

Carbon Kai Ltd – An introduction to our vision

Please see this confidential document designed to inspire interest and support for our new environmental and social Carbon Venture, that happens to have a positive financial by-product. We are looking for assistance from partners who will provide insights from a different angle, accessing government and influencers to give serious consideration and development assistance to the solutions we are proposing. This venture is designed with multiple environmental and social outcomes and has the values and wishes of our people and whenua at its core.

Our proposal is to develop, manufacture and sell a range of products based on third generation biochar technology, that we like to call Carbon Coated Minerals (**CCM**). Our CCMs can be sourced from multiple feedstocks, blended and cooked for many uses, including food scraps, tires, cropping wastes and more.

However, in this immediate proposal, we are blending an animal feed supplement (**AFS**) that mitigates enteric methane emissions, while increasing animal and soil health, and the live weight gains to improve animal productivity.

Internationally, AFS products have already been evaluated and tested, with results showing a reduction in animal methane emissions by 30% minimum. The lab bench tests on ruminant stomach fluids show the potential for a 75% methane reduction from ruminant animals from our CCM.

Our team have been looking to provide “climate impact” solutions from our up-cycling and farming businesses. In this instance we are very proud to have a solution based on well tested engineering and chemistry where multiple positive outcomes are accomplished, and the widespread by-product will be multi layered profitable, connected enterprises.

- **In the first instance we were looking to up-cycle forestry, food and fibre wastes** – For example, a CCM solution can utilise the thousands of tonnes each year of forestry slash and wood ends that are causing environmental issues all over NZ (Flooding, Structural damage, CO₂ emissions).
- **Then there is the opportunity for reducing agricultural emissions** – Our biochar products will reduce agricultural methane (minimum of 30%) in ruminant animals, however we believe it could achieve a 75% methane reduction with further scientific investment and development.
- **New Zealand has an agricultural emissions reduction target of 5% by 2030** – Using only our current AFS biochar products rolled out in stage one to the Dairy herd only, will achieve a 14% reduction across the entire NZ farming agricultural emissions (dairy, beef and sheep). That beats the 2030 target by 180%!
- **Carbon Sequestering** - Our biochar products will sequester substantial volumes of non-labile carbon into our soils naturally, daily, and for free via the very animals that are benefiting from it. This carbon is stable for 100 years or more!
- **Soil and Water health** – Our biochar products will increase soil health, soil production and soil moisture retention. All while reducing nitrogen run-off into our waterways.
- **Affordability** - Our biochar products will retail around 20c per day, per milking cow, 4c per sheep.
- **Giving farmers tools to fight the climate crisis** – Forcing farmers into methane reduction programmes involving changes to farm systems is difficult, while NZ is looking to spend billions offshore offsetting these same emissions. However, with AFS biochar, the production gains in the animals will provide a significant increase in productivity - all while reducing emissions, solving emissions on-farm and keeping money in NZ. Our market testing shows, farmers will willingly use this product, even if just for bottom line profit gains.
- **Employment and development rural areas** - We intend setting up production facilities in rural areas with local communities, where bulk supplies of forestry, food and fibre are currently managed as waste to landfills; left to rot; or create hazards in forestry areas.
- **iwi partnerships** – We see opportunities for hapu and iwi to develop very profitable production facilities and transport businesses to support them, therefore offering their local whanau jobs in their rohe, while improving environmental outcomes for soil and water.

All of these solutions and their by-product enterprises in the communities will be a win-win-win-win. Everyone engaged with this commercial ecosystem will be engaged today in climate impact responses to improve the future resilience and for future generations, while financially benefitting at the same time. Our future generations will thank us for having the courage to change “for the good”.

Our biochar product has been proven in smaller trials around the world, but we are confident it can be improved with further evaluation. No one has been bold enough (yet) to do what we are proposing. No one has had the foresight to scale biochar into a climate intervention project like we have, and to share the opportunity for change and prosperity across all in Aotearoa New Zealand.

Our biochar products are world leading and New Zealand has the ability, with our forestry, food and fibre resources and agriculture production to be the world leaders in climate change impact mitigation.

Breakdown of each Benefit

- **In the first instance we were looking to up-cycle forestry, food and fibre wastes** – For example, a CCM solution can utilise the thousands of tonnes each year of forestry slash and wood ends that are causing environmental issues all over NZ (Flooding, Structural damage, CO2 emissions).

