



Central Highlands Circular Economy

Project Business Case Clean Growth Choices

Final Version: 25 March 2020



Proudly supported by





Document Development History

Build Status:

Version	Date	Author	Reason	Sections
Final	25 March 2020	Andrew Chamberlin	Proof reading edits	All
Final	9 December 2019	Andrew Chamberlin	Incorporate DES feedback	All
2.2	21 November 2019	Andrew Chamberlin and Bronwyn Read	Final draft	All
2.1	24 October 2019	Andrew Chamberlin	Workshop amendments	All
1.0	29 August 2019	Andrew Chamberlin	Initial release	All

Acknowledgements

The Clean Growth Choices Consortium would like to thank members of the community and local experts who participated in workshop discussions. With their ideas and experiences, they made valuable contributions.

We would also like to extend our sincere thanks for the continued support and help from the Central Highlands Regional Council including Mayor Kerry Hayes, Councillors Megan Daniels, and Charlie Brimblecombe, General Manager Kirstin Byrne, Strategic Planner Jason Hague, and facilitator Bronwyn Read of 4T Consultants.

The Clean Growth Choices Consortium is comprised of experienced practitioners and academics from the University of Southern Queensland (USQ), James Cook University (JCU), CSIRO and The Ecoefficiency Group (TEG). The consortium team would like to acknowledge the strong support we received from the Queensland Department of Environment and Science (DES), especially from Georgine Roodenrys, Matthew Arthur, Sandra Avendano and Rosanna Virzi.

The Clean Growth Choices Consortium is delivering the Communities in Transition (CiT) pilot project with the support of the Queensland Government.

Extensive resources including case studies are available at: <https://www.cleangrowthchoices.org/>



Proudly supported by



Table of Contents

1 Executive Summary	5
1.1 Communities in Transition: Clean Growth Choices	5
2 Introduction/Background	6
3 Overview 6	
3.1 Vision.....	6
3.2 Organisational Objective	7
4 The Business Case	7
4.1 Purpose of the Business Case	7
4.2 Sustainable Development Goals	7
4.3 Business Case Sponsor	8
5 Situational Assessment and Problem Statement	9
6 Stakeholders	17
7 Assumptions and Constraints	18
7.1 Assumptions	18
8 Identification and Analysis of Options	18
8.1 Identification of Options.....	18
8.1.1 Option 1 – Central Highlands Resource Inventory.....	18
8.1.2 Option 2 – Do Nothing Option	19
8.2 Comparison of Options	19
8.3 Recommended Option	20
9 Risks and Benefits	20
9.1 Risks.....	20
9.2 Potential Benefits	21
9.3 Other Opportunities.....	22
10 Implementation Strategy	22
10.1 Project Title	22
10.2 Target Outcomes	22
10.3 Outputs	22
10.4 Work Plan	23
10.5 Budget	24
10.6 Other Resources.....	24
11 Project Management Framework	25
11.1 Governance	25
11.2 Project and Quality Management	26
Appendix A: Benefit Analysis	27
Appendix B: Risk Analysis.....	28
Appendix C: Background Information.....	29
Queensland's new waste strategy	29
Appendix D: Waste Management and Resource Recovery Strategy Highlights	32
Appendix E: Synthesis on Circular Economy.....	34



Proudly supported by



1 Executive Summary

This business case proposes a number of actions to develop additional value from resources in the Central Highlands by identifying and facilitating circular economy principles in the region.

A number of steps are proposed to identify underutilised materials or resource streams which are currently disposed of as waste, identify and match to opportunities and facilitate initial projects with technical assistance where necessary.

The project highlights the benefits of a circular economy approach, starting with an industrial ecology framework to find initial opportunities.

The project seeks to assist individual businesses in achieving resilience by potentially reducing both waste and input costs. The project will establish networked industries of the future through new science and technology.

The project will deliver value under the *Queensland Waste Management and Resource Recovery (WMRR) Strategy*, particularly *Strategic priority 2: Transitioning to a circular economy for waste*. Value can be gained from materials otherwise destined for landfill when there are increased options for reuse, recycling and recovery of resources, energy and fuels from waste.

This business case proposes a project which will contribute to the Queensland Government WMRR Strategy targets of ninety per cent of all waste diverted from landfill by 2050.

