



## AusBiotech submission to the Queensland BioFutures 10-year Roadmap Consultation Paper

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## Introduction

AusBiotech is pleased to submit to this consultation regarding Queensland Biofutures 10-Year Roadmap. The submission represents a collation of comments and submissions from AusBiotech members engaged in delivering agricultural and industrial biotechnology innovation to Australian industry either through research and development activities and/or pathway to market commercialisation activities in agricultural and industrial biotechnology.

AusBiotech is a well-connected network of over 3,000 members in the life sciences industry, which includes bio-therapeutics, medical technology, food technology, industrial and agricultural biotechnology sectors.

AusBiotech welcomes the Queensland Government's recognition of the importance of a sustainable industrial biotechnology sector and the vision to focus on regional areas with the appropriate land and climate resources.

The demand for biofuels and bioproducts is increasing at a significant rate globally. The World Economic Forum estimates in five years, by 2020, the market for biofuels, bioplastics and biochemicals will be \$100 billion annually. AusBiotech would like to see Queensland positioned as part of this global "Bio-boom".

Queensland's tropical climate and large agricultural sector produces significant volumes of biological material, directly as food and fibre products, and also as by-products – often waste materials available at little or no cost. There is a major opportunity to profitably convert these biological materials into chemicals, plastics, building products, fuels and energy.

Queensland is a major producer of several potential feedstocks including grains, sugar cane, cotton and horticulture from our plant industries, and waste and by-products from our animal industry production. Hence there is a significant opportunity to convert renewable feedstocks into a diverse range of bioproducts and bioenergy.

A range of industries with renewable resources (direct products and waste and by-products) that could be used as feedstocks include:

- Grains - sorghum / corn / wheat / barley / rice
- Oilseeds – rape / soybean / peanut / sunflower / safflower
- Fibre – cotton / hemp / kenaf / jute / bagasse
- Sugarcane / crop stubbles / algae
- Horticulture
- Forestry – introduced (*Pinus sp.*) and natives (including eucalypts and brigalow)
- Cattle – beef and dairy
- Pigs / chickens.

Queensland has enviable resources in terms of:

- Land area and suitable soils
- Climate, with year-round growing conditions in many parts of Queensland
- Water resources and delivery infrastructure, with the opportunity for further developments
- Research institutions, including universities, CSIRO, state government departments
- Expertise in key areas of technology delivery
- Industries and businesses 'hungry' to be part of the solution in commercialising opportunities
- Strong labour force with significant opportunities for job creation
- Significant infrastructure in terms of roads, rail and ports.

Queensland would benefit from explicitly fostering environments to enable bioproducts and bioenergy industries to grow and develop. These bioproducts (including biochemicals and biofuels) are often sustainable in the long term when compared to the current petrochemical based products and fossil fuels, which can have detrimental impacts on our climate and environment.

### ***Developing industrial biotechnologies***

There are currently three commercial biorefineries in Queensland that use conventional first-generation production techniques. These currently produce more than 170 million litres of biofuel. A 2014 Deloitte Access Economics report modelled seven potential new facilities throughout Queensland using several arid, tropical and sub-tropical crops. By 2015, the annual impact of the modelled biorefineries is expected to be over \$1.8 billion, and the net present value (NPV) of their contribution over the modelled period is in excess of \$21.5 billion.

These new modelled refineries utilised the following as feedstocks:

- Greenfield sugarcane
- Green agricultural waste
- Sugarcane bagasse
- Brigalow regrowth
- Forestry Residue
- Sweet sorghum
- Sorghum stover

### ***Bioenergy***

In addition to the opportunities for biofuel production, there are also significant opportunities for biogas production from Queensland's animal industries. Bioenergy currently only contributes 7.9% of Australia's clean energy generation and less than 1% of Australia's total energy generation.

Bioenergy technologies such as biogas can be incorporated into existing operations to provide elegant solutions to turn waste into power, heat and other valuable by-products such as fertiliser.

In 2015, the Nipponham Group (NH Foods Ltd) officially opened its new facility at its Oakey Beef Exports facility to collect and utilise biogas for energy. Utilising the biogas will produce 183 gigajoules of energy per day, and utilisation of this green energy will save the equivalent of 12,000 tonnes of carbon dioxide, equivalent to removing 2,700 cars from the road. In addition, the anaerobic digestion produces a reliable and predictable base load of power.

