EDE: ASX 4 May 2018). Eden proposes to now request GDOT to add EdenCrete® to its approved products list for use in new concrete pavements.

## **Georgia Commercial EdenCrete® Trials**

A growing number of trials of EdenCrete® in various concrete mixes for a range of commercial applications with potential commercial customers in Georgia were conducted or are still being planned to be conducted over the next few months. These trials include applications such as for marine and coastal applications, warehouses and flooring and hard stand areas.

Great progress in these areas is being made in both discussions and trials, particularly in relation to the warehouse, flooring and hard stand area applications, and growing levels of sales are anticipated over the coming months.

## **COLORADO**

### **COLORADO COMMERCIAL SALES AND TRIALS**

During the quarter, an increasing number of commercial sales of EdenCrete® occurred in Colorado for use in a range of commercial and residential applications including:

- Approximately fifteen concrete driveways completed during the quarter (first reported in Eden's September Quarterly Activities Report – see ASX:EDE 29 October 2018);
- six curved concrete walls (to help reduce cracking) completed during the quarter;
- continuing shotcrete usage during the quarter on the CDOT Central 70 project on the I-70 Interstate Highway in Denver involving the reconstruction of 10 miles, including sinking part of the highway (see Eden announcement- ASX:EDE 15 November 2018);
- regular usage by different shotcrete suppliers for a range of other applications, including for soil retention and construction of concrete swimming pools (7 concrete swimming pools completed during the quarter);
- a heavy duty concrete hardstand application;

- EdenCrete® was approved for a mining project as a densifier focussed on chemical attack reduction in a mine support building which is expected to take place the next couple of months;
- EdenCrete® was introduced to a number of new customers in Colorado that also place concrete driveways and numerous trials are underway or planned; and
- A forthcoming CDOT (Colorado Department of Transportation) paving trial (at a date to be advised) was confirmed.

To date, repeat commercial orders have been received from ten customers in Colorado. Both the number of repeat customers and the value of the sales are targeted to grow significantly over the next year. Whilst many of these orders are for residential applications, with a smaller number of the orders for commercial applications, and are presently for relatively small projects, the growing number of repeat customers in Colorado using EdenCrete® on a regular basis, and the increasing aggregate volume of sales, are very encouraging.

## **TEXAS**

Eden is continuing a test program with the precast contractor in Texas with which it has been involved since 2017, to develop improved and more cost effective mix designs, and remains hopeful that it will be successful and that the contractor will again start using EdenCrete® in its precast beams.

## **NEW YORK**

### **EdenCrete®Pz Progress - Successful Truck Trials**

Further truck trials continued during the quarter with one significant sized New York based ready mix supplier, testing the benefits that EdenCrete®Pz can deliver in new commercial pozzolanic concrete mixes. These trials again showed encouraging benefits delivered by EdenCrete®Pz in trials with standard commercial pozzolanic mixes.

Follow up, confirmatory trials of a high strength commercial concrete mix are scheduled in the near future with an independent laboratory, following which it is hoped that the first commercial sales into the huge New York concrete market will commence. Relevantly, the New York concrete market uses a significant amount of pozzolanic concrete in relation to which EdenCrete®Pz is of great relevance.

## **AUSTRALIA AND NEW ZEALAND**

During the quarter Eden continued working with Parchem Construction Supplies Pty Ltd (“Parchem”), with Eden sending technical staff to Australia to provide EdenCrete® product training to Parchem. Growing Australian market interest in EdenCrete® is being received and it is anticipated that Australian sales will commence over the coming months.

The first Australian commercial trials of EdenCrete® took place in April 2019.

### ***Background***

*In September 2018 Parchem Construction Supplies Pty Ltd (“Parchem”) was appointed as the exclusive Australian and New Zealand distributor of the EdenCrete® range of products. Parchem has been servicing the Australian construction industry for over 50 years. It is a long-established marketer of a wide range of products that it either manufactures or distributes on behalf of other manufacturers. These products are sold for use in many facets of the concrete industry in both Australia and New Zealand, supplying contractors operating throughout many markets including infrastructure, buildings, power and mining.*

*Parchem has a wide geographical footprint with locations across Australia. It covers a broad spectrum of concrete applications. It is currently represented by an extensive Account Management team, focused on supporting customers on-site and providing solutions across its serviced industries. A National Specifications Team provides expertise to Architects, Engineers and Specifiers at multiple stages of projects. This experienced national sales and marketing network, supported by high level of in-house technical capacity, provides an ideal platform upon which Parchem can promote the EdenCrete® range over the next 3 years in Australia and New Zealand.*

*Parchem’s infrastructure focus is on bridges, tunnels, maritime, rail, airports, and roads.*

## KOREA

Trials being undertaken in South Korea at Hanyang University to fully evaluate the potential of EdenCrete® products to enhance both the overall durability and other performance characteristics of Korean concrete (see Eden Quarterly Report to 31 December 2018 - ASX: EDE 10 January 2019) were completed. A wide range of tests were undertaken in two different concrete mixes made with Portland cement and slag (designed for road pavement applications) and Portland cement and fly ash (designed for pre-cast concrete applications).

