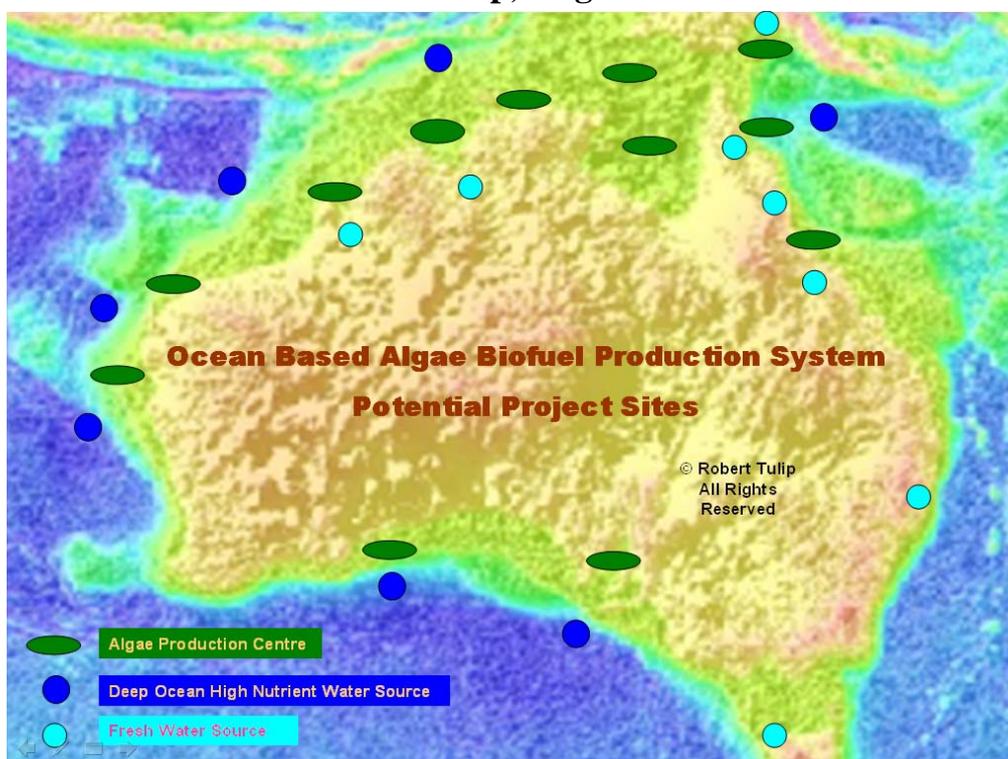


Business Plan Concept Note

Algae Biofuel Feedstock Project

Robert Tulip, August 2009



Part A: Description of the Business Opportunity

1. *Is the business opportunity as presented both highly attractive and clearly realistic?*

1.1. The venture will build a large scale system to produce diesel fuel and other products from algae grown in the ocean. It will produce competitively priced biofuel, scaling up carbon capture for a range of major environmental, economic, social and climate benefits. The business model is attractive and realistic, using new proprietary technology to produce biofuel feedstock on a large scale at low price for existing customers.

1.2. World wide research efforts¹ have focussed on producing algae biofuel feedstock as a response to declining fossil fuel reserves and the need to reverse carbon emission trends. Our proposal combines existing algae research findings with new inventions, using the fact that fresh water floats on salt water to develop innovative technologies that will enable large scale biofuel feedstock production in the ocean at low cost and low risk.

1.3. The venture will use large floating ocean-based polymer bags as photo-bioreactors, and will utilise simple new proprietary renewable energy technologies, primarily tidal and wave energy, for pumping of water and air as part of an algae oil production system. These new technologies are shown on the attached provisional patent application, lodged in July 2009.

1.4. Proposed potential locations, subject to prioritisation by local feasibility criteria, are shown on the map above. Initially, the North West Shelf of Western Australia appears most

¹ Discussions on algae biofuel research are available at sites such as the Yahoo technical group Oil From Algae and the website www.oilgae.com.

promising. Other potential domestic sites, as shown, include the Timor Sea, Arafura Sea, the Gulf of Carpentaria, the east coastal waters of Queensland, and South Australia.

1.5. The shallow warm sheltered waters of northern Australia are ideal for marine based algae production. The venture will pump nutrient from deep water, for example from the North Australian Basin, and transform it into concentrated algae oil as feedstock to existing biofuel refineries. Factors guiding location include environmental assessment, the views of commercial partners, and the logistics for sourcing inputs and supplying customers.

