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**Full Cycle Bioplastics Australia's Submission to the Inquiry into Innovative Solutions in Australia's Waste Management and Recycling Industries**

Full Cycle Bioplastics Australia welcomes the invitation to submit an opportunity to the House Standing Committee on Industry, Innovation, Science and Resources on their Terms of Reference to inquire into and report on innovative solutions in Australia's waste management and recycling industries.

This submission will outline the present opportunities provided by the acquisition of a patent to Polyhydroxyalkanoates (PHA) technology that can create a strong domestic market for recycled products in Australia that will reduce landfill and reduce the waste in Australia's waterways and oceans by producing a raw material from organic waste.

Full Cycle Bioplastics Australia's technology and commercial enterprise can convert a by-product of organic waste compost (such as food waste, agricultural waste, green waste and other dirty cellulosic material like paper and cardboard) into virgin PHA bioplastic material to be made available for the use in Australian goods and services. Once this virgin material is produced and used, the material either biodegrades in land or water or can become virgin PHA bioplastic again. This innovative technology presents a major opportunity to shift Australia's consumer behaviour and supply chain towards a fully biodegradable circular economy bioplastic packaging solution using organic waste and ending the use of petroleum-based plastics.

Full Cycle's circular approach improves waste industry profitability, enables regenerative upcycling of compostable material, and gives consumers a choice in sustainable packaging material. Included is an overview of the closed loop, circular economy process.



**Figure 1:** Overview of how Full Cycle Bioplastics replaces traditional “take, make, dispose” consumption cycles with a superior Circular Economy solution on (<http://fullcyclebioplastics.com/>)

The development of Full Cycle Bioplastics technology began in 2013 with the generation of a prototype in the state of California, United States of America. We have included a timeline of four phases of development for what is today a commercially ready technology that has been brought to life and is suitable for co-location and further expansion in an Australian market.

***Four stages of development for Full Cycle Bioplastics technology:***

**1. First Generation Prototype (2013 - 2015) [Complete]**

Designed to convert peach waste into PHA, this prototype system was installed at Wawona Frozen Foods in Clovis, California. The system consisted of pump mixed anaerobic fermenters with homemade odor scrubbers as well as 6-liter aerobic bioreactors with timer driven feeding/decanting. This system produced milligram quantities of PHA and validated the waste-to-PHA concept. Full Cycle filed its patent application with the US patent office (<https://patents.google.com/patent/WO2016081902A1/en>). This patent was fully granted in 2019.

**2. Second Generation (Q1, 2015 - 2017) [Complete]**

Designed with 10-liter reactors, microcontrollers and overhead mixers, this system incorporated the first feedback automation into the conversion process and unlocked the



ability to produce 10g/day of PHA. This system was implemented in the US Department of Agriculture's Agricultural Research Services Western Regional Research Center. The Generation 2.5 upgrade replaced the bootstrapped automation controls to industry standard PLCs, enabling rapid optimization of the entire PHA production process. Using the same reactor bodies, the output of these reactors increased to 20g/day of PHA over time.

### **3. Small Pilot (Q1, 2017) [Ongoing]**

Located at the US Department of Agriculture's Agricultural Research Services Western Regional Research Center, the Small Pilot system uses the same reactor control automation system together with 100-gallon tanks to manufacture 1 lb. of PHA per day. Full Cycle has also installed front-end organics processing to generate VFA feedstocks.

### **4. First Commercial System (Q2 2019 Launch) [Ongoing]**

Located at the Google's (strategic partner) production/assembly kitchen in Mountain View, California, Full Cycle's pilot facility will convert ~2 tons of organic waste per day into approximately 10lbs. of PHA per day, additional VFA feedstock and treated compost. This facility represents a real-world demonstration of Full Cycle's technology, complete with integrated control systems.