Biochar can be made from many, many different waste streams, including food wastes, human wastes and organic wastes. Our technology will later be applied across many different uses, however our first goal is to tick a few other important boxes first. Like solving our agricultural emissions dilemma.

While the chemical structure of pine trees is not the most ideal feedstock for AFS biochar products, we are determined to develop its use in order to offer an economic solution to rural communities and the forestry industry so slash and wastes are not discarded at harvest. We have all seen the devastating results of slash in recent weather events - flooding, destruction, loss of productive land, deaths. Then there are the unnecessary emissions the wastes are releasing back into the atmosphere as they rot.

To scale our solution 370,000 tonnes of wet pine would be needed each year to make enough Carbonkai for 6.2 million Dairy cows.

- **Then there is the opportunity for reducing agricultural emissions** – Our biochar products will reduce agricultural methane (minimum of 30%) in ruminant animals, however we believe it could achieve a 75% methane reduction with further scientific investment and development.
- **New Zealand has an agricultural emissions reduction target of 5% by 2030** – Using only our current AFS biochar products rolled out in stage one to the Dairy herd only, will achieve a 14% reduction across the entire NZ farming agricultural emissions (dairy, beef and sheep). That beats the 2030 target by 180%!

We are currently in round two of applying for a grant from CERF (Climate Emergency Relief Fund). While we have worldwide research and international support – we need to improve and trial our recipes to NZ farming systems. The grant will allow us to build a methane chamber for up to 12 calves and employ researchers. These initial studies are to be audited by Lincoln University. From there AgResearch will be given bags of our Carbonkai to do their own trials.

After “pushing the button”, we believe we can create a cooperative of 23 manufacturing facilities around the country, with two machines at each facility, fully operational within four years.

The most recently published study is from the University of South Queensland. Their study trial using a basic activated carbon (not our CCM which we believe to be superior), measured a 30–40% methane (CH₄) reduction and a 10% Carbon Dioxide (CO₂) reduction. We also know from other trials that biochar will reduce nitrous oxide (N₂O) emissions from decomposing dung by at least 20%.

Recent research by Davis University (CITY?) shows that a 10% reduction in global methane (CH₄) emissions will stabilise the effects of atmospheric temperature increases, however a 35% reduction has the potential to reverse atmospheric temperature increases.

Dealing with Greenhouse Gases (GHG):

CO₂ → Carbon Dioxide is stable atmospheric carbon that is very long lived and is accumulating each year from burning fossil fuels.

CH₄ → Methane is 28 times worse than CO₂ at holding heat in the atmosphere and is primarily responsible for rapid temperature rises but is short lived (10 – 12 years). CH₄ reverts back to CO₂ and water.

N₂O → Nitrous oxide is 265 worse than CO₂ at heating the atmosphere and has a lifespan of about 120 years, however its concentration in the atmosphere is much lower. Decay from animal wastes is a significant global source of nitrous oxide.

When fed to animals, biochar traps the mineralised nitrogen from the cows' digestive tract into the carbon sponge of the biochar. When the dung is released by the animal, mineral nitrogen is trapped in the biochar so does not oxidise to nitrous oxide (N₂O). The mineralised nitrogen forms are then still available to be released into the soil from the biochar in the dung as a very efficient natural fertiliser.

- **Carbon Sequestering** - Our biochar products will sequester substantial volumes of non-labile carbon into our soils naturally, daily, and for free via the very animals that are benefiting from it. This carbon is stable for 100 years or more!
- **Soil and water health** – Our biochar products will increase soil health, soil production and soil moisture retention. All while reducing nitrogen run-off into our waterways.

The farm animals provide the best way to spread the mineral soaked carbon biochar as it is feed to them as a low volume feed supplement. They naturally activate the carbon in the biochar, with mineralised nutrients and spread out across the farm through their dung (including spreading by effluent). The carbon is then drawn down into the rhizosphere of the plant root zone, where it significantly increases the cation exchange capacity of the soils.

In example one cubic metre of biochar can provide over 120ha of surface area (1.2million m²)! This surface area provides a biological and nutrient warehouse for soils.

