Submission No 60

INQUIRY INTO BENEFICIAL AND PRODUCTIVE POST-MINING LAND USE

Organisation: Advanced Simplicity

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Image of Mt. Arthur Mine taken from The Australian

Inquiry into beneficial and productive post-mining land use

ADVANCED SIMPLICITY

Innovate. Then add simplicity.

Response to Legislative Council, Standing Committee on State Development

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Table of Contents

List of Abbreviations

ACCU	Australian Carbon Credit Unit
ARENA	Australian Renewable Energy Agency
Ca	Calcium
CO_2	Carbon dioxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CST	Concentrated solar thermal
EAAS	Equipment-As-A-Service
EPA	Environmental Protection Authority
Fe	Iron
FOGO	Food organics and garden organics
ISCO	In-situ chemical oxidation
K	Potassium
LCA	Life cycle analysis
Mg	Magnesium
MW	Megawatt
N_2O	Nitrous oxide
NSW	New South Wales
P	Phosphorus
PV	Photovoltaic
S	Sulfur
SDGs	Sustainable Development Goals
THC	Tetrahydrocannabinol
UN	United Nations
UNSW	University of New South Wales
UTS	University of Technology Sydney
Zn	Zinc

1.0 About Us

Advanced Simplicity are engineers of strategic solutions. We believe in innovation and the application of novel solutions. Simplicity is key, because simplicity works. As we say, “Innovate. Then add simplicity”.

Advanced Simplicity was founded in 2004. Advanced Simplicity has been a panel member to the NSW Office of Environment & Heritage to deliver their business programs for resource efficiency improvements. We have been a preferred supplier to the Climate Clever Program for Sydney’s Northern City Councils. We have provided technical assistance to the NSW Environmental Protection Authority (EPA) in conjunction with the University of New South Wales (UNSW). We have consulted across a range of projects and industries including the development and construction of sustainable housing for the mining sector and remote areas of Australia.

Advanced Simplicity has been engaged internationally, in particular Europe, Asia, the Middle East and Africa. This has included the delivery of such projects as wastewater treatments plants; water treatment projects; renewable energy and off-grid projects; waste management and recycling programs; environmental remediation; sustainable infrastructure development; and addressing environmental challenges such as the clean-up of the Niger Delta and PFAS contamination.

As part of our work in developing countries, we have engaged in community consultation to ensure that we achieve their buy-in into delivering sustainable and holistic solutions. We have worked with leading human right groups to monitor supply chains and issues of modern slavery.

Dr. Antonio Pantalone, founder of Advanced Simplicity, has been a Visiting Fellow of UNSW and continues his interest in the development of environmental technology and methods through ongoing relationships with the University of Technology Sydney (UTS), the University of Sydney and Murdoch University. He is also a special advisor to Wandarra, a pioneering industrial hemp company that is based in Townsville, Queensland. The experienced gained so far with Wandarra has seen him become a member of the NSW Hemp Taskforce. This relationship forms a strong part of this submission, as the Wandarra team, experience and knowledge base that has been developed will be at our disposal, including the use of hemp for mine site remediation in Northern Queensland. Additionally, expertise in the use and farming of kenaf and bamboo has been developed and is also considered in this response to inquiry.

2.0 Terms of Reference

The Terms of Reference that will be addressed in this response to inquiry are:

(c) Opportunities for investment and growth in training and skills in established or traditional mining areas, including:

i. The need to reskill and retrain current workforces

(d) Opportunities to encourage innovative post-mining land uses including:

ii. The development of solar farms, pumped hydro, and other clean energy industries

iii. The compatibility of post mining land sites with commercial projects

vi. The development of sites for use for advanced manufacturing, commercial and industrial use

3.0 Response to Inquiry

This response to inquiry will address the Terms of Reference listed above and will also touch on other peripheral points. This document makes specific reference to the BHP owned Mt. Arthur Coal mine (referred to as the 'site' for the remainder of this document), located in the Hunter Valley of NSW. The site-owner has published a 2030 visualisation for the re-use of the site that includes the development of: agriculture; renewable energy, in particular pumped hydro and a photovoltaic (PV) solar farm; cattle grazing; farming; equine facilities; advanced manufacturing; recreational facilities; and the establishment of native woodland corridors. This is shown in Figure 1.