Several Queensland piggeries also operate biogas energy utilisation. The key benefits tend to be:

- Reduced odour and greenhouse gas emissions
- More complete digestion of waste products
- Improved regulatory compliance
- Reduced carbon footprint
- Reduced operating costs
- Cleaner production, which provides marketing advantages over other protein food sources.

There are a range of opportunities for Queensland's intensive animal industries to utilise biogas for energy production and consumption.

Within municipalities there are significant opportunities to better utilise biogas from landfills. Municipal solid waste, when first deposited, typically undergoes aerobic decomposition when little methane is generated. Typically within a year anaerobic conditions are established and methane-producing bacteria begin to decompose the waste and generate methane. Methane is a potent

greenhouse gas, so opportunities to capture and utilise it for energy should be encouraged. Landfill gas is typically produced for 20 to 30 years after the solid waste is landfilled.

The commercial waste management company J.J.Richards & Sons Pty Ltd is currently capturing biogas from some Queensland landfills and on a relatively small scale are utilising some of this biogas for energy production. Through government programs and initiatives, establishing an environment that encourages greater utilisation of biogas would support the viability of businesses such as J.J.Richards & Sons.

The development of renewable, partially and completely biodegradable, environmentally friendly polymer and fibre-reinforced biocomposites from agricultural biomass and residues offer the potential to reduce our dependence upon petroleum and other non-renewable resources. These products can provide a better or comparable strength than traditional materials.

#### *Biocomposites*

A range of agricultural and bast (phloem) fibres are a useful, strong and flexible raw material, because they are an environmentally renewable, reusable and recyclable resource. Manufacturers use bast fibre in plastic composites, insulation and as a substitute for traditional wood products and synthetic fibres and a wide range of agricultural fibre products now exist on the market.

Development of biocomposites materials from hemp, kenaf, jute and flax fibre is still ongoing in the research sector. Different production processes of the biocomposite are being investigated. The biocomposite materials in extrusion, injection, compression and rotation moulding grade are being investigated and developed to comply with the existing industrial processes. The utilisation of natural fibres as supplement reinforcement for vacuum resin transfer moulding is being introduced to the existing production in the fiberglass reinforced plastic industries. New techniques are being developed to manufacture the new products such as bioshingle, composite board and eco-block for construction industries.

There is an important role for government to play in encouraging the development and growth of the bioproducts and bioenergy industries. In particular, governments can make a contribution by supporting initiatives that foster collaboration between industry and research institutions, that ensure the necessary infrastructure and skill base exist to see research outcomes translated into commercial products and to promote a business environment that attracts investment from domestic and international organisations.

## Response to Specific Submission Questions

### ***What could a successful industrial biotechnology sector in Queensland look like in 10 years?***

A successful industrial biotechnology sector would require collaborative linkages and partnerships from researchers, industry bodies and government. Such collaborations should deliver investment-ready technologies that generate both economic and social benefits.

A successful industrial biotechnology sector would include a range of small to large businesses and industries utilising new technologies that have been sourced from domestic and international research.

A successful industrial biotechnology sector might include:

- Greater acceptance and use of biogas and biofuels, in combinations with other renewable energy sources including solar, wind, hydro and thermal energy.
- Increased utilisation of renewable agricultural products directly, or as secondary and waste products for development of plastics, building materials, and other biocomposite uses.
- Greater acceptance and use of biological pesticides.
- Greater acceptance and use of GMO technologies in fibre and food production in order to feed increasing global populations and provide feedstock for bioproducts and bioenergy.
- Utilisation of renewable resources for fuels, and chemical and medicine development, and for building products.