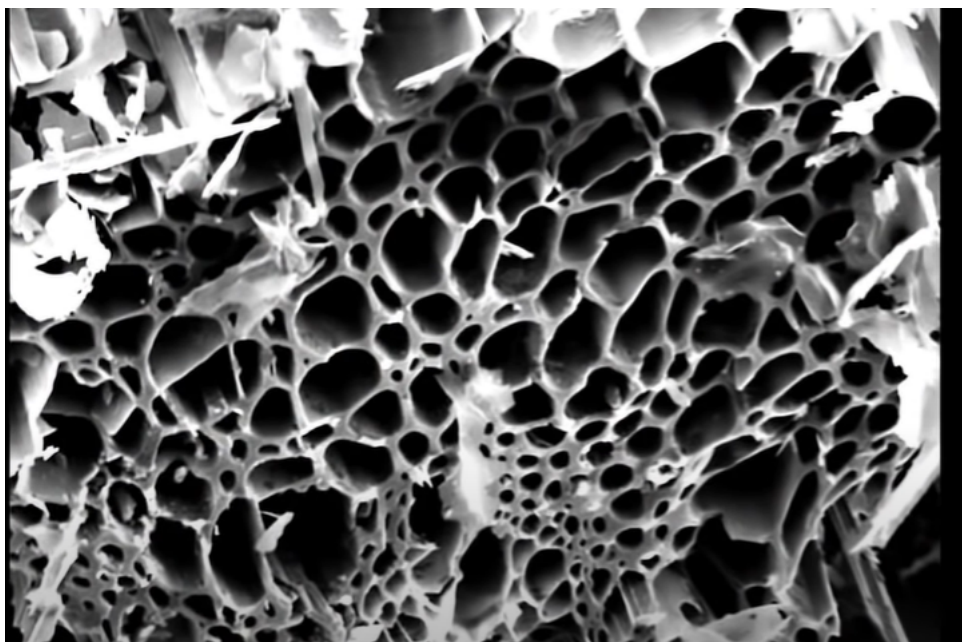


Figure 1: *Electron microscope view of biochar surface*

Biochar can store and donate electrons to assist in chemical reactions that also make nutrients more available and reduce the bioavailability of some toxic compounds like heavy metals. Biochar in soil acts like a microbial fuel cell, powering plants to take up nutrients more efficiently and increasing the abundance of beneficial microbes that make nutrients more available. These microbes can do the hard work to find the minerals for the plant and make them readily available right beside the root structure, so the plant available minerals increase.

- Biochar helps plants take up nutrients by increasing the abundance of growth promoting micro-organisms and reducing the energy required to transport nutrients from the soils to the inside of the roots.
- Biochar enhances the ability to make macro and micron nutrients more available to plants through facilitating chemical and microbial reactions on the external and internal surfaces of its pores.
- Biochar adsorbs and binds root exudates, dead microbes, and other soluble organic matter in its pores. This builds up soil organic carbon and some of this carbon can be used as a source of energy for growth promoting microbes.
- It has a stable carbon content of greater than 50% that can last for hundreds of years. This stable carbon sequestered into your soils will continue to increase the value of your land and productivity into the future.
- Biochar can reduce nutrient leaching and increase soil moisture. Each one percent increase in soil carbon per hectare can increase soil retention of water in the root zone by 13mm, therefore, less watering is required from irrigation or rain to top up the plant available water.
- When biochar locates near the roots it can help plants resist disease and help regulate the uptake of specific nutrients
- If looked under a microscope, biochar has honeycombed like appearance. A piece of Biochar the size of the tip of your thumb (base of nail up) has the surface area of a basketball court.
- **Affordability** - Our biochar products will retail around 20c per day, per milking cow, 4c per sheep.
- **Giving farmers tools to fight the climate crisis** - Farmers do not want to be forced into expensive methane reduction programmes. However in this case, the production gains in the animals will be a significant return on investment - all while reducing emissions, improving soil health and environmental outcomes. Our market testing shows, farmers will willingly use this product, even if just for bottom line profit gains.

The vision of this venture has always been to have multiple “wins” for the parties involved who form the network or ecosystem to make this possible. If this opportunity is taken on by a large corporate or investment fund, the profit returns demanded will be much greater and the profits will be centralised into the funding entity. Keeping the cost around 20c per animal, per day will also allow the farmers to also win.