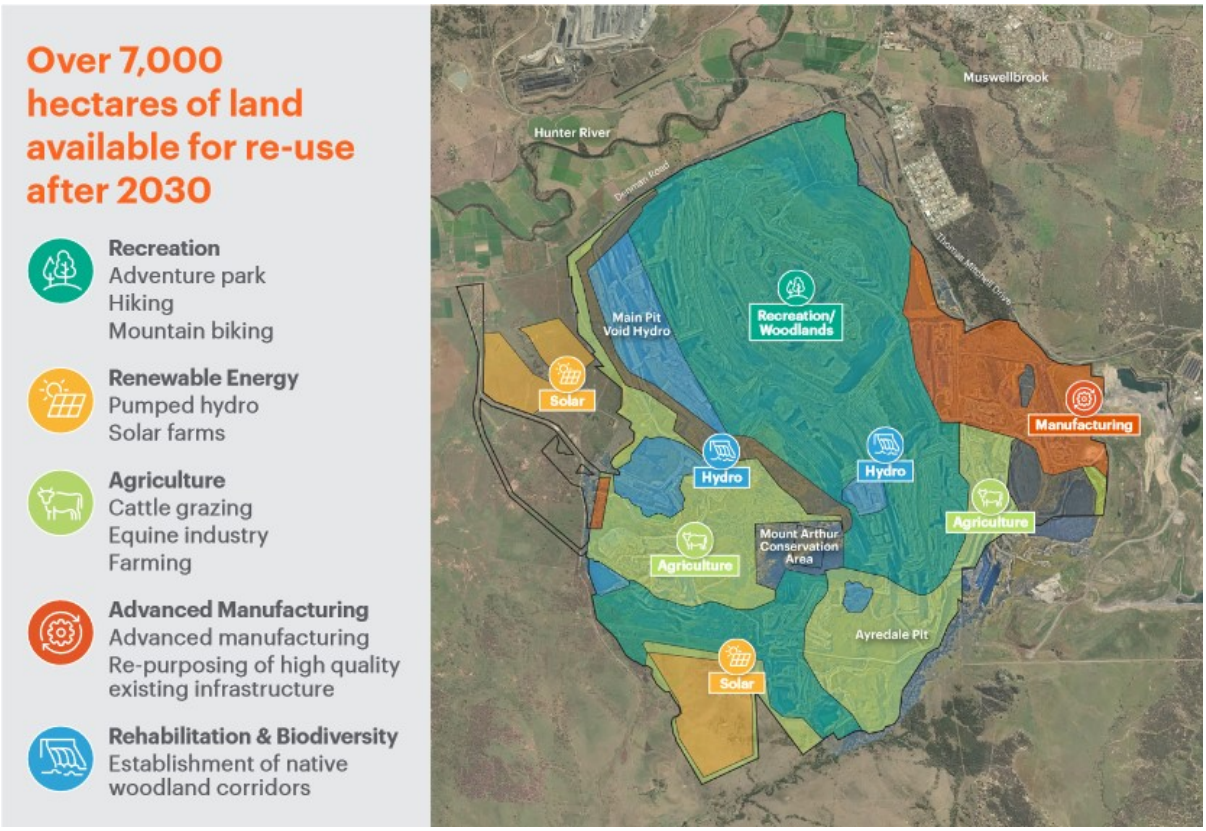

Figure 1. Re-use after 2030 as shown in 'Community Connect Mt. Arthur, April 2024'

Our goal in making this response is to provide a pathway for BHP to become a leader of the "vibrant green economy".

This response aims to address the areas that we have knowledge and experience in developing and delivering, to ensure a viable pathway forward that takes advantage of the site's existing infrastructure that is shown below in Figure 2 by way of:

- Growing industrial hemp in available agricultural areas on site for commercial purposes
- Utilising remediation methods including industrial hemp to rehabilitate the site
- Utilising industrial hemp outputs for cattle feed or equine bedding
- Transforming industrial hemp into value-added products within the advanced manufacturing sector
- Creating renewable energy to provide heat and power on-site
- Utilising the high voltage transmission lines to supply excess power to the grid
- Utilising the exiting train line to transport goods in and out of the site for use in advanced manufacturing processes and external sales of manufactured products

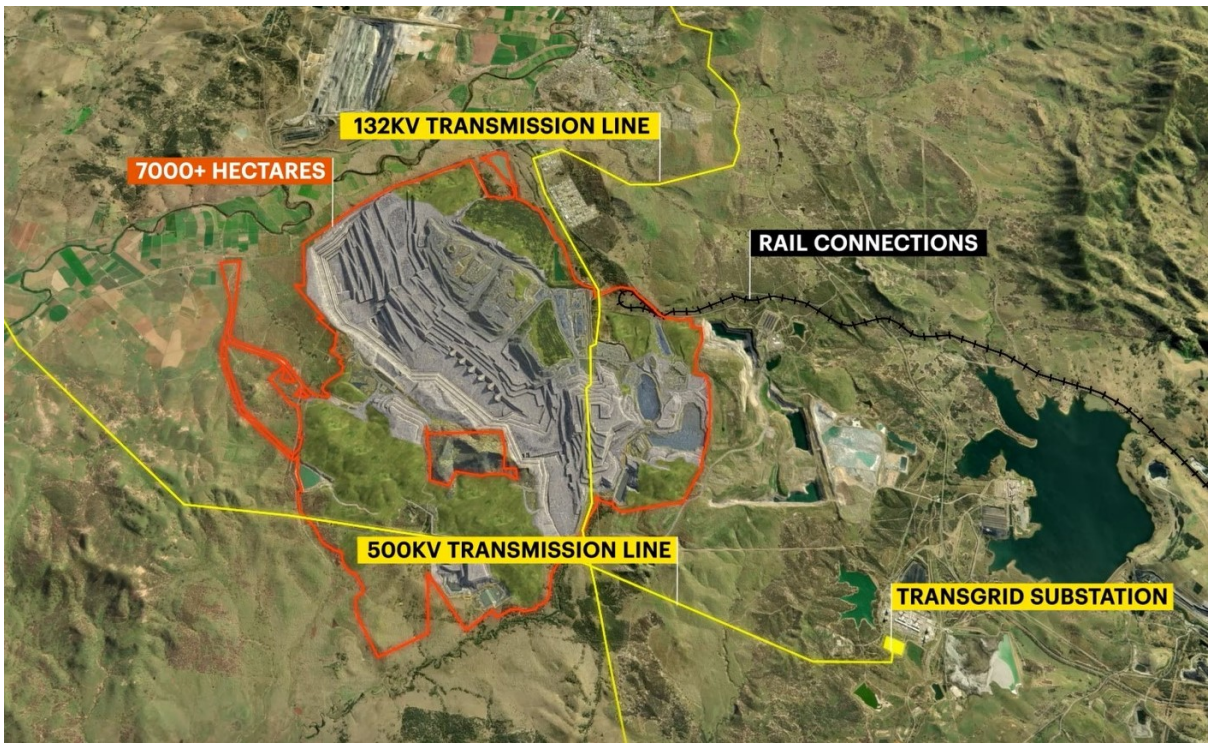

Figure 2. 2030 visualisation published by BHP

This response to inquiry does not contain any estimates as to costs or economic modelling as further information is required. Early stage considerations included in this document are deemed economically feasible based on prior experience and current and projected market analysis[1].

[1] Industrial Hemp Market by Type (Hemp Seed, Hemp Seed Oil, CBD Hemp Oil, Hemp Bast, Hemp Hurd), Source (Conventional, Organic), Application (Food & Beverages Pharmaceuticals, Textiles, Personal Care Products) and Region - Global Forecast to 2027

4.0 Sustainability Hub and Community Education

A key opportunity to spread the message of the initiatives to be taken at the site is the development of a Sustainability Hub to act as a learning centre for the public, school children, and future generations. The hub will act as a prelude to the development of a Centre of Excellence in the area. The goal of the Centre of Excellence is to develop work class intellectual property and practical advancement in the sustainability industries. A Centre of Excellence within the site will strengthen the region's knowledge base with the likely development of collaborative projects with the other existing local and international Centres of Excellence.