[Our Future State](#): This business case advances projects that address a number of key Government objectives including:

- Creating jobs in a strong economy by creating and maintaining jobs for regional employees in drought-affected communities
- Keeping Queenslanders healthy – by reducing financial pressures on regional families and reducing suicides.

1.1 Communities in Transition: Clean Growth Choices

The CiT Pilot Program delivers on the Queensland Climate Transition Strategy's action to build leadership capacity within communities to develop place-based climate transition roadmaps.

These roadmaps, and this business case, identify opportunities for economic and social development and climate resilience in regional Queensland. The opportunities range across a number of sectors including agriculture, waste, water supply, tourism, energy, manufacturing, transport and human services.

The multidisciplinary nature of these business cases means that other Queensland Government priorities are indirectly being addressed, thus offering an opportunity to leverage efforts across Government.

The CiT Pilot Program contributes to emissions reduction by identifying economic opportunities that support the transition to a low carbon economy, under the *Queensland Climate Transition Strategy*.



Proudly supported by



Importantly this business case identifies not only low emissions opportunities, but offers economic diversification to build resilience in regional economies.

The Central Highland's living roadmap outlines how a group of Central Highlands residents came together to develop this business case, including the options canvassed by the working groups.

2 Introduction/Background

This project has been prioritised by the Central Highlands working groups under a Value Creation pathway.

The Central Highlands sustains several highly productive industries, notably agriculture and coal mining. Both these industries generate significant waste streams, as do the region's households and general industry.

There is currently no accounting for these various waste streams apart from the Central Highlands Regional Council (CHRC) characterisation of waste streams entering the Council-operated landfill facilities.

The working group believes that within these waste streams may be potentially profitable products, inputs for other industries/business, and/or energy generation capacity.

In addition, the CHRC is faced with the need to open up more landfill facilities in the coming years as a growing population and increased economic activity fill existing capacity.

Central Highlands has a *Waste Reduction and Recycling Plan 2016-2026* with targets aimed at reducing waste to landfill. The CHRC manages 18 waste management sites including three landfills, transfer stations and bulk bin sites. A waste audit in 2013 indicated that 37% of household waste going to landfill was organic and approximately 28% of other waste (glass, plastic and metal) could have been put into the recycling stream (Pitt et al., 2016).

This CHRC Plan sits under the Queensland Government's *Waste Management and Resource Recovery Strategy*.

By reducing the amount of waste that goes to landfill, and subsequent greenhouse gas emissions, the Strategy will also directly contribute to the goals of the Queensland *Climate Transition Strategy* including to achieve zero net emissions by 2050 and reduce emissions by at least 30 per cent below 2005 levels by 2030 (interim target).

3 Overview

3.1 Vision

The vision is to leverage existing industries and projects, diversify the Central Highlands Region's economy and add value by utilising waste streams generated by local industry.



Proudly supported by



3.2 Organisational Objective

This project has been identified by the Central Highlands Clean Growth Choices working group. The objective of the project is to add diversity to the Central Highlands' economy through the development of new industries and increasing the efficiency of existing businesses.

4 The Business Case

4.1 Purpose of the Business Case

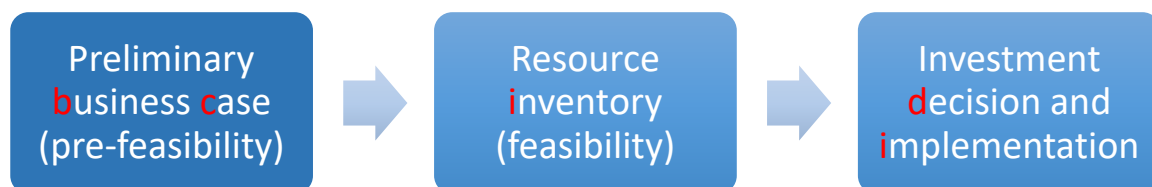
The purpose of the business case is to identify opportunities to:

- Outline the potential for business opportunities through the application of circular economy principles in the Central Highlands
- Analyse options as proposed by the Clean Growth Choices Working Group
- Identify costs, benefits and risks
- Develop a proposal to proceed with the project, or to identify a funding source for the project.

The business case is a pre-feasibility level proposal. It proposes a project option to achieve the above outcome.

As a preliminary business case, it will provide the working group with:

1. A sound basis for a decision to proceed to a project
2. The next steps and estimated costs to develop the resource inventory.