Our initial decision to target dairy cows is based on the convenience that they come in to milk daily and can easily be feed the supplement. The supplement can be mixed as a dry powder to their other feed, mixed into a feed pallet at manufacture source – or put into a loose lick. The results from our early trials for feeding calf’s daily and feeding to a dairy herd show:

- Consistent weight gains for calves over the 66 days.
- Significant differences between the control and the study herd.
- Returns for weight gain in excess of the daily feed costs.
- Increased milk fat and protein production.
- Increased earnings per milking animal.
- Returns in milk solids in excess of the daily feed costs.

The operation of the biochar machines is proposed to be regionally distributed to reduce transport costs to market and movement of feedstocks (forestry, food and fibre). When in operation each machine will process more than thirty tonnes of feedstock each day. This is conservative based on the machines operating at 80% capacity (highly efficient) this could equal depending on the feedstock up to 5,900ton per year. The initial feedstock planned is pine slash and tree tops to enable the reductions of another environmental and social problem. In cases where the carbon in the feedstock, isn’t already accounted for in the emissions trading scheme (ETS) there is an opportunity registering the mineralised carbon in the biochar as additional carbon above the national emissions inventory. In example the pine feedstock if not in the ETS could sequester twenty two tonnes per machine day.

- **Employment and development rural areas** - We intend setting up production facilities in rural areas with locals, where bulk supplies of food and fibre are currently managed as waste to landfills or left to rot in forestry areas.
- **Iwi partnerships** – We see opportunities for hapu and iwi to develop these very profitable production facilities and transport businesses to support them, therefore offering their local whanau jobs in their rohe, while improving environmental outcomes for soil and water.

The raw pine feedstock for this venture, is widely available in the rural regions of Aotearoa New Zealand, so is the obvious choice as the first feedstock where we intent to set up the production facilities. Each facility would be in the position to employ 20 – 25 people from within the local community/rohe at good wage rates that will enable their whanau to prosper. There will also be other job opportunities required in support of those businesses.

The proposed venture has the ability to create unique partnerships with iwi in their rohe to redirect ‘waste’ from landfill to a beneficial purpose which improves the whenua and the mauri of the waterways. In example the wilding pines in South Canterbury (or forestry slash in the central plateau) are an immediate environmental and social problem costing the local communities significant amounts of money each year and the dairy farms across the Canterbury Plains are responsible for significant degradation of groundwater (or dairy farms in Lake Taupo/Waikato River). While these problems are addressed the biochar product of the facilities is also making a substantial reduction in the nationally determined contribution to meet our Paris Climate Accord commitments. We would like to discuss and share the ability to capture all of these problems inside the same solution and at the same time providing rural employment and wealth opportunities to invest in other ventures.

Our business model for roll out is an “all-inclusive cooperative” model that will make it very attractive for participants within the rural sectors to get involved and excited by the opportunity. Including sharing Carbonkai production around the country, profit sharing, creation of over 600 rural jobs for people, environment benefits, on-farm productivity gains, and New Zealand leading worldwide carbon positive farming.

We estimate the need for approximately 50 of our 3rd Generation Pyrolysis machines, placed around the country where (initially) pine waste, wilding pines or similar food and fibre materials are situated (like grape marc). The facilities and operations can be owned and operated by iwi and community enterprises.

Each machine is 95% self-powered by syngas (gas that comes from heating the organic matter to a high temperature without oxygen) and hydrogen (internally generated). These machines have operating emissions footprint less than a modern linehaul truck, but more than that each machine will also mineralise carbon equivalent to approximately 5,900 tonnes of CO₂ each year. This carbon is removed from the atmosphere for hundreds of years.

The 25 proposed manufacturers (sites) running the 50 machines will form a national Biochar Cooperative. All product will be sold through the Biochar Cooperative to create a single market to ensure quality and performance standards are met.

Our financial modelling shows each facility will generate an annual bottom line profit of approximately \$8.5 million, before tax and depreciation and after any land lease and machinery payments.

The land development costs with buildings and plant are forecast to be around \$2m.

Machinery purchasing and commissioning with materials handling equipment etc would be approximately \$3.5m.

It is our vision that a government organisation would loan (not grant) this money to the facility trust at a favourable rate, that could obviously easily be repaid. It is important for the integrity of this opportunity to iwi, that this be a loan – not a grant.



www.bichartp.co.nz
raymond@biochartp.co.nz

0274 322282