The hub can be located close to the entrance of the site, ideally built using materials that are produced at site. Catering to different age groups and levels of understanding, the hub can become a vital educational tool for the region as a whole and showcase the initiatives that are being taken. For e.g. that the Hunter region was one of the first hemp growing areas and that hemp seeds were brought on the First Fleet.

The Sustainability Hub can provide a clear definition for such topics as circularity and zero waste, terminology that is becoming more frequent in society but without complete understanding. Throughout the site can be strategic learning sections, information points, and interactive activities.

The site-owner has already established effective means of community communications via their website and digital information, including a newsletter. Continuing these methods to build upon the community engagement with positive updates and education will be effective in promoting the sustainability hub concept.

Education around the hemp sector is something that Wandarra has already established, having had to single-handedly develop the North Queensland market. Similarly, Wandarra has worked closely with indigenous groups in the region to develop working projects; create long-term employment opportunities for youth; develop skills amongst the community; and develop indigenous landholdings and businesses. Wandarra continues to be a sponsor of Cowboy House, a culturally safe boarding facility for young Aboriginals and Torres Strait Islander men and women attending partner schools in Townsville. Advanced Simplicity has experience in tertiary education, ongoing university engagement and the previous development of community consultation programs. Overall, we would be available to participate in any working groups with the goal of developing the sustainability message.

5.0 Circularity

There have been previous Life Cycle Analysis (LCA) conducted by our partners for each area identified in this response to inquiry. The thought design is that each business unit is sustainable in its own right, and all parts combine into a holistic vision that we have termed the **'Mt. Arthur Circle of Innovation'** that is outlined in Figure 3 below. The business units are explained in further detail within the document.

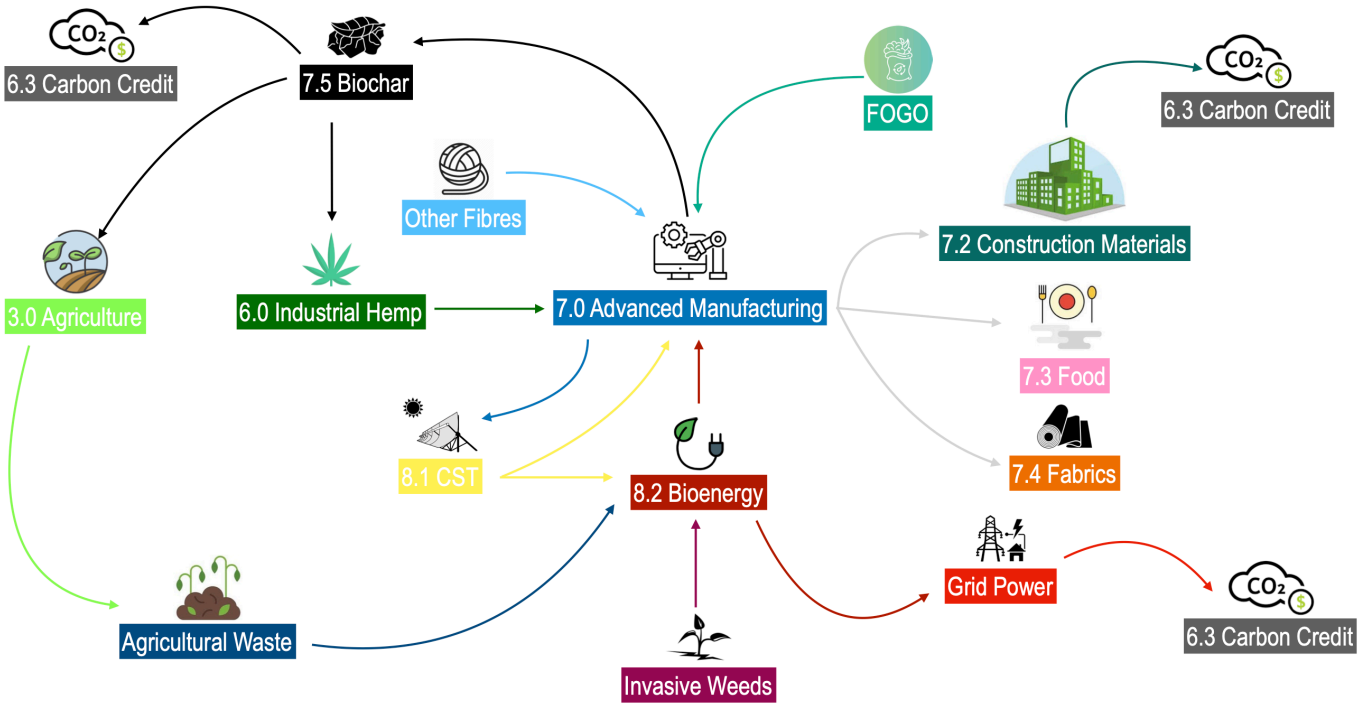

Figure 3. Mt. Arthur Circle of Innovation

6.0 What is industrial hemp?

Cannabis sativa L., commonly known as industrial hemp, is a very old and innovative plant that has thousands of applications ranging from textiles, paper products through to building materials, cosmetics and pet food. Hemp is thought to have been the first domestically cultivated plant dating back to 8,000 years ago. In the 1930s, it was touted as a “billion-dollar crop” after Henry Ford built a car from hemp that was fuelled by hemp.

Figure 4. Hemp field in Brittany, France, which is Europe's largest hemp producing area

Industrial hemp differs greatly from marijuana. The key difference is that hemp has been bred with very low levels of the psychoactive compound, tetrahydrocannabinol (THC). Typically, this is about 0.3 per cent in industrial hemp versus upwards of 25 per cent in marijuana plants.

Cannabis sativa L. Seeds were first introduced into Australia on the First Fleet and were gifted to settlers…

Cannabis sativa L. seeds were first introduced into Australia on the First Fleet and were gifted to settlers to promote cultivation and the production of sails, rigging, clothing and waterproofing for ships.[2]

The Hunter Region is one of the original hemp growing regions of Australia, and continues today to be an important producer within Australia.

Industrial hemp is a whole-of-use plant that is comprised of the outer fibrous bast, the inner material called hurd, the seeds, flowers and leaves. Different plant genetics determine the makeup of hemp plants, with some species providing more bast fibre and hurd versus the volume of seed produced.