In 2018, Full Cycle was introduced to the Google Food Team (GFT), the group tasked with creating sustainable and healthy food systems at Google's headquarters in Mountain View, California. At the time, the focus of GFT was to streamline the efficiency of their food operations and to implement advanced, system-level food waste management solutions in conjunction with their efforts. Both teams quickly realised that there was high alignment on mission and vision and pursued a project focused on upcycling Google's food waste into Full Cycle's PHA biopolymers for use throughout Google's operations.

Today, Google is licensing Full Cycle's technology to convert its waste streams into high value products at its centralised food production facility. Full Cycle completed construction of the facility in 2019 and is currently operating the facility, translating lessons learned into plans for future, larger-scale facilities. Full Cycle Bioplastics USA are also currently pursuing a larger, commercial-scale facility that will source waste from the entirety of Google's HQ and the surrounding municipalities in which they operate and transform that waste into PHA.

Full Cycle Bioplastics Australia has recently acquired the rights to explore this PHA technology patent in an Australian market and has been registered as an Australian company with the sole purpose of introducing this technology to create a strong domestic market for recycled products that will address the waste and recycling crisis.

Full Cycle also enables the waste industry to significantly reduce its carbon footprint by sequestering carbon from organic waste. This carbon would otherwise be released as



greenhouse gas if the waste industry were to continue with traditional degradation and industrial treatment processes.

We note that in the Report on Waste and Recycling in Australia, [\*Never waste a crisis: the waste and recycling industry in Australia\*](#) developed by the Senate Standing Committees on Environment and Communications published on June 28, 2018 recommends the establishment of a circular economy for the waste and recycling industry to include the phase out of petroleum based plastics by 2023 and that the Australian Government have strong procurement policies to support domestic markets for recycled material.

Our team of experts and leaders in the Australian retail and social/environmental entrepreneurship sectors aim to explore the possibility of constructing a commercial facility in Australia for organic waste to PHA bioplastic production that is developed within the framework of a circular economy, presenting a closed loop solution to support for the phase out of petroleum based plastics by 2023 and create a strong domestic market for recycled material.

We currently have strong commercial interest from 7-Eleven Australia, Starbucks Coffee Australia and we are in discussions with other major Australian retailers who are interested in integrating this innovative solution into their products and supply chain processes to limit their current dependency on petroleum-based plastics.

Market demand for PHA is high. Our primary challenge and roadblock to innovation at this stage is the need for Full Cycle Bioplastics Australia to build its first commercial-scale facility to demonstrate the ability to deliver material to meet the demand. Following the successful commissioning of the Google facility in Mountain View, California we have set the stage for the planning and development of a commercial-scale facility as a next step.

Development of a commercial-scale facility requires alignment across a number of stakeholders, including the Australian Government who can provide essential capacity building for the commissioning of a stand-alone Full Cycle Bioplastics Australian facility operating at commercial scale. Success in this next phase will be critical to continue building confidence for follow-on system installations.

We are seeking investment from the Australian Government of \$22-\$35 million dollars to construct a commercially viable facility with a 12,000-20,000 m2 footprint to help meet the Australian demand for PHA bioplastic products and create a strong domestic market for recycled materials to address the waste and recycling crisis.

We also seek to be invited to, and participate in any future public hearings, roundtables or meetings with the Department of Industry, Innovation and Science, Minister for Industry, Science and Technology, the Hon Karen Andrews MP or Committee's pertaining to innovative solutions to, and technological advancements in, Australia's waste management and recycling industry.



We invite the Minister for Industry, Science and Technology, the Hon Karen Andrews MP, members of the Committee on Industry, Innovation, Science and Resources and members of the Environment and Communications References Committee from the Senate to visit our facilities at Google Headquarters in Mountain View, California with our US partners in San Francisco or take a virtual tour of our facilities from Australia.

Please contact Elliot Costello, Executive Director of Full Cycle Bioplastics Australia [REDACTED] if you would like to discuss any aspect of this submission.

Yours Sincerely,

[REDACTED]

Elliot Costello  
Executive Director