1.6. The venture has strong technological feasibility and highly profitable cash flow projections. Utilizing links with established major firms with strong technical capacity and financial resources, it will serve the existing large commercial market for diesel fuel.

1.7. The technical innovations of this venture offer a clear transition path for current energy and transport systems to a low-emission future, with major benefits for mitigating and adapting to climate change. The venture provides a method to reduce atmospheric CO₂ level by obtaining the carbon used to grow the algae from the atmosphere or from emitters. As well as the main benefit for climate change mitigation, co-benefits include diesel fuel supply, employment generation, economic growth, food production, fertilizer production, water supply and storage, and environmental protection.

1.8. The proposal presents a new technology with processes and methods to remove anthropogenic greenhouse gases from the atmosphere to improve the stability of the Earth's climate through a large scale rapid response.

2. *Does the proposal reflect an unanticipated or unusual application of the research creating new value?*

2.1. By combining new technologies that are innovative and simple, the venture will create large scale new value with strong environmental and economic benefits. The venture will use inputs which are available abundantly at no purchase cost, and will apply new low-cost bulk processing and transport methods to generate product. Existing methods for commercial production of algae biofuel feedstock will be taken to a new level through the proprietary methods in the venture.

2.2. Selected species of algae have been shown to grow up to fifty times faster and make correspondingly more oil than land-based crops. The algae industry is constrained by the expense of using current technology to scale up to large commercial production levels, and has not yet commercialised its natural advantage on a large scale.

2.3. In this venture, new intellectual property is combined in a proprietary system that will be commercially competitive against all other fuel sources, while also making large contribution to CO₂ emission reduction.

3. *Does the proposal have a chance to redefine an existing marketplace or create a new one?*

3.1. The biofuel market is constrained by problems of existing feedstock sources such as palm oil and cereals. These sources are expensive, have adverse environmental impact and displace food production. The venture will help to reduce food prices and protect the environment by competing against tree crops and cereals as a biofuel feedstock.

3.2. The venture will redefine the biofuel market by solving the problems of producing commercial biodiesel from algae, including feedstock availability, cost, logistics, land use and environmental impact.

3.3. By enabling ongoing use of the internal combustion engine with a fuel source producing zero net carbon emissions, the venture will redefine future vehicle fuel supply options.

3.4. Our system is very commercially attractive compared to subterranean carbon capture and storage (CCS) as an alternative use for CO₂ produced by industry (eg Barrow Island in Western Australia). Our venture can co-locate with emission sites or potentially tow CO₂ in polymer bags through the ocean to the algae production centre from emission sites such as gas fields, power stations, ammonia factories, cement factories etc. By creating a market for CO₂ our venture could replace some other methods of CCS.

4. *Does the proposal lend itself to an entrepreneurial new venture or as part of the infrastructure of an established enterprise?*

4.1. The proposal lends itself to an entrepreneurial new venture, working in partnership with existing firms in the oil and gas industry, in biodiesel refining, in water supply and sanitation, in shipping and in algae production.

5. *What comparisons are there to past success stories that indicate this venture will succeed?*

5.1. The aviation industry, transport of liquefied natural gas and containerisation of shipping are comparable large scale industries which have used innovative technology to create successful new business enterprises with major transformative economic impact.

5.2. This venture aims eventually to be as big as these main world industries, through capacity to replicate world wide in the open ocean as a cost-effective method to remove anthropogenic carbon from the atmosphere and reduce ocean temperature, sustained by an income stream from sale of diesel feedstock and other commodities.

6. *Can this venture achieve a leadership position in its market?*

6.1. This venture will achieve a leadership position in the energy sector through protection of intellectual property and strong governance arrangements, using highly innovative but simple new technologies as an early mover in commercialising algae biofuel feedstock production at large scale.

7. *Why is this business going to be around and a real winner in 5 years?*

7.1. This business will be successful over the medium and long term by commercialising new technology to provide low priced zero emission fuel for existing vehicles, providing a practical way to reduce atmospheric CO₂ levels, and providing a new method for ocean-based fish farming and water transport and storage. Replicated on a world scale, our simple scaleable method to remove anthropogenic carbon dioxide from the air could remove more carbon than total world emissions, pushing the atmospheric CO₂ level down towards safe levels of around 300 parts per million over the coming decades.

7.2. Other products from the business will include highly productive enclosed fish farms, a low cost method to remove pollutants from ocean or river water, localised cooling of ocean water, such as on the Great Barrier Reef, fresh water transport and storage, and soil fertilizer such as bio-char.