6.1 Why industrial hemp?

Industrial hemp is grown specifically for industrial and consumable use. Along with bamboo, hemp is one of the **fastest growing plants**.[3] The growth cycle typically lasts 100 days. It can be refined into a large variety of uses and as mentioned above, is a **whole-of-use-plant**. Industrial hemp is **renowned for its strength**, producing materials that are **stronger and lighter than steel**.

The attributes of industrial hemp have made it an attractive solution to meet the current global demand for sustainable alternatives to traditional materials.

Our experience in the North Queensland market has demonstrated that industrial hemp is an effective rotational crop that provides many benefits. These include:

- Excellent fast growing cover crop that does not require any special agricultural techniques
- Stabilises soil and prevents overland runoff reducing waterway pollution and contamination
- Requires less water and fertiliser application
- If planted correctly, can be used as a smother crop to kill weeds

[2] https://thefarmermagazine.com.au/hemp-industry-set-to-thrive/

[3] Robert Deitch (2003). Hemp: American History Revisited: The Plant with a Divided History. Algora Publishing. p. 219

Being **fast growing, requiring less water and fertiliser**, and being **naturally resistant** to most pests and diseases, industrial hemp is considered a **sustainable plant** that can potentially service a range of industries. The outer bast fibres have been extensively used throughout history and through advancements in technology, now offer exceptional materials to consumers. Industrial hemp as a building material is **naturally light-weight, mold resistant, breathable** and has a **high fire resistance**. As a **non-toxic recyclable material** that also demonstrates **excellent insulative properties**, hemp is increasingly becoming a popular choice for green building construction.

In its simplest form, hemp hurd is used for animal bedding. It is the preferred material for the equine industry, being soft, highly absorbent and biodegradable. Hemp products that are fed to horses also demonstrate exceptional properties including easing joint pain and inflammation; improving skin, coat and stronger hooves; and providing optimal nutrition that is easy to digest and enhances overall health.

Figure 5 illustrates the numerous uses of the hemp plant.

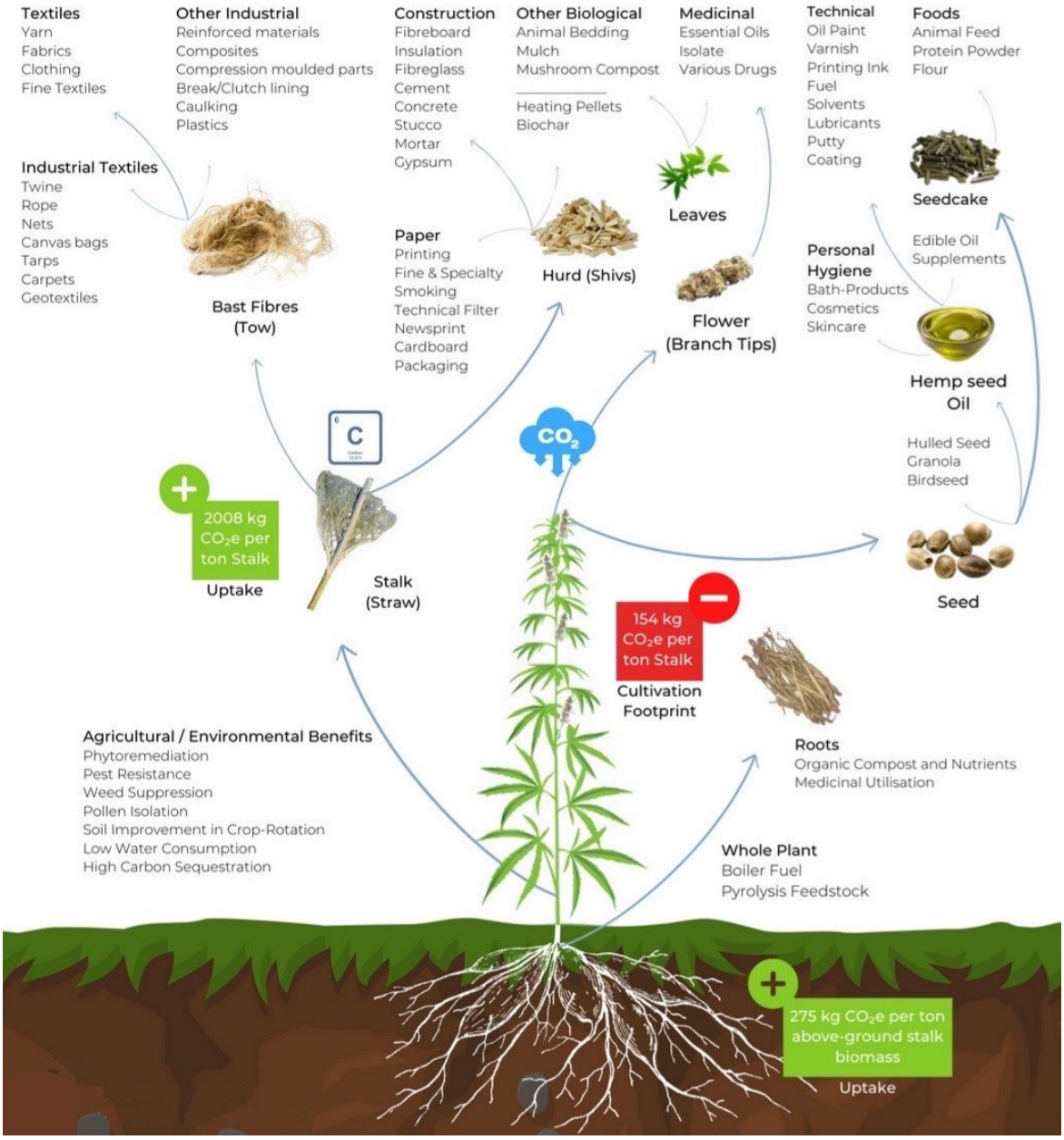

Figure 5. The many uses of the hemp plant

Another reason for industrial hemp's sustainability is its **ability to absorb and store carbon**. It is considered a **carbon negative crop**, absorbing more carbon from the atmosphere and soil than is emitted. Industrial hemp has been scientifically proven to **absorb more CO_2 per hectare** than any other forest or commercial crop and is therefore the **ideal carbon sink**. In addition, the CO_2 is permanently bonded within the fibre that is used for anything from textiles, to paper and a building material.[4] The total net-negativity on the farm level has been calculated as **2.20 tons of CO_2 per stalk**, with the total amount per hectare being determined by the yield.[5]

6.2 Site Remediation Using Hemp

The hemp plant acts as an excellent phytoremediator and there has been extensive global work on the use of hemp to clean-up contaminated sites. There are thousands of scholarly articles that have examined different contamination scenarios. Hemp has demonstrated that it is an effective "mop crop", capable of clearing impurities from wastewater and agricultural waste. In fact, hemp has been used at the Chernobyl site to absorb nuclear isotopes from the water, soil and air.

