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## AUSTRALIAN SECURITIES EXCHANGE ANNOUNCEMENT

22 OCTOBER 2021

### GROWING DEMAND FOR EDEN'S LOW CO<sub>2</sub> TECHNOLOGIES AND PRODUCTS

With growing concern over changes in the global climate, many countries and companies have, for a number of years, been endeavouring to lower their total emissions levels, and in particular their CO<sub>2</sub> emissions. In addition to progress already made, today they are targeting achieving further significant longer-term reductions in their respective Green House Gas (GHG) footprints.

As a consequence, Eden Innovations Ltd (ASX: EDE) (Eden), over the past few years, has received enquiries from a growing number of companies from a range of countries, interested in the potential benefits offered by one or more of Eden's technologies and/ or products, to assist them to reduce their CO<sub>2</sub> emissions. This interest and the level of enquiries has significantly accelerated over the last twelve months.

Not all enquiries progress beyond initial discussions, but some have already resulted in sales of Eden's products, or have resulted in currently on-going trials and/ or discussions which have the potential to develop into a range of future market opportunities for Eden.

The following is a summary of the current position related to sales, trials, and/or ongoing discussions of, or around, Eden's products and technologies, that in a significant part are being driven by their ability to assist in reducing the user's GHG footprint.

#### Hydrogen and Carbon Nanotube Production

Enquiries from companies from a number of countries have been received into Eden's patented methane pyrolysis technology. All these companies have proposed only using renewable power to drive the production process, thereby not producing any CO<sub>2</sub> and producing only hydrogen and carbon nanotubes (CNT) from the natural gas.

"Clean" hydrogen produced, using only renewable power, from a hydrocarbon feedstock such as natural gas, with no GHG footprint being generated in its production is known as "blue hydrogen". It has the same GHG footprint as "green" hydrogen that is produced by electrolysis of water that is similarly driven by renewable power from a renewable source.

The economics of hydrogen production is extremely important. The splitting of natural gas into hydrogen and CNT produces three times the mass of the CNT compared to hydrogen. Further, the CNT also commands a far greater market price per kilogram than the hydrogen that is produced. As a result, Eden's patented and fully developed and proven, energy efficient methane pyrolysis process, coupled with its established and emerging downstream commercial

applications for the CNT, enables Eden's pyrolysis process to deliver a globally very competitive solution to companies wishing to produce low-cost hydrogen with a zero GHG footprint. As the sales of products that incorporate Eden's CNT grow, the greater the quantity of CNT that will be required, and the greater volume of blue hydrogen that will be produced in consequence. To accelerate this process, Eden is reviewing several possible new applications and markets for its CNT (in addition to its current EdenCrete® and EdenPlast® markets). If any of the new applications are successful, they will require additional CNT, which would also enable higher quantities of low cost, blue hydrogen to be economically produced.

### **EdenCrete® Concrete Admixture Product Range- EdenCrete®, EdenCrete® Pz and EdenCrete® Pz7**

All Eden's patented CNT-enhanced concrete admixtures enable production of concrete with reduced CO<sub>2</sub> emissions.

In some cases, a lower initial CO<sub>2</sub> footprint results from a reduced quantity of cement being required to meet the performance specifications when EdenCrete® is added. In other cases, lower GHG footprint cementitious materials, such as fly ash, can be used in replacement of a substantial percentage of the Ordinary Portland Cement (OPC). In other cases, even if there is no lower upfront GHG footprint, a longer lasting, more durable concrete will result in a lower total emissions footprint over the entire service life of the concrete.

The current market footprint of these products is growing with current product sales and/or trials in a number of countries, including USA, India, France, Australia, Israel, Indonesia and Korea. In particular, growing interest has been shown in India and USA for some time, and more recently in Indonesia, in concrete that, with EdenCrete® products added, can include far higher percentages of fly ash, a waste product from coal fired power production, as a suitable low cost, zero emissions cement that is invariably both cheaper and has a far lower CO<sub>2</sub> footprint.

Eden is presently in discussions and trials with fly ash suppliers in several countries, focused on widening this market interest and accelerating the uptake of high fly ash concrete mixes in their respective markets, when EdenCrete® Pz and/ or EdenCrete® Pz7 are added to the concrete mix. These discussions and trials are looking promising and each has the potential to lead to increased levels of EdenCrete® product sales.

Already one major Indian construction company has incorporated EdenCrete® Pz, and a greatly increased percentage of fly ash, into several of its standard concrete mixes. Similarly, a large French construction company has done the same. Similar trials are also underway in Indonesia.

The high GHG footprint of concrete, resulting from the CO<sub>2</sub> emissions generated when OPC is produced, is reduced when fly ash is substituted for OPC. Further, the negative economic and environmental issues which result from the accumulation of large stockpiles of waste fly ash are reduced when fly ash is used. High fly ash concrete is likely to be a major driver of growth in EdenCrete® sales where fly ash is available and its use will help reduce the concrete's GHG footprint.

### **EdenPlast®**

Interest has been received from companies in both Japan and India in EdenPlast®, Eden's patented CNT-enhanced plastics and polymers that demonstrate higher performance

characteristics. It is considered likely that EdenPlast® may enable the products produced with it to last longer, and in some cases be re-cycled more times, resulting in lower GHG footprints over the life of the polymer.