4.2 Sustainable Development Goals

The project aims to achieve sustainable economic development in Barcaldine and, in particular, works towards achieving the following of the [United Nations Sustainable Development Goals](#) (SDGs):

Goal	Title	Description
SDG 7	Affordable and Clean Energy	More people are using electricity than ever before, with the proportion of the global population having access to this service rising from 83% in 2010 to 87% in 2015, and rising to 89% in 2017 (a gain of 1 percentage point annually in the past two years). Still, 840 million people were without this essential



Proudly supported by



		service in 2017, mostly in sub-Saharan Africa. In that region, only 44% of the population had access, and an estimated 573 million people still lacked electricity.
SDG 8	Decent Work and Economic Growth	Roughly half the world's population still lives on the equivalent of about US\$2 a day with global unemployment rates of 5.7%. Having a job doesn't guarantee the ability to escape from poverty in many places. This slow and uneven progress requires us to rethink and retool our economic and social policies aimed at eradicating poverty
SDG 9	Industry Innovation and Infrastructure	Goal 9 encompasses three important aspects of sustainable development: infrastructure, industrialization and innovation. Infrastructure provides the basic physical systems and structures essential for the operation of a society or enterprise. Industrialization drives economic growth, creates job opportunities and thereby reduces poverty. Innovation advances the technological capabilities of industrial sectors and prompts the development of new skills.
SDG 13	Climate Action	Climate change is now affecting every country on every continent. It is disrupting national economies and affecting lives, costing people, communities and countries dearly today and even more tomorrow. Weather patterns are changing, sea levels are rising, weather events are becoming more extreme and greenhouse gas emissions are now at their highest levels in history. Without action, the world's average surface temperature is likely to surpass 3 degrees centigrade this century. The poorest and most vulnerable people are being affected the most
SDG 17	Partnerships for the Goals	A successful sustainable development agenda requires partnerships between governments, the private sector and civil society. These inclusive partnerships are built upon principles and values, a shared vision, and shared goals that place people and the planet at the centre, and are needed at the global, regional, national and local level.

4.3 Business Case Sponsor

The sponsor of the business case is the Queensland DES.



Proudly supported by



5 Situational Assessment and Problem Statement

This section outlines the benefits to the region for proceeding with the one or more of the proposed options and contains:

- A description of the current situation, challenges and opportunities
- An assessment of how the opportunities are currently being met or not met
- An analysis of the gap between the current situation and the stated objective(s).

The project projects seeks to build on Central Highlands' strength as a resources and agriculture economy by establishing the basis for deriving the greatest value from the region's materials through the acceleration of industrial ecology and circular economy concepts.

The Central Highlands Regional Council has implemented a *Waste Reduction and Recycling Plan (WRPP)*, as required by the Queensland's *WMRRS*. This plan is reviewed every three years.

At present, too much valuable material is underutilised, either by down-cycling or disposal. The group considers that this presents a major opportunity for the region to build experience and expertise in these future-economy initiatives.

There are numerous waste strategies and action plans in place relevant to the project highlighted as highlighted in Figure 1.