We have engaged with UTS and Murdoch University regarding their findings related to their research on the use of hemp to remediate mine sites. Some of this research included the use of hemp to stabilise tailing dams after coverage. Hemp was shown to be a hyperaccumulator for most contaminants. Generally speaking, hemp has always shown an affinity to absorbing heavy metals.

While we continue our cooperation with UTS for the use of hemp to remediate PFAS contaminated soils, we are also engaged in mine remediation and repurposing in North Queensland via Wandarra, in particular the shut down of Mount Isa Mines.

Internally, Advanced Simplicity has successfully demonstrated the use of hemp to absorb hydrocarbon contamination in challenging areas and it is important to note that our experience in remediation extends beyond the use of hemp. Other forms of remediation that we are experienced with include in-situ chemical oxidation (ISCO), fixation, electrocoagulation, absorption, adsorption and thermal desorption techniques. Further site evaluation will determine if any additional remediation techniques need to be applied.

[4] www.aph.gov.au/documentstore.ashx%3Fid%3Dae6e9b56-1d34-4ed3-9851-2b3bf0b6eb4f

[5] Knodel, N., Kunzel, T., *Carbon in Hemp Explained*, Hemp Connect Report Version 1.7, February 2024

6.3 Carbon Credits

As mentioned, hemp is an excellent sequester of carbon. Additionally, the absorbed CO_2 is permanently bonded within the fibre when it is converted into products such as a construction materials or biochar. Essentially, a large-scale adoption of industrial hemp will help NSW achieve its carbon reduction goals.

Due to hemp's promising environmental impact there are hemp-specific carbon trading platforms that already exist. We have developed a relationship with Hemp Carbon Standard based in Canada, and via a project with Wandarra, we are currently undergoing the methodology to generate voluntary carbon credits for an upcoming crop yield. At present, a number cannot be placed on the potential volume of carbon credits that could be generated at the site with the conversion of industrial hemp into construction materials or biochar.

Similarly, carbon credit generation, more specifically ACCU generation, will be achieved through developing a solar thermal farm and biomass power generation. Generation of carbon credits have already established processes and mechanisms within the international marketplace. Although a figure cannot be placed on the potential volumes of credits to be generated, we are confident in the viability of the business unit at the site.

7.0 Advanced Manufacturing

BHP identified that the site's existing infrastructure provides an exciting opportunity to develop advanced manufacturing. Without identifying specific infrastructure, and leveraging off both local and international technology partnerships, the following business units are recommended:

7.1 Decortication

Decortication is the process of removing the surface fibrous layer from an inner membrane. Decorticators are machines that separate the fibre from hurd in plants such as hemp, kenaf and bamboo. Similarly, nuts, seeds and grains undergo decortication to remove hulls to improve edible properties.

A series of decorticators will be necessary to begin the first stage of hemp manufacture and transfer into high-value products. As mentioned, decorticators can be utilised for other agricultural products. Given the different types of decorticators, and the cost associated with them, creating a decorticator hub on site will provide a pathway for local producers to further process their agricultural products in a cost-effective and timely manner. This is especially the important given that hemp is currently grown in the area and requires processing. Providing this access will create a revenue stream for the business unit and be of community benefit as an Equipment-As-A-Service (EAAS) provider.

7.2 Construction Materials

As described, hemp provides many exemplary properties that creates superior building products. Our local and international technology partners are established producers of hemp and other fibre-based building products with decades of experience between them. Utilising the hemp that is grown on-site, along with other locally produced hemp, we can act as an off-take partner to the region. Following decortication hemp can be transformed into construction products.

Current hemp products that are produced by our technology partners include but are not limited to:

- Wall panels
- Hemp based concrete blocks
- Corrugated roofing
- Pipes
- Floorboards
- Bollards
- Structural I-beams
- Insulation
- Cabinetry
- Fencing
- Bioplastics
- Bowls and serving instruments
- Pallets
- Tilt up wall panels

These products are interchangeable with existing construction materials. They are currently sold on both the Australian and international marketplaces, and the demand for hemp-based products has grown as they offer significant advantages. They have been tested to various international standards and have demonstrated excellent results including:

- Fire resistance
- Mold and mildew resistance
- High strength
- Lightweight
- Excellent thermal properties
- Excellent acoustic properties
- Locks in carbon for 100+ years
- Recyclable

Given the current housing crisis, the shortage of construction materials and the elevated costs, hemp-based construction materials offer a sustainable solution to these challenges. These hemp-based materials also present unique advantages in terms of their fire resistance and insulative properties. Construction with hemp-based materials provide high performing, sustainable, and completely circular building materials for the future.

Alongside hemp-based materials, construction products made from waste materials including other fibres from plants and single use plastics can be produced at site within the advanced manufacturing precinct. Through our technology partnerships, we can utilise waste materials to produce bricks and panels for longer-lasting housing construction.

7.3 Food Production

One of the pressing concerns that faces the nation is food security. This was highlighted in the CSIRO report[6] commissioned by Wandarra. The investigation identified the potential for processing and co-processing of hemp for the food sector and associated markets. It identified the local and international markets for food products, and the process streams that would be required. Hemp was studied in conjunction with chickpea, mungbean, soybean and sunflower. The report identified that the various components of processing can service a variety of markets including aquaculture, ruminant feed, oils, flours and textured vegetable protein more commonly known as plant protein meat replacements. Figure 6 outlines the products that can be manufactured from the hemp plant.

Some key advantages that were noted were that **hemp is gluten free**, catering to an emerging global market of consumers. Also highlighted were the benefits of hemp for the equine industry, ranging from bedding to feed and the positive impacts on the animals. This ties in with the site-owner's proposed 2030 visualisation of developing equine facilities at the site.