The trials of EdenPlast® in Japan by a Japanese polymer manufacturer that took place earlier this year (**see Eden's ASX Quarterly Report dated 30 April 2021**) have now been extended, and further follow-up trials are underway.

If these additional trials by the Japanese polymer manufacturer are successful, a significant market for EdenPlast® could be opened, not only in Japan but also in the various countries in which the company sells its products. This would generate a rapid growth in EdenPlast® sales that in turn will require additional CNT.

The precise quantities of CNT that may be required for such increased sales of EdenPlast® are not presently known. However, in light of the size of the global polymer market and the anticipated reduced GHG footprint of CNT- enhanced polymers that are likely to be stronger, longer lasting and may be better able to be effectively re-cycled, increased sales of EdenPlast® could lead, over time, to a significant demand for CNT and thus result in increased blue hydrogen production.

#### **Hythane®**

Ongoing enquiries have recently been received from companies in India and New Zealand about accessing Eden's hydrogen-enriched natural gas fuel (Hythane®) technologies related to its production, storage and use. Hythane® usage, in lieu of natural gas, enables the CO<sub>2</sub> emissions from natural gas-powered engines to be reduced as well as delivering other performance and omissions benefits.

Interestingly, more than thirteen years ago, after Eden first introduced its Hythane® technology into India, the Indian Government adopted hydrogen-enriched natural gas as the transitional fuel in its national Hydrogen Roadmap. Following this, Eden won a tender and built for Indian Oil a hydrogen and Hythane® production and dispensing station at an Indian Oil fuel station at Dwarka, near the Delhi Airport (**see Eden's ASX Quarterly Report dated 22 April 2009**).

Relevantly, Eden designed, fabricated and installed the hydrogen electrolyser, compressor, storage, Hythane® blending and dispensing at the Dwarka station, that operated for almost 10 years until it was moved to Indian Oil's main campus near Delhi a couple of years ago (**see Figures 1 and 2 below**).

During the past year, in order to reduce pollution, the Indian Supreme Court has mandated that all 7,500 natural gas-powered buses in Delhi must be converted to operate on hydrogen or hydrogen-enriched natural gas, and the conversion process is presently underway.

Similarly, in other parts of India moves are afoot to follow the same path, opening up a considerable opportunity for Eden to utilise its significant technical skills in the area.

In recent weeks, enquiries have been received from companies in India and New Zealand that are each investigating possibly utilising Eden's Hythane® technologies in various applications in those countries. Should those uses eventuate, they are expected to open significant market opportunities for Eden's Hythane® technologies that will also assist in the reduction of GHG emissions in these countries.



**Figure 1 Hythane®/Hydrogen Dispenser at Dwarka Station built by Eden for Indian Oil 2009**

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**Figure 2 Hydrogen Electrolyser and Compressor built by Eden at Dwarka Station**

**OptiBlend®**

Growing interest and product sales are emerging in USA and India in OptiBlend®, Eden's long-proven dual fuel system that enables diesel powered generator sets to operate on a mixture of diesel and either natural gas or Hythane® (see **Eden's ASX announcements on 15 July 2021 and 28 July 2021**) thereby resulting in reduced GHG emissions levels from the operation of the generators and cost savings where lower priced natural gas is available.

When using natural gas, up to 70% of the diesel fuel can be replaced with natural gas which produces far lower CO<sub>2</sub> emissions, and if Hythane® is used instead of natural gas, over 80% of the diesel fuel can be replaced, each offering a greatly reduced GHG footprint resulting from the operation of a diesel-powered generator set.

## **CONCLUSION**

Eden was established in 2004 , less than three years after the 9/11 terrorist attacks in the US, that led to President Bush declaring hydrogen to be "freedom fuel".

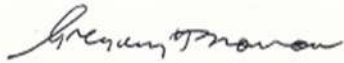
Eden focused on commercialising a range of hydrogen technologies, and made great progress but when the new US President changed direction in early 2009 and moved the focus away from hydrogen and instead focused on electricity to power vehicles, Eden was also forced to re-focus on its emerging OptiBlend® technology, its then recently developed methane pyrolysis process, and on possible applications for the carbon nanotubes produced by this process.

However, Eden still retained its hydrogen technologies, and after a hiatus of more than 11 years, these technologies are once again in demand for addressing, today, the same issues that Eden was addressing in late 2008.

Whilst some companies that approached Eden were small, some larger companies approached Eden and reviewed different aspects of Eden's technology to see if it could fit with their own plans.

Whilst they did not proceed because they did not have a use for the carbon nanotubes and had a grant to try to develop an alternative process, one large company in 2019, jointly with Eden's scientists, conducted trials and a detailed review of Eden's pyrolysis process, and in discussions both then and since, they have confirmed the technical and economic relevance to them of Eden's technology.

The hydrogen market place has continued to evolve and is growing rapidly. After a long dormant period, Eden is both well placed, and looking forward, to being an active participant in this rapidly emerging global hydrogen market. Not only does Eden retain its important original hydrogen technologies, but it also now has a range of very valuable derivative products that have been developed out of the pyrolysis process that are being commercialised and could well, in the future, make the commercial production of blue hydrogen using Eden's pyrolysis process a reality.



**Gregory H. Solomon**

Executive Chairman

This announcement was authorised by the above signatory.

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