### ***What are the key challenges to the development of a commercial industrial biotechnology sector in Queensland?***

The key challenges to the development of a commercial industrial biotechnology sector in Queensland are:

- Encouraging investment in Queensland biotechnology.
- Developing better linkages and collaborations between researchers, industry and governments. Australia ranks poorly with its commercialisation of ideas despite have excellent education and research capabilities. Developing a culture of entrepreneurship and commercialisation is critical if industry is to benefit from our investment into education and research.
- Regressive policy positions of other jurisdictions. Whilst Queensland and the Federal Government generally have good policy settings to encourage agricultural biotechnology, many of the other States have policy positions that are undermining industry confidence more broadly in Australian agricultural biotechnology investment. Industry investment is critical to Australia's long-term competitiveness in agriculture and therefore the industries that are dependent on agriculture. Queensland should both capitalise on its position as a technology 'friendly' state, and also use its influence to encourage other states and territories to recognise the benefits of a unified and supportive position on biotechnology.
- Social licence has in recent years become a critical factor in the adoption of biotechnology and is an area that the government can play an important role in building awareness and minimising the fear factor of biotechnology applications. Many in the public are not aware of the opportunities that exist for bioenergy and bioproducts. An education and awareness program might help to drive community acceptance and demand for these products (very few people in the community realise that biodegradable plastics can be manufactured from agricultural products).

***What should the balance be between government, industry, and research support for the development of industrial biotechnology?***

Industry investment is critical for a sustainable industrial biotechnology sector. Large biotechnology firms will spend hundreds of millions of dollars commercialising technologies and will undertake that work where the conditions are most conducive to success. Queensland should focus on ensuring that it provides the right incentives to capture industry investment in areas that will contribute to a sustainable sector. In many cases such incentives will be policy settings, access to state facilities or business incentives rather than public 'spend'.

***What should the government's role be in the development of a commercial industrial biotechnology sector in Queensland?***

Government has a significant role to play in encouraging the growth and development of the industry and in facilitating investment in the sector. The Government could provide resources either directly or indirectly. AusBiotech would support funding targeted research and development for the sector, and strongly encourages Government to actively support the commercialisation of research outcomes either from local or international research.

***What policy settings could improve Queensland's competitiveness in the development of second generation industrial biotechnology?***

AusBiotech applauds Queensland for avoiding some of the policy barriers – such as the policy position introduced by some states to recognise GM-free areas – that have limited industry investment in other Australian states. AusBiotech encourages the Queensland government to maintain and capitalise on its position as a technology 'friendly' state and continue to ensure that future policies are evidence-based and have considered the broader implications of its policy positions.

***How important will oil and gas prices be to the rate of development of the sector?***

Oil and gas prices and the inherent fluctuations in their price cycles will continue to be important to the success of biofuels in particular, however other bioproducts such as bio-plastics may be less susceptible to the price of oil since many of these products have multiple factors impacting their commercial success. For example, bio-plastics often have different material properties such as higher gas barrier qualities that make them suited to applications such as carbonated drink containers. Degradable biomaterials have obvious advantages over traditional polymer-based plastics.

Initiatives that underpin the development of new or fledgling industries, such as the biofuels mandate or the encouragement of biomaterials in packaging will encourage the growth and sustainability of these products.

***How do we bridge the gaps between good ideas and bankable projects to realise the potential of industrial biotechnology in Queensland?***

We strongly support initiatives that lead to the commercialisation of ideas and technologies. Despite an excellent education system and world class research capabilities in several specialised areas Australia has a poor commercialisation track record.

Governments – state and Federal – have an important role in ensuring that industry has the necessary infrastructure and human capacity to capitalise on ideas and technologies that arise from research and development, independent of the source of the research.

Effective translation of research outcomes requires strong science, knowledge of the pathway to market and business management literacy across the ‘farm-to-product’ supply chain. The prosperity of Queensland’s biotechnology industry cannot be sustained in the absence of a community of enquiring and capable people, a steady pipeline of specialist science, technology, engineering and maths (STEM) skills in the workforce, and general science and mathematical literacy in the community.

Many of the technologies required to remain competitive in either agriculture or industrial biotechnology require large markets to support the investments in R&D – usually US, Canada, Brazil and Argentina, but increasingly China and other Asian countries. Recognising this, Australia must ensure that it has the necessary translational research, commercialisation and extension skills to adapt and adopt technology from internationally developed research.