Hemp demonstrated to be a preferable crop for processing and co-processing due to:

- Hemp being an in-demand product that is currently sourced from overseas rather than produced locally
- Hemp can produce oil co-products
- A range of hemp products can be manufactured including flour, protein enriched flour, protein concentrates and isolates, fibre extracts, and textured vegetable proteins
- Hemp flour and oil have higher market prices than those obtained from other products
- The high prices of hemp flour and oil have a positive effect on the indicative return ratio, providing a very fast payback time (as low as 1 year based on modelling)
- Hemp allergens are uncommon
- Hemp flours can be added to a variety of applications including bakery products or minced meat without affecting appearance
- The oil from hemp seed is a rich source of omega-3 and omega-6 polyunsaturated fatty acids and whole hempseeds are also a rich source of P, K, Mg, S, Ca, Fe and Zn

[6] Regional plant protein processing hub in north Queensland, CSIRO, 2021

Overall, hemp food products have a large local and international demand for immediate consumption. The processing of hemp for food products has already been extensively reviewed by the CSIRO. The nutritional benefits of hemp-based food products has been identified. The use of off-the-shelf machinery provides another advantage as hemp processing and co-processing can begin quickly.

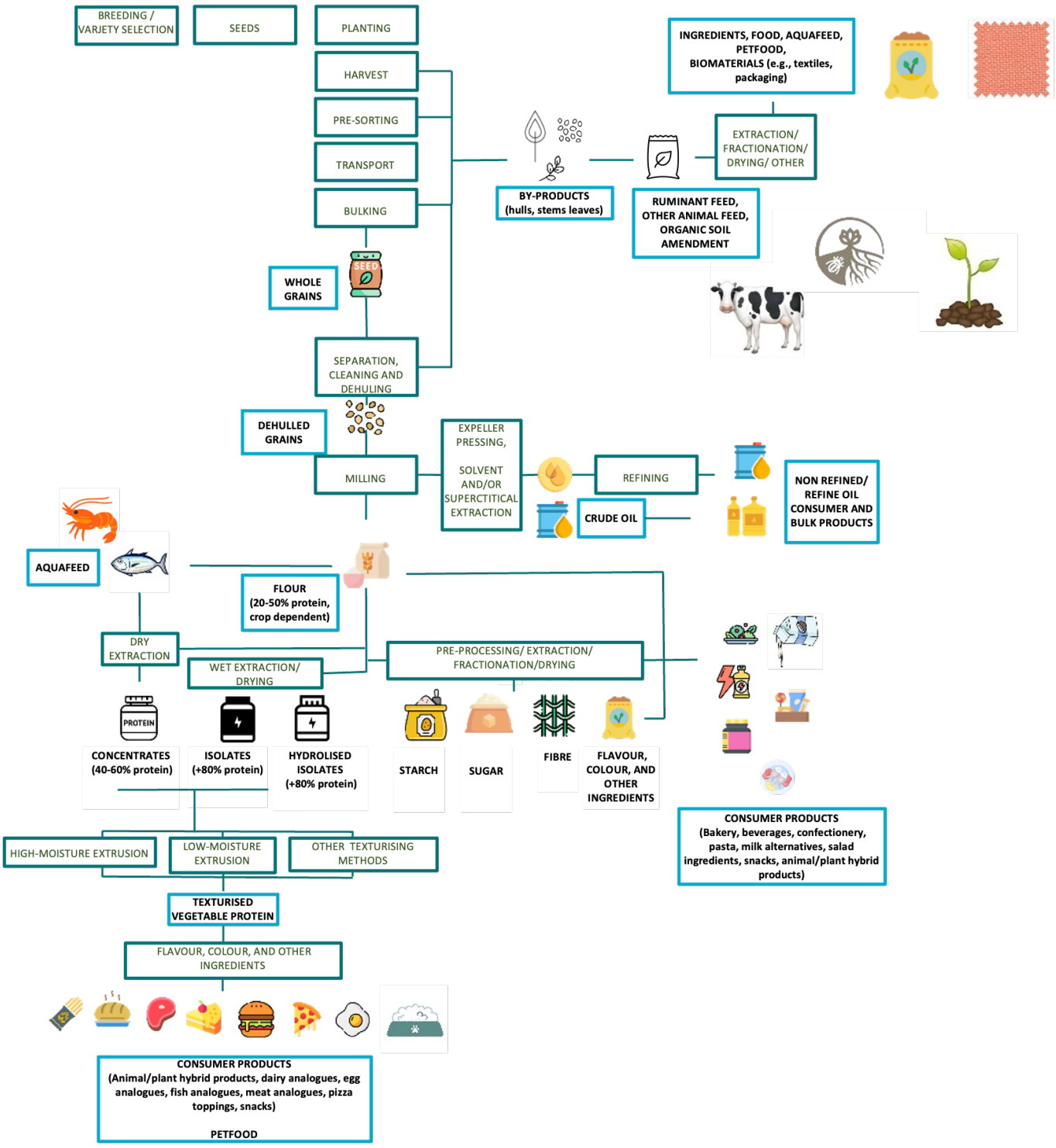

Figure 6. Food units using hemp as identified by the CSIRO

7.4 Fabrics

Hemp-based fabrics have demonstrated superior qualities to synthetic alternatives. As a natural fibre, they are sustainable and environmentally friendly. As described, hemp is a fast-growing plant that requires little to no chemical pesticides, fertilisers and water. Using hemp fibre to produce textiles helps to reduce waste, conserve resources and support the growth of a sustainable and eco-friendly industry.

The advantages of hemp fabrics include:

- **Durable and strong**. Hemp fibres are naturally robust and long-lasting, making the material highly resistant to wear and tear. This reduces the need for frequent replacements, aligning with the current trend by consumers[7] to move away from 'fast fashion' and towards higher quality, longer life clothing[8].
- **Breathable**. Hemp's porous structure allows for optimal airflow, helping to regulate body temperature and making it comfortable to wear in various climates. It also has moisture-wicking properties that helps inhibit the growth of bacteria and reduces the presence of odours.
- **Versatile**. Hemp fabrics can be applied to a wide range of industries including clothing; bedding; home textiles; and industrial sectors such as automotive and construction. Hemp's versatility allows it to be blended with other fibres such as cotton, silk and wool, creating unique textiles that combine the best qualities of different materials.
- **UV resistant**. Hemp fabrics have natural UV protection, making them ideal for outdoor use. This is particularly relevant to uniforms for professions such as law enforcement, first responders, and defence personnel.
- **Hypoallergenic**. Hemp fabrics are naturally hypoallergenic, making them ideal for people with sensitive skin. Again, as an application for uniforms, this ensures that all personnel are able to safely and comfortably wear required clothing.
- **Biodegradable**. Hemp fibres are biodegradable, meaning that they will break down naturally back into the environment at the end of their working life.