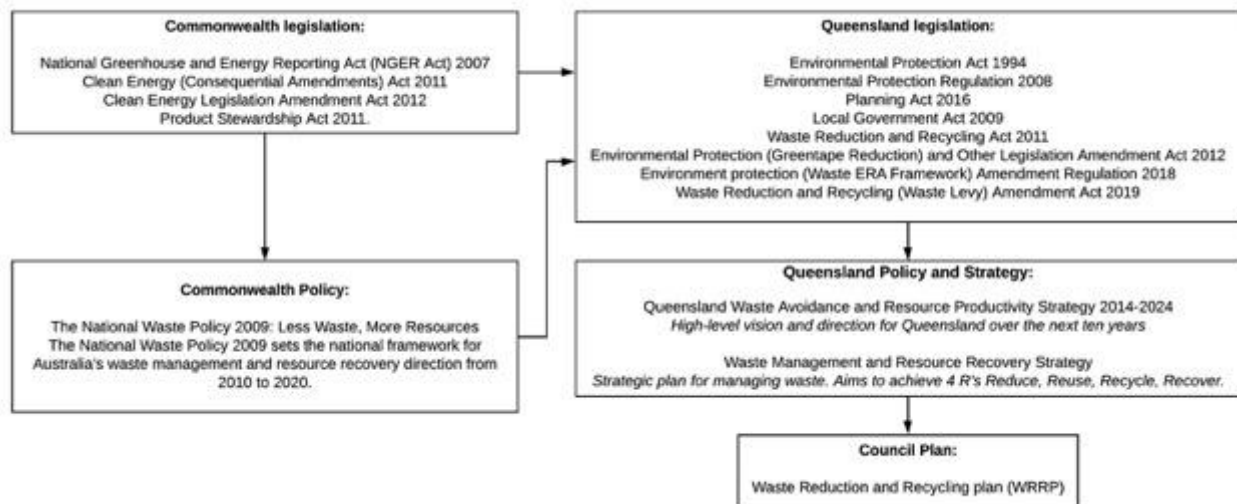


Figure 1: The relationship between Australian waste management plans and strategies

The working group considered that the Council may need to act quickly on waste as the existing landfills are close to filling to capacity. In addition, a number of the working group members noted that Council was considering reducing the opening hours of regional landfills so that access to waste disposal may be limited.

The working group discussed a number of key background issues:

- Throughout the region, there are significant opportunities to extract additional value from process waste and residue
- The Council has recently changed waste contractor and may have recently done some studies of the make-up of waste streams in general waste bins to give an indication of the potential
- Infrastructure, such as roads, rail, multimodal, has been upgraded and applying to the Building our Regions fund for an integrated waste strategy is the next logical step
- A number of options have been developed for green and organic waste processing with two capacities tested – 100,000t/year and 400,000 t/year with both achieving a return on investment of 8% (payback period of 14 years)
- There is now a State [resource recovery](#) plan and [waste to energy](#) discussion paper
- Global demand for ammonium nitrate with two options – either produce at a local plant or import
- Whether returning (empty) coal trains can be backloaded with freight or recyclable material to the region for reprocessing (requiring change in operating procedures)
- Other councils are starting to work on easy-wins. An example is Ipswich Council which has established a Green Waste Service that also takes kitchen vegetable waste and some paper that cannot be placed in traditional recycling bins (eg. tissues) which is composted https://www.ipswich.qld.gov.au/residents/waste/green_waste_service
- There are already agricultural and some other organic materials processed by CQ Compost and there may be scope to value add with that service.

A key aspect in the successful delivery of this project will be the need for collaboration between stakeholders. The complex material flows in the lifecycle of any resource mean no one party can accomplish change individually.

Central Highlands contains a large industrial area (Yamala Enterprise Area). It now appears that a secure water supply to the industrial area can be secured. This will allow for the development of more, diverse industries in the industrial zone.

The working group discussed a number of waste streams and potential material flows in the Central Highlands. These are shown in Figure 2.