Highly encouraging results were achieved in 23 out of the 29 tests completed (including on some tests, the same test measured after as many as three different time periods). In the compressive strength tests, one mix tested at three different time periods resulted in three of the six, mostly small negative results that resulted. Possible further testing for chloride permeation and fire resistance did not occur as it was noted these tests would not provide conclusive results. The results achieved from the testing program include the following:

### Durability and Strength Evaluation

	Concrete Pavement Concrete EdenCrete® HC +Pz added	Precast Concrete EdenCrete® Pz added
TEST	% IMPROVEMENT	% IMPROVEMENT
Ring-Test (shrinkage)	Improved concrete by delaying cracking by approx. <b>20%</b>	<b>No Cracks after 40 days</b> (end of trial). Reference cracked approx. <b>11 days</b> .
Drying shrinkage measurement	Improved concrete by reducing shrinkage strain by up to approx. <b>24.6%</b>	Improved concrete by reducing shrinkage strain by approx. <b>21.8%</b>
Plastic shrinkage cracking resistance	Improved concrete by reducing crack width by up to approx. <b>49.9%</b>	Improved concrete by reducing crack width by up to approx. <b>60.1%</b>
Amount of Water Permeation	Improved concrete by reducing quantity of permeated water by up to approx. <b>16%</b>	Improved concrete by reducing quantity of permeated water by up to approx. <b>7.5%</b>
Compressive Strength	Improved concrete by increasing compressive strength by up to approx. <b>9.7%</b>	Reduced compressive strength by up to approx. <b>8.9%</b>
Young’s Modulus	Improved concrete by increasing Young’s Modulus by up to approx. <b>11.13%</b>	Improved concrete by increasing Young’s Modulus by up to approx. <b>10.6%</b>
Flexural Strength	Improved concrete by increasing flexural strength by up to approx. <b>15%</b>	Improved concrete by increasing flexural strength by up to approx. <b>15%</b>
Split Tensile strength	Improved concrete by increasing split tensile strength by up to approx. <b>6%</b>	Improved concrete by increasing split tensile strength by up to approx. <b>13.6%</b>

The Korean precast company with which Eden had been working has to date not decided to use EdenCrete® in its precast operations, due to limited early strength gains being achieved after 12 hours with the particular ferro-nickel pozzolanic concrete mix that it uses, and as a result Eden has commenced exploring other possible customers and distributors for EdenCrete® in South Korea. Considerable initial interest is being shown.

**EUROPE**

Initial interest has been received from a large European construction company in relation to the possible use of EdenCrete® in its projects, and discussions are continuing.

**INDIA**

During the quarter, initial discussions were commenced with a number of potential EdenCrete® customers in India, and a positive response was received.

Since the end of the quarter, meetings with a number of these parties have taken place, and will be followed up over the next few months.

The Indian concrete market is extremely large and is projected to continue its very rapid growth over the foreseeable future, particularly in the infrastructure sector.

Eden is well placed, with its well established Indian subsidiary, to try and penetrate this market, particularly in light of the huge supply of fly ash that is generated by the many Indian coal fired power stations, and which is currently given away by the power stations.

Initial testing of EdenCrete® Pz with Indian fly ash has produced encouraging data, and it is possible that it may assist concrete producers to increase the percentage of fly ash that they use in their concrete mixes, which could provide a significant cost saving. This could be a key factor in any future success in this huge but often difficult market.

**OptiBlend®**

During the quarter Eden recorded the following OptiBlend® sales:

**OptiBlend® Sales for the Quarter**

	<b>SALES (A\$)</b>
<b>USA</b>	<b>78,877</b>
<b>INDIA</b>	<b>34,352</b>
<b>TOTAL</b>	<b>113,229</b>

These sales for the quarter represent a year on year increase of 35% compared to the corresponding quarter in 2018, in part driven by an increasing demand in India for the OptiBlend® dual fuel systems for back-up power supplies supplied by large diesel powered generator sets, with the increase in sales resulting from a combination of both attractive economics as well as from a national effort to reduce air pollution.