There is an increasing demand for natural fibre by consumers, fashion houses, and workforces. Hemp provides the ideal solution to this new trend. Additionally, hemp fabrics have been continually used and are requested from nearby Asian markets.

In collaboration with our technology partners, we are able to provide hemp fabric processing within the advanced manufacturing site. Following decortication, the fibres go through a process of degumming before being separated and spun into twine. We will utilise environmentally friendly degumming processes that minimise the use of chemicals. Similarly, the dyeing process will utilise environmentally friendly processes.

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[7] Alyssa Hardy, *Everything You Need to Know About Fast Fashion* Vogue, April 24, 2024

[8] *Sustainability and Circularity in the Textile Value Chain, A Global Roadmap* United Nations Environment Programme 2023

The establishment of this infrastructure can also be utilised for other fibres that can be supplied from the region utilising the existing rail infrastructure. As mentioned, hemp fibres can be blended with other fibres such as cotton, wool and silk. At present, there is ongoing work to develop a blended hemp ‘superfibre’ that could be produced at site. This fabric, along with other blends or hemp only fabrics can supply local and international demand. As mentioned, there is an eager export market that is seeking a viable supply of hemp and hemp blended fabrics.

The installation of fibre processing machinery at the site will process hemp and other fibres for fabric production. Given the current trends towards sustainable materials, and traditional use of hemp-based and natural fibre garments, there exists a ready export market.

7.5 Biochar

Biochar is produced by the pyrolysis of organic matter. Pyrolysis is the process of heating a substance in the absence of oxygen. The international definition of biochar is ‘the solid substance produced during biomass thermochemical conversion in an oxygen-deficient atmosphere’.[9] Its production can also produce oil and gas byproducts that can be used as a renewable fuel. Another byproduct is wood vinegar, and powerful plant growth stimulant. Pyrolysis machines, or pyrolysers create biochar.

Figure 7. Biochar generated from biomass

Biochar production is a 2,000-year-old practice that converts agricultural waste into a soil enhancer that can hold carbon, boost food security and increase soil biodiversity. It is applied to soil to enrich the carbon content and encourage microbial growth on active sites within the biochar.

[9] Sivasubramanian Manikandan, Sundaram Vickram, Ramasamy Subbaiya, Natchimuthu Karmegam, Soon Woong Chang, Balasubramani Ravindran, Mukesh Kumar Awasthi,
Comprehensive review on recent production trends and applications of biochar for greener environment,
Bioresource Technology, Volume 388, 2023, 129725

Biochar presents many benefits in its production and use. These include:

- **Carbon capture**. The carbon in biochar resists degradation and can hold carbon in soils for hundreds of years.
- **Reduced nitrous oxide (N_2O) soil emissions.**
- **Reduced methane soil emissions.** Biochar has been shown to influence soil gas fluxes.
- **Reduced odours**. Biochar has a high specific area and microporous structure that is suitable for sorption purposes.
- **Decreased nutrient runoff**. Biochar improves water quality and quantity by increasing soil retention of nutrients for plant utilisation.
- **Increased soil carbon**.
- **Increased soil fertility**.

Its use and distribution is being encouraged amongst Wandarra's contract farmers in North Queensland as a means to encourage sustainable regenerative farming and repair the impacts of 100 years of monocropping.

Biochar production is an effective means of organic waste disposal that produces valuable products. It provides another community benefit to transform their waste into products that are useful to them. Careful selection of the correct technology is essential in maximising the production capacity that can be achieved.

Through our technology partnerships, we can install and commission a pyrolyser to transform 'waste' hemp or similar products, along with agricultural waste from the site, into biochar. Additionally, the pyrolyser can process agricultural waste and food organics and garden organics (FOGO) waste from the region, providing a sustainable avenue for the community to dispose of organic waste. This waste is then converted into a valuable resource that can be returned to the local and national agricultural sector to reduce synthetic fertiliser use, improve soil quality and establish greater circularity within the agricultural supply chains.

7.6 Machining

Although an inventory of machinery has not been reviewed, it is expected that machining equipment already exist on-site. This equipment can be repurposed for a variety of uses within the advanced manufacturing section of the site. These include:

- Custom machining of parts for other process lines within advanced manufacturing
- Custom machining of piping and joints for process lines within advanced manufacturing
- Maintenance of parts for other process lines within advanced manufacturing
- Production of collector units for concentrated solar thermal (CST) units and associated equipment

The machining unit is essential for on-site work, but can also provide expert services to business in the greater area. This provides a social service to small businesses that cannot purchase or use large scale equipment.

7.7 Defence Applications

Hemp's inherent strength and nutritional value provides opportunities to support the defence industries. As mentioned, our technology partner produces hemp-based construction materials. They have also developed in-house Intellectual Property and expertise to modify their formulations to create ballistic resistant panels. Although these products are still relatively new within their lineup, they are being tested and further developed with a range of applications in mind including lightweight ballistic armouring of vehicles.

The advantages of hemp fabrics have already been highlighted. The use of hemp fabrics for military personnel provides long-wearing and comfortable uniforms that can be reinforced to be more resistant to tears and damage.

As identified by the CSIRO hemp-based foods are packed with nutrition and provide essential omegas, vitamins, minerals and protein. These products can be easily integrated into defence ration packs without negative impact to flavour or texture whilst increasing the nutritional value.

8.0 Renewable Energy

8.1 Concentrated Solar Thermal (CST)

The initial concept for the re-use of the site after 2030 includes renewable energy production via pumped-hydro and photovoltaic (PV) solar farm projects. As an alternative to these, we recommend the use of solar thermal technologies. Through our Australian technology partner and using their proprietary, patented CST technologies, we can establish a CST farm to provide industrial grade heat for large scale agricultural and industrial processes; dewatering; process heat and steam; chilling; desalination; and energy production.