Proudly supported by



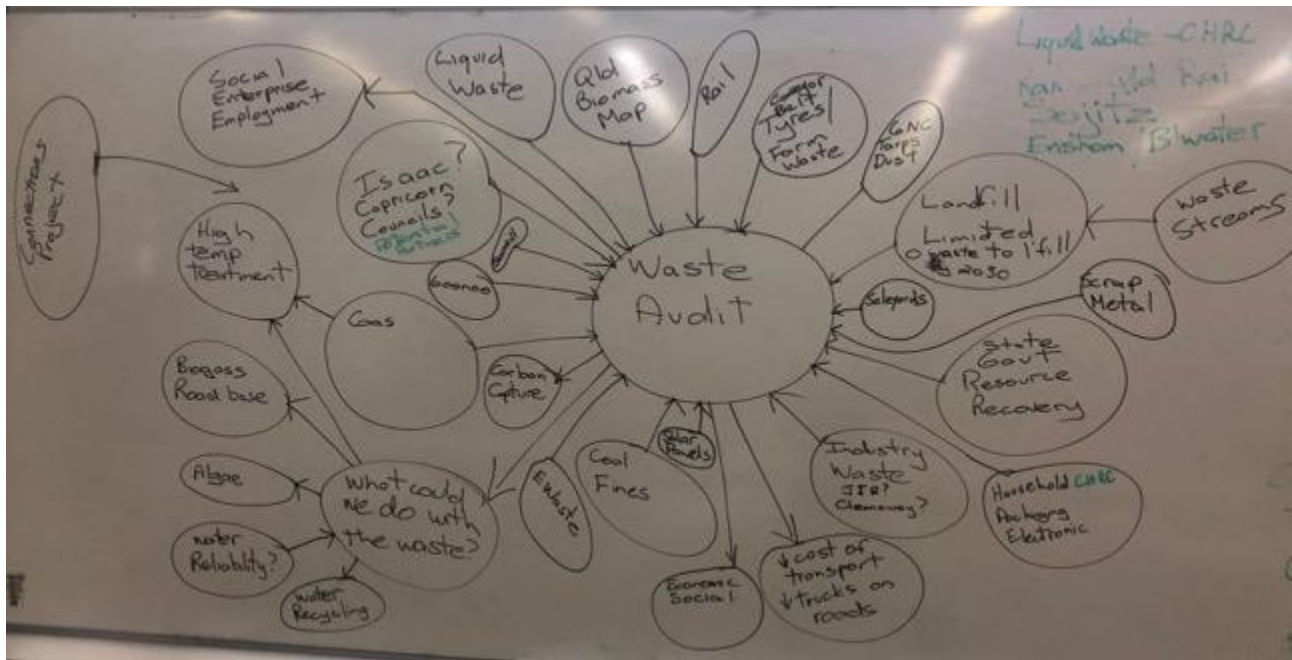


Figure 2: Working group summary of the potential material flows from a Central Highlands resource inventory

The term ‘circular economy’ refers to the concept of regenerative and responsible product design with a view to reducing the amount of waste produced by a whole system. It involves the concepts of reuse, repurposing, recycling and remanufacturing, and is best typified by the diagram at Figure 3.

The concept is useful in considering the design of new products and systems and also applies to adapting existing systems. The working group considered that a circular model offers the potential to create and retain additional value in the region from the extensive primary products and value-added goods produced. Such a model would create new business opportunities, leading to training and employment opportunities.