7.3. Very large areas of the ocean can be made productive at low cost using waterbag algae photo-bioreactors. 50 million square kilometres of ocean is classed as 'ocean desert',² with very low chlorophyll production, an area estimated by NASA to be growing by more than 10% per year due to global warming. Within ten years our business will start to make these large areas of the world ocean productive, with immense global benefits for security of fuel, food, water, environment and climate.

² Information including NASA maps on ocean deserts is available at http://images.suite101.com/328567_com_globe2.jpg and http://environmentalism.suite101.com/article.cfm/ocean_desert_areas_are_escalating.

7.4. Fossil fuel reserves are declining, leading to inevitable peaking of petroleum production. The large carbon emissions of fossil fuel energy sources have major impact on climate change. These factors make the development of new environmentally beneficial biofuels and related climate change mitigation technologies essential and urgent.

7.5. Our technology will reduce commercial pressure to clear tropical rainforests for palm oil production by providing a less expensive biofuel feedstock than palm oil, hence making palm oil less profitable.

8. *Does the proposal identify or anticipate business issues that a successful commercialisation might entail?*

8.1. Major business issues for successful commercialisation include strategic alliances with partners and customers, patenting of innovative methods, development of corporate structure and full business plan, mobilising human capital especially in engineering, communications strategy, piloting of technology, obtaining finance, technology research and development, and achieving supportive regulatory frameworks regarding location, environmental assessment and carbon offset status.

9. *What is the business model?*

9.1. The business model is a new venture to supply feedstock to biodiesel refineries using safe new renewable technologies to produce, compress and transport large scale contained algal blooms at sea.

9.2. The system will

9.2.1. pump nutrients from the deep ocean, for example from the North Australian Basin, to the surface using proprietary wave and tidal power systems;

9.2.2. mix the nutrient with high lipid content algae³, fresh water and air/CO₂ in a shallow wide fabric polymer sack floating on the ocean surface; and

9.2.3. utilise polymer bags containing fresh or salt water for a range of buoyancy, storm protection, pumping, de-watering, transport, storage and propulsion tasks.

9.3. The system will be optimized to combine nutrient, carbon dioxide, algae, fresh water and salt water to mimic natural production of algae blooms in the ocean within a controlled environment. It will use deep ocean water as feedstock, and use the waterbags' vertical motion in the ocean waves and tide as power source for pumping and movement. The 'bio-mimicry' involves replicating the up-welling of deep ocean currents, a natural process which is the primary nutrient source for the world's most productive fisheries. The process will mimic the original natural process of deposition of petroleum from algae in shallow seas over millions of years, made much faster through modern technology.

9.4. Proposed partners include existing oil and gas companies, biodiesel refineries, Spragg and Associates waterbags, CSIRO and other agencies involved in algae research, and government authorities.

9.5. The aim is to provide initial delivery of biofuel feedstock suitable for refining into biodiesel about one year after receipt of finance from an ocean-based pilot facility 0.5 hectares in size.

9.6. The project goal is to produce more than five tonnes of dry weight algae per hectare per day. This level of production is above current algae industry projections.⁴ Initial estimates for production are two tonnes dry weight algae per hectare per day.

9.7. This production goal assumes that indicative daily input of 0.5 megalitres of nutrient-rich deep ocean water per hectare will produce algal blooms containing one percent algae and

³ Botryococcus braunii http://en.wikipedia.org/wiki/Botryococcus_braunii

⁴ <http://www.valcent.net> claims that algae can produce up to 4000 litres of oil per hectare per day.

99% water over a period of 20 days, based on doubling rates of around two days from input of ten kilograms of algae, in a continuous production system. A proprietary technology will de-water produced algae, enabling transport of concentrated biofuel feedstock in towed trains of polymer bags for refining.

9.8. Initial modelling will prove the safety and feasibility of the technology, prior to piloting at sea. Environmental safety, including prevention of algae spillage in storms, will be a main goal, and will be delivered through proprietary methods. In the event of storm, the entire system will be lowered beneath the waves to safe depth by expulsion of air used for system buoyancy. Loss of algae would have minimal adverse environmental impact.

9.9. At indicative commercial scale of 100 square kilometres of algae production, the venture would use less than 0.01% of available ocean space in the shallow waters stretching from the Exmouth Plateau to the Gulf of Carpentaria including the Timor Sea and the Arafura Sea. These four seas have total area of more than one million square kilometres.

9.10. At one kilolitre of algae oil per hectare per day, with eventual operations at 100 km² of ocean or 10,000 hectares, the venture would produce more than three gigalitres of fuel oil per year, worth almost three billion dollars, as well as CO₂ reduction and non-oil products suitable for bio-char, enclosed fish farming, fertilizer, water supply and other uses.