Utilising heat from the sun, collector panels concentrate and capture heat for practical applications either as heat, or to create steam. **CST is more efficient than conventional PV technology, requiring less space per MW**. **Additionally, the CST units have a lower embedded carbon footprint than PV and do not require rare earth or critical minerals in their production.**

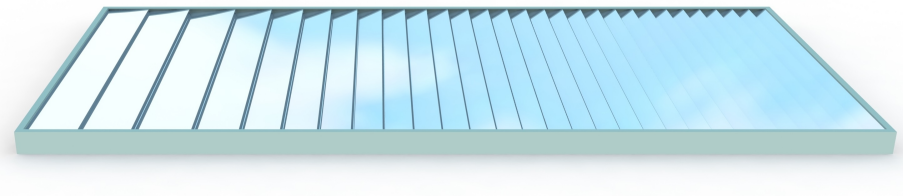

Figure 8. Australian designed CST panel

Our technology partner's CST units are Australian designed and made, and as they do not use glass mirrors, they provide dramatic savings in weight, installation time, and safety. After their 25+ year lifespan, all the components can be recycled providing complete circularity.

The benefits of CST include:

- Low-cost production of industrial grade heat up to 400ºC
- Green heat production from the sun for 30-70 per cent less than the price of gas
- ‘Battery’ storage of heat via molten salt or thermal bricks for use at a later time
- Heat and hot water production
- Drying applications such as grain or timber
- The potential for Green Hydrogen production

Figure 9. CST solar farm

The judicious selection of this technology and technology partner also provides a unique advantage. That is, the potential to produce the CST units on-site within the advanced manufacturing area. The CST units have both national and international application, with local advanced on-site manufacturing protecting Intellectual Property and supplying the export market.

Overall, CST provides greater flexibility in the applications that it can service, especially those that can be developed at site including agriculture, advanced manufacturing and energy production.

8.2 Small Scale Bioenergy Production

Bioenergy is a form of renewable energy generated from the conversion of biomass into heat, electricity, biogas and liquid fuel.[10] ARENA have identified that bioenergy has the scope to expand as an energy source in Australia, currently contributing 5 per cent of Australia's total clean energy generation compared to 7 per cent in other OECD countries and 59 per cent in the European Union.[11]

Given the on-site power demands of the advanced manufacturing area, along with the proximity to high voltage transmission lines that can "export" energy to the grid, renewable energy production generated via biomass is recommended. It is recommended that this biomass be generated from the following sources:

- Any hemp (or similar plant type/s grown) or agricultural waste that is generated on-site
- Invasive weed species in the region

The use of agricultural waste products as a renewable energy source provides a zero-waste solution. The collection of weed species, particularly woody weed species from the region provides another ongoing feedstock and greatly assists with non-chemical weed control. It turns on-site waste and problem organics into valuable resources.

Assuming that CST is utilised on-site, the heat and/or steam that is created can be directed to a bioenergy plant to co-generate power within the same piece of infrastructure.

The introduction of a bioenergy production facility provides many benefits. These include:

- Renewable energy production
- Energy production from a small footprint
- Consumption of waste materials as a feedstock creating a zero-waste scenario
- Consumption of problematic invasive weed species as a feedstock
- On-site use of energy within advanced manufacturing facilities
- Renewable energy supply to the grid
- Co-generation with CST within the same infrastructure

[10] https://arena.gov.au/renewable-energy/bioenergy/

[11] https://energy.ec.europa.eu/news/bioenergy-report-outlines-progress-being-made-across-eu-2023-10-27_en

9.0 Social Benefits

A project of this magnitude has the capacity to reshape communities for generations. Currently there are approximately 2,200 workers, of which at least 800 that will require retraining, repurposing or reskilling. Within this response to inquiry are a number of advanced manufacturing components that can utilise the existing workforce and their skillset, creating a green workforce that will last into the future. Future additions to the advanced manufacturing business units will further cater for more employment opportunities.

9.1 Transitioning of the Current Workforce

A change to the operational future of this magnitude will always have an impact on the local communities and social fabric. The goal is to minimise the negative social impact and lay foundations for a better overall future. Developing advanced manufacturing at the site will establish new supply and service chains whilst still incorporating some previous services including trades such as electricians, plumbers, etc. The advanced manufacturing sector promises to establish a new green workforce, transitioning workers into a long-term career in the sustainability sectors.

9.2 New Business Development

Establishing a range of new businesses, including agriculture and horticulture, will also provide new work opportunities for salespeople, finance and accounting, and administrative roles.

Based on the recommendations in this response to inquiry, businesses in the greater region can be more engaged. This may be through the use of advanced machinery on site; through material supply such as cotton or wool; or the supply of waste material as a resource such as feedstock for biochar.

9.3 Environmental

The social impact of creating green jobs and green technology extends across the State and the country. Green construction products have the potential to address current difficulties with building products and the growing housing crisis. Green construction products made at site can provide material for government housing, including indigenous housing programs. Green fabrics help strengthen and expand the Australian fashion industry and have immense export opportunities.

As mentioned, the growth of industrial hemp has very positive environmental benefits, including acting as a carbon sink. Ongoing growth and development at the site will greatly assist the NSW State Government's climate objectives and set an example to other parts of the country.

As demonstrated, the proposed approach in this response to inquiry is circular, with an emphasis on zero waste. In fact, our approach treats waste as a resource to increase value. For e.g. biochar production from waste materials to distribute for use in agriculture, generating carbon credit certificates, promoting regenerative farming, reducing the use of fertilisers and enhancing soil conditions for generations to come.

10.0 Overall

In summation, transformation will be achieved by repurposing the site into a sustainability hub that utilises crops such as industrial hemp to act as a feedstock into advanced manufacturing, operates with a zero-waste goal and is powered by renewable energy.

Our response to inquiry highlights our belief that the 2030 visualisation can become a model of beneficial and productive post-mining land use.

Transitioning the region and the site into a vibrant green economy business centre is a once in a generation opportunity that we can support and be instrumental in achieving alongside the State Government and the site land-owner.

11.0 Contact

Advanced Simplicity Pty Ltd