To promote the technology adoption AusBiotech urges the Queensland Government to consider boosting investment in the following areas:

- Support for dedicated technology hubs or precincts that foster collaboration between research and development institutes and industry.
- Encouragement of start-ups in agricultural and industrial biotechnology. Whilst much of the focus of agricultural and industrial biotechnology is on the major initiatives it is equally important that we foster and promote small to medium sized initiatives that offer opportunities for entrepreneurs and to provide a testing ground for concepts that may be specific to local conditions or industries.
- Establish a Queensland-focused commercialisation ‘fast track’ pathway for agricultural and industrial biotechnology adoption that can contribute to Queensland’s competitive advantage in global agricultural production and industrial biotechnology innovation.
- Ensure that plans for adoption of innovations are a key part of any research initiative funded by Queensland Government departments. Funding should be made available specifically for translation of R&D results (independent of the source of the idea) into outcomes for Queensland agricultural producers and industrial organisations.
- Support initiatives that build science and business-management literacy in the sector including specialised education initiatives that in-particular target translation of agricultural biotechnology into commercial outcomes.

***What more can government and industry do together to attract investment in this sector in Queensland?***

Investment types vary depending on opportunities and therefore investment strategies will vary with the role of Government. For example Government could assist in:

- Outward and inward-bound trade missions.
- International and domestic events. Support for events such as the AusBiotech’s Agricultural Biotechnology Symposium (being held in Brisbane in August 2016), which provide opportunities for organisations to participate in forums that bring together researchers, business and investors and that showcase local and international technologies.
- Business matching support. Supporting local industry to participate in national or international events targeting investment or business matching such as BIO or the AusBiotech’s Biotech Invest Summits will provide tangible investment outcomes for the sector.
- Supporting joint technology adoption programs such as jointly-managed extension and support services.

***How can we ensure Queensland's small and medium enterprises can participate and compete in the global industrial biotechnology value chain?***

AusBiotech welcomes the Queensland Government's inclusion of small and medium size enterprises (SMEs) in its Roadmap.

AusBiotech believes that SMEs have an important role to play in developing outcomes of research that may be beneficial to smaller industries such as crops that suit Queensland conditions but that are not necessarily suited to other major growing regions. This can provide a strategic opportunity for Queensland agriculture and the industries that it supports.

As an example safflower is a crop that was grown extensively in Queensland in the 1960s and 1970s often as a rotation crop with cotton. Safflower production peaked in 1979 but declined for a variety of reasons including a severe outbreak of disease. The CSIRO successfully developed a cultivar Sironaria, with resistance to the key pathogen alternaria and the root pathogen phytophthora but unfortunately for other reasons this did not restore the safflower industry in Queensland at the time.

As a result of a successful 12-year collaboration between CSIRO and the Grains Research and Development Corporation (GRDC) Australian scientists have developed safflower plants that produce super high oleic safflower oil (SHOSO). Vegetable oils with high levels of oleic acids are in high demand as a precursor to the production of lubricants, bioplastics, biochemicals, cosmetics and pharmaceuticals. These naturally occurring oils are a substitute for petroleum-based oils in the manufacture of industrial products as well as a replacement of sources of lower level oleic oils such as palm, sunflower and tallow. The SHOSO technology uses gene silencing as a boost in the level of desirable oleic acid and a huge reduction in the level of undesirable oils in the safflower seed.

A small Australian company Go Resources Pty Ltd has the exclusive rights to commercialise and manufacture this technology.

Companies such as Go Resources can be encouraged to set up in Queensland through Government initiatives that:

- Develop base technologies to extend product range and product applications. The technology used to develop SHOSO could also be used to produce other high value 2<sup>nd</sup> and 3<sup>rd</sup> generation oils in safflower using the same infrastructure (such as nutraceuticals, and specialised oils for cosmetic or pharmaceutical applications). State-based institutions are ideally suited, and should be encouraged to support SME businesses, such as GO Resources, to establish themselves in Queensland.
- Develop agronomy and extension programs that will support the implementation and adoption of specialised technologies such as SHOSO.
- Support and fast-track the establishment of infrastructure such as the crushing and processing facilities that is necessary to process SHOSO.
- Encourage and incentivise downstream industries to utilise SHOSO to develop high-value products such as bioplastics and pharmaceuticals providing both the necessary pull-through to reward the producers and processors of SHOSO and to ensure that Queensland fully capitalises on the value of a specialised raw material.