9.11. All carbon will be extracted from the atmosphere or from emitters rather than from fossil fuels, with strong eligibility for carbon offset and re-use programs, giving strong incentive for high emission industries to invest in the venture.

9.12. Following initial operations, the project will replicate elsewhere, including in the deep ocean, producing large material impact on climate change mitigation (CO₂ level and ocean temperature) and climate change adaptation (production of new low-net-emission fuel oil).

Part B. Capability of the management team

10. Is the team of sufficient breadth, balance and quality to make the ideas happen?

10.1. Mr Robert Tulip, proposal originator, technology inventor and team leader, has worked for twenty years for the Australian Agency for International Development. He has extensive experience in project management, financial management, policy analysis, development research and commercial contracting. He has worked on Australia's aid programs in infrastructure, rural development, private sector development, academic research and carbon emission reduction through forestry, in Australia and Papua New Guinea.

10.2. Mr Tulip's experience in the international development industry has included a focus on key themes for this proposal. These include the role of technological innovation to mitigate climate change, private sector investment for economic growth, new approaches for carbon emission reduction, negotiating strategic partnerships for common goals, and project management and communication skills. The proposal has been developed separately from AusAID, while making use of expertise gained in a range of development contexts.

10.3. Mr Tulip has developed this proposal in association with Mr Terry Spragg, inventor of the Spragg Waterbag, and in consultation with climate and algae experts. The scale and innovative nature of the proposal means that it can only be taken forward in cooperation with major oil and gas firms such as the Gorgon Joint Venture partners.

10.4. Waterbag technology has been demonstrated by Mr Terry Spragg in successful ocean and laboratory trials in the USA. All the technology used for Spragg Waterbags is available for this venture. Using large scale ocean based polymer waterbags for water transport and storage is a closely related potential business application, as described in the attached submission to the Garnaut Climate Review. A commercially-funded waterbag demonstration voyage is an early related objective to assess polymer materials and construction and transport methods for robust and durable operation at sea.

11. Is the team focused on its target market?

11.1. No discussion has yet occurred with potential commercial partners. The major benefits in carbon offsets and renewable fuel supply are expected to motivate strong interest, especially among resource companies active in Western Australia and the Timor Sea.

11.2. The strong commercial potential for the venture, and its clear alignment with the missions of the proposed partner firms, provide major incentives for success. Subject to obtaining commercial funding Mr Tulip is able to work full time on the venture.

12. Do the market and financial projections demonstrate that the team understands its business?

12.1. The key claim for the business, supported by market financial projections is that ocean-based algae production will be significantly more cost-effective and scalable than land-based production. By establishing a new climate-friendly and cost-effective liquid fuel source, the venture will address a main central problem for the Australian and world economy. Projected demand for diesel is extremely high, and there is strong indication the process will be extremely commercially competitive and environmentally safe and beneficial. Technical expertise is readily available in the oil, water, algae, shipping and biofuel industries to develop the components of the process.

Part C. Outline the marketing strategy, including:

13. Identification and a brief description of the potential customer(s) including a demonstration market analysis, the target market, and the marketing strategy to promote the enterprise.

13.1. Biofuel is emerging as a major new industry. The main potential customers are biofuel refineries which are now struggling due to high price of feedstock.

13.2. The high price and environmental impact of land-based biofuel feedstock, including palm oil for diesel and cereals for ethanol, indicate that an effective technological answer to the problems of scaling up algae production will establish a strong commodity market.

13.3. The oil industry and other partners have ready access to capital and expertise to promote and implement the enterprise.

14. Does the proposal show a thorough understanding of the competition for the proposed product/service?

14.1. A range of parties are developing new algae biofuel technology, with widespread international effort to market land-based commercial products using photo-bioreactors and raceway ponds. Our venture has several material advantages over land-based algae production. New technology to access the abundant nutrients and energy of the ocean will keep costs low and drive competitive advantage. Utilising the highly innovative recognition that fresh water floats on salt water, and that polymer bags of fresh water can enable ocean based algae production, will enable rapid scale up. Linking algae production to the use of floating fresh water polymer bags at sea will solve problems in the algae industry of scaling up input supply, energy source and delivering to market.

14.2. Alternative approaches to carbon emission reduction such as subterranean carbon capture and storage technology are in competition as strategies to mitigate climate change. Our aim is to make subterranean CCS commercially uncompetitive by providing a profitable use for waste carbon dioxide.

14.3. The venture will be profitable if we can produce biofuel for less than the current crude oil market price of around A\$75 per barrel.