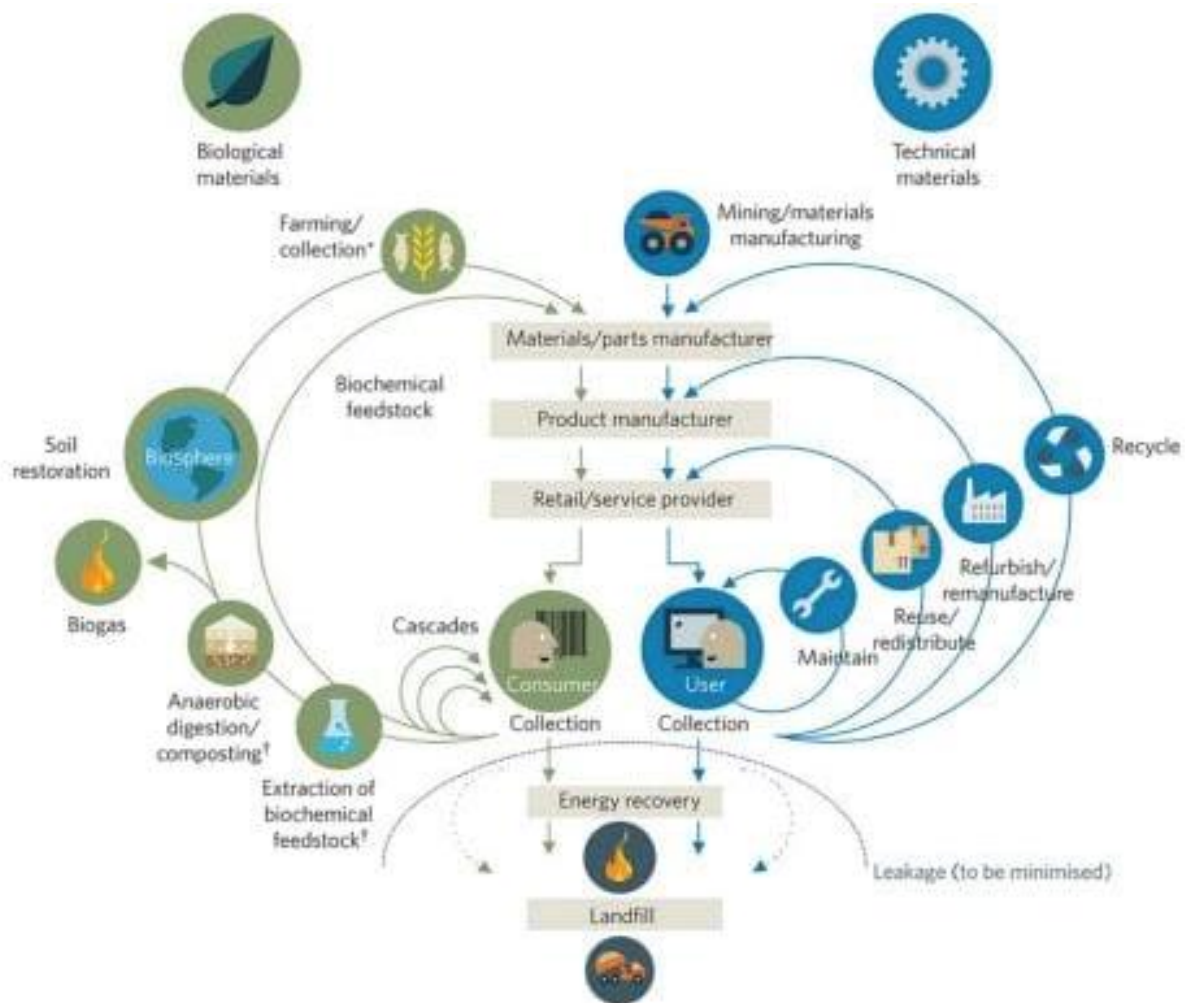


Figure 3: Circular Economy Concept¹.

A number of materials that the stakeholders might represent include:

1. _____

¹: Source: <https://www.governmenteuropa.eu/circular-economy-concept-explained/90557/>

Materials	Stakeholder	Re-use opportunities
Ash	Stanwell	Road base, structural concrete products
Municipal waste	CHDC JJ Richards Cleanaway	Organic materials, metals, Rare Earths and valuable metals
Mining camps	Mining camps Camp operators	Food Waste, packaging, sewage, general waste
Used Cooking oils	JJ Richards Cleanaway Health inspectors	Biodiesel, compost, bioenergy
Tyres	Woods Childs	Road base, oils, recycled steel Central shredding for economic transport
Coal fines	To be investigated	To be investigated Briquettes NSW has a separate coal washery rejects levy
Drums	To be investigated	Already re-used by drumMUSTER, but could provide central point or collection process for other materials
Other	Private landfill operators	Other materials
Cotton trash	Cotton Gin Operators	Bioenergy, cellulose processing
Organic materials	CQ Organics	Existing composting operations
Biosolids - Sewage	CHRC	Bioenergy, composting
Farm Residue	Farmers and farm groups	Composting, bio digestion,
Grains	Farms	Bioenergy, soil conditioners, some is currently fed to intensive agricultural sectors
Farm waste	Farmers and farm groups	Tyres, agricultural plastics, oils
Construction waste	Building companies, building materials suppliers	Recycling and repurposing of surplus and waste materials
Tarpaulins	From a number of agricultural industries	Re-use
Glass	Council, local hospitality and events businesses	Re-use and recycling
e-waste	Large businesses, Council and Government	Reuse and recycling

These stakeholders could identify opportunities such as:

- Use of materials
 - Raise awareness of available materials and open up discussions about potential uses for them
- Collection points



Proudly supported by



- Identifying new or expand existing central collection points for materials, which could lead to opportunities to consolidate other materials
- Industrial ecology
 - Matching businesses' waste and inputs to encourage greater utilisation of materials along with increased revenues and reduced costs
- Smart Resources Precinct
 - Establish a precinct of businesses who are sharing inputs and outputs, and attract other businesses based on the availability of these
- Circular economy opportunities
 - Business opportunities that may exist that business has not considered.

The Queensland [Waste Management and Resource Recovery Strategy](#) identifies three priorities:

1. Strategic priority 1: Reducing the impact of waste on the environment
2. Strategic priority 2: Transitioning to a circular economy for waste
3. Strategic priority 3: Building economic opportunity.

Targets for 2050:

1. 25% reduction in household waste
2. 90% of waste is recovered and does not go to landfill
3. 75% recycling rates across all waste types
4. Powering Queensland with 50 per cent renewable energy by 2030.

Appendices C & D show a number of key actions for each of these strategies.

The [Queensland Biomass Map](#) indicates that there are up to 204,000 tonnes of available biomass annually in Central Highlands with some potential for adding value (Figure 4 below). Some of this waste is either already utilised (for example, cotton seed) or forms part of an urban waste stream (paper, food waste) so an assessment would be required to determine how much is readily available.



Proudly supported by



Queensland biomass data

To print all graphics in this report go to your web browser's print settings and enable print all graphics. For information about how this data was derived download the [technical methods documents](#). To access the raw data download the files from the [Queensland data portal](#).