Eden expects to see further continued growth in sales of the OptiBlend® dual fuel systems in the June quarter in both the USA and India, with strong interest and further orders having been received in April for more than US\$170,000 worth of products in the US alone.

## **JOINT RESEARCH PROJECTS**

### **High strength CNT enriched concrete**

The three-year research project with Deakin University (“Deakin”), which is almost completed and has been partly funded by an Australian Research Council (“ARC”) Linkage Grant into ultra-high strength carbon nanotube enriched concrete, continued during the quarter with ongoing trial work with EdenCrete® enriched concrete.

### **EdenPlast™ / CNT Enriched Polymers and Plastics**

The three-year research project with the University of Queensland (“UQ”) for the development on a new method for producing carbon nanotube (“CNT”) enriched thermoplastic composites, and which is partly funded by an Australian Research Council (“ARC”) Linkage Grant, continued during the quarter, still focussing on bringing this project to commercialisation as soon as possible.

A highlight of the work was that a concentrated master-batch of CNT- enriched plastic, containing a high concentration of CNT, was successfully prepared using a novel technique, bringing this project far closer to being ready for commercialisation. Further, the master batch then diluted with more plastic, bringing the mix to commercial concentration, and its performance characteristics were then tested, confirming that the process resulted in a potentially commercially viable end-product.

Based on the success achieved to date, Eden plans to commence preliminary investigations of possible suitable commercial markets and partners for EdenPlast™ in both Australia and overseas.

## **HYDROGEN**

After a number of years when little external interest was shown in Eden’s hydrogen production process and related technologies that it has successfully developed and commercialised, over the past year interest in these technologies has started to re-emerge, largely driven by its relatively low costs, low Greenhouse Gas footprint (no CO<sub>2</sub> is directly produced in the production of the hydrogen), and the significant value of the carbon that is produced in the process (being either carbon nanotubes or carbon nano-fibres).

Discussions with an international company that expressed interest in Eden’s hydrogen production process have now been continuing for a number of months and a trial of this production process is currently planned to occur during the June quarter to evaluate its potential for use as a low cost, low Greenhouse Gas emissions method to produce large quantities of relatively low cost hydrogen.

Whilst this interest is still at an early stage and may well not result in any commercial outcome, it confirms the potential significance of this technology as well as offering a potential opportunity for Eden to perhaps further expand and commercialise this technology.

### **Hydrogen Background**

*Whilst focusing heavily on hydrogen related activities between 2004 and 2012, Eden built, and still retains, a strong hydrogen technology base (comprising significant know how, techniques, designs and eight relevant patents), including Eden’s patented pyrolysis process for production of hydrogen and carbon nanotubes/carbon nanofibres from natural gas (without producing carbon dioxide as a by-product), and a patented blender for blending hydrogen and natural gas to create a highly*



*efficient, low emission blend called Hythane® which Eden promoted for a number of years, particularly in India.*

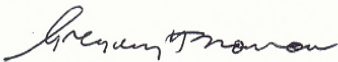
*During this period, Eden built a hydrogen electrolyser and an operating Hythane® station for Indian Oil near the New Delhi airport (and which was still operating until recently), and developed Hythane® bus engines with Ashok Leyland, the largest Indian bus manufacturer.*

*Eden was also at that time working on joint ventures with various Indian natural gas suppliers to establish a number of Hythane® bus trials in various parts of India, but interest in hydrogen as a fuel started to wane after 2008, when US policy moved away from hydrogen as a vehicle fuel to electric vehicles. As a result none of these early developments in India progressed beyond the planning stage.*

*Over the past couple of years however, around the world there has been a growing increase in the level of interest in hydrogen as a fuel, in large part being driven by concern about climate change, which has resulted in increased interest in Eden's hydrogen technologies.*

*Additionally, in India, extreme air pollution in Delhi and other cities is causing great concern, which has resulted in the Indian Supreme Court having mandated that the 10,000 strong, natural gas fuelled bus fleet in Delhi, be converted to run on a hydrogen based fuel, that in the short term is focusing on converting these buses to operate on Hythane®. This in turn has resulted in enquiries being received in relation to Eden's various hydrogen capabilities.*

*Similarly, in Australia, the Federal Government in 2018 allocated funds for research into the production of "clean hydrogen", opening a further area of possible interest for Eden for its now commercialised, pyrolysis process that produces, with a very low Greenhouse Gas footprint, both relatively low cost hydrogen and high value carbon nanotubes or carbon nanofibres.*



**Gregory H Solomon**

*Executive Chairman*

*For information, please contact Greg Solomon (+61 8 9282 4889) or visit [www.edeninnovations.com](http://www.edeninnovations.com)*