15. Has the team gone out to the market already to test its ideas?

15.1. The Spragg Waterbag, a component technology, has sought support for an Australian demonstration (proposal attached). Constraints include jurisdictional issues, low value of water as a product, and market capture by desalination, pipelines and dams. The proposed

venture utilises the intellectual property of Spragg and Associates regarding polymer waterbag technology, while developing new intellectual property for algae production.

Part D. Present the financial proposition that may include:

16. An outline of the proposed financials for the business and its cash flow projections for the first 12 months. Describe establishment costs and on-going cost finance or explain how the pricing structure was determined.

16.1. Proposed size of pilot production system is 0.5 hectares. Financial modelling is premised on producing 1000 litres of oil per hectare per day after one year, for annual system production of 2,000,000 litres of oil, expanding over ten years to 3000 litres per hectare per day through improved productivity.

16.2. 1000 litres of diesel fuel is worth A\$470 at current crude oil price of A\$75 per barrel, and \$790 at price of \$100 per barrel. Non-oil co-products (protein, carbohydrate and carbon offsets) have roughly estimated net commodity value of \$120 per 1000 litres of oil produced.

16.3. Operating costs are estimated at \$600,000 per year, increasing by 5% per annum, for staffing, materials and processing, including use of funds for system expansion.

17. What is the amount of up-front capital investment required?

17.1. A 0.5 hectare system is estimated to require \$4 million in up-front capital for establishment costs including materials and staff, following laboratory proof of concept. Unit costs for subsequent replication will be much lower due to economies of scale and streamlining of production methods.

18. How long will it take from the current stage of development to bring to market?

18.1. With finance, we estimate that commercial production is possible within two years.

19. What is the expected time and amount of pay-off to investors?

19.1. On this costing, the system would achieve internal rate of return of 25% after ten years, and would repay its capital cost in five years. The repayment period would be shorter if larger CO2 capture subsidies are available, linked to Carbon Pollution Reduction Scheme offsets and international climate change mitigation and adaptation measures, if production exceeds targets, or if oil price increases faster than projected (above A\$0.70 per litre after ten years). Successful replication would produce even better financial results. The system will provide ongoing assured high dividends due to low operation cost, low risks, large established diesel market and effective contribution to mitigation of climate change.

20. Does the team have a clear plan for spending the investment money it receives?

20.1. Seed funds will be used to mobilise investment, aiming to raise around \$4 million from the private sector. Investment funds will be directed to recruitment of an engineering team for initial development of a proof-of-concept model, followed by sea-based pilot project.

21. Net present values or the internal rate of return.

| Algae Biofuel Feedstock Pilot | | | | | | | |
|--------------------------------------------------------------|--------------|------------------------------------|--------------------------------------------|--------------------|--------------------------------|-------------------------|-------------------|
| Estimated Production Volumes and Financial Projections (AUD) | | | | | | | |
| Year | Oil Produced | Oil Income | Other Income | Operating Costs | Net Annual Income | Internal Rate of Return | Net Present Value |
| | Litres | rising from \$0.50 to \$0.70/litre | Carbon Offsets, Fertilizer, Fish food, etc | Increase @ 5% p.a. | Starting Capital (\$4,000,000) | | Discount Rate 9% |
| 1 | 0 | - | - | 600,000 | (600,000) | | (\$4,174,733) |
| 2 | 2,000,000 | 1,000,000 | 240,000 | 630,000 | 610,000 | | (\$3,703,701) |
| 3 | 2,500,000 | 1,312,500 | 300,000 | 661,500 | 951,000 | | (\$3,029,988) |
| 4 | 3,000,000 | 1,650,000 | 360,000 | 694,575 | 1,315,425 | | (\$2,175,052) |
| 5 | 3,500,000 | 2,012,500 | 420,000 | 729,304 | 1,703,196 | 0% | (\$1,159,492) |
| 6 | 4,000,000 | 2,400,000 | 480,000 | 765,769 | 2,114,231 | 9% | (\$2,935) |
| 7 | 4,500,000 | 2,812,500 | 540,000 | 804,057 | 2,548,443 | 15% | \$1,276,042 |
| 8 | 5,000,000 | 3,250,000 | 600,000 | 844,260 | 3,005,740 | 20% | \$2,659,968 |
| 9 | 5,500,000 | 3,712,500 | 660,000 | 886,473 | 3,486,027 | 23% | \$4,132,503 |
| 10 | 6,000,000 | 4,200,000 | 720,000 | 930,797 | 3,989,203 | 25% | \$5,678,451 |

Contact: Robert Tulip, phone 0407 866777, email waterbagaustralia@yahoo.com.au