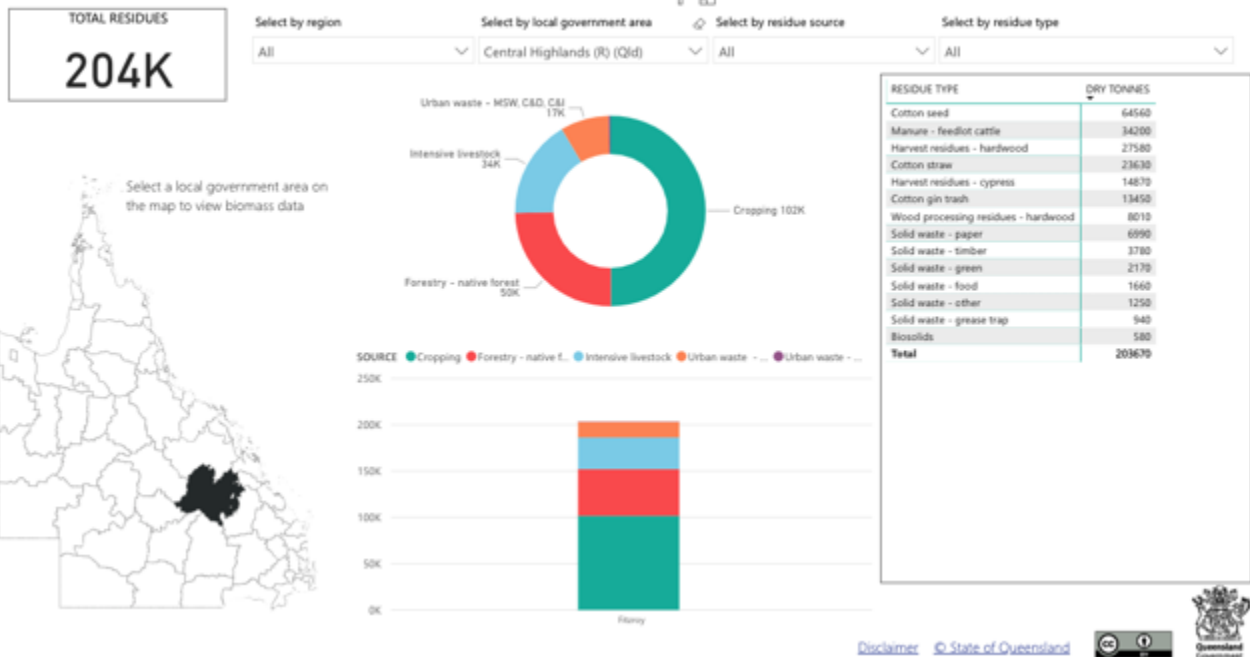


Figure 4: Queensland biomass data showing annual availability of biomass feedstock

The working group considered an opportunity to extract more value from the range of residues, by-products and waste and develop more business opportunities from them. Further, the working group considered that greater opportunities would arise from new businesses moving to the Central Highlands based on these available resources. A key issue is the lack of data on existing waste streams.

There is a potential to facilitate additional linkages through industry to improve resource use efficiency and develop circular economy opportunities. There is potential for this to occur within existing businesses in the region. This will demonstrate Central Highlands as an effective place to establish, where facilitation of waste reduction and circular economy value-adding is made.

A feasibility assessment was conducted on the potential for a beef abattoir in the Central Highlands with a throughput of up to 100,000 per annum².

If this project proceeds, it will provide valuable opportunities for a circular model. A key opportunity is that the capital cost includes the construction of a wastewater treatment plant. Such a component of the project could be developed by others as part of another projects; such as a bioenergy plant.

1. _____

² https://chdc.com.au/site/files/CHDC_AbattoirFeasabilitySummary_Oct18.pdf

A risk to the community is missing the opportunities presented through a waste levy. There is significant potential for economic growth in the waste management and resource recovery sector in Queensland. For every 10,000 tonnes of waste that goes to landfill, it is estimated that fewer than three jobs are supported, but where that waste is reused or recycled, it is estimated that there are more than nine jobs created³.

Waste collected needs to be diverted prior to becoming regional landfill. Councils do not have the ability to collect valuable waste once it is landfilled. Therefore, potentially valuable waste needs to be captured by resource recovery businesses that might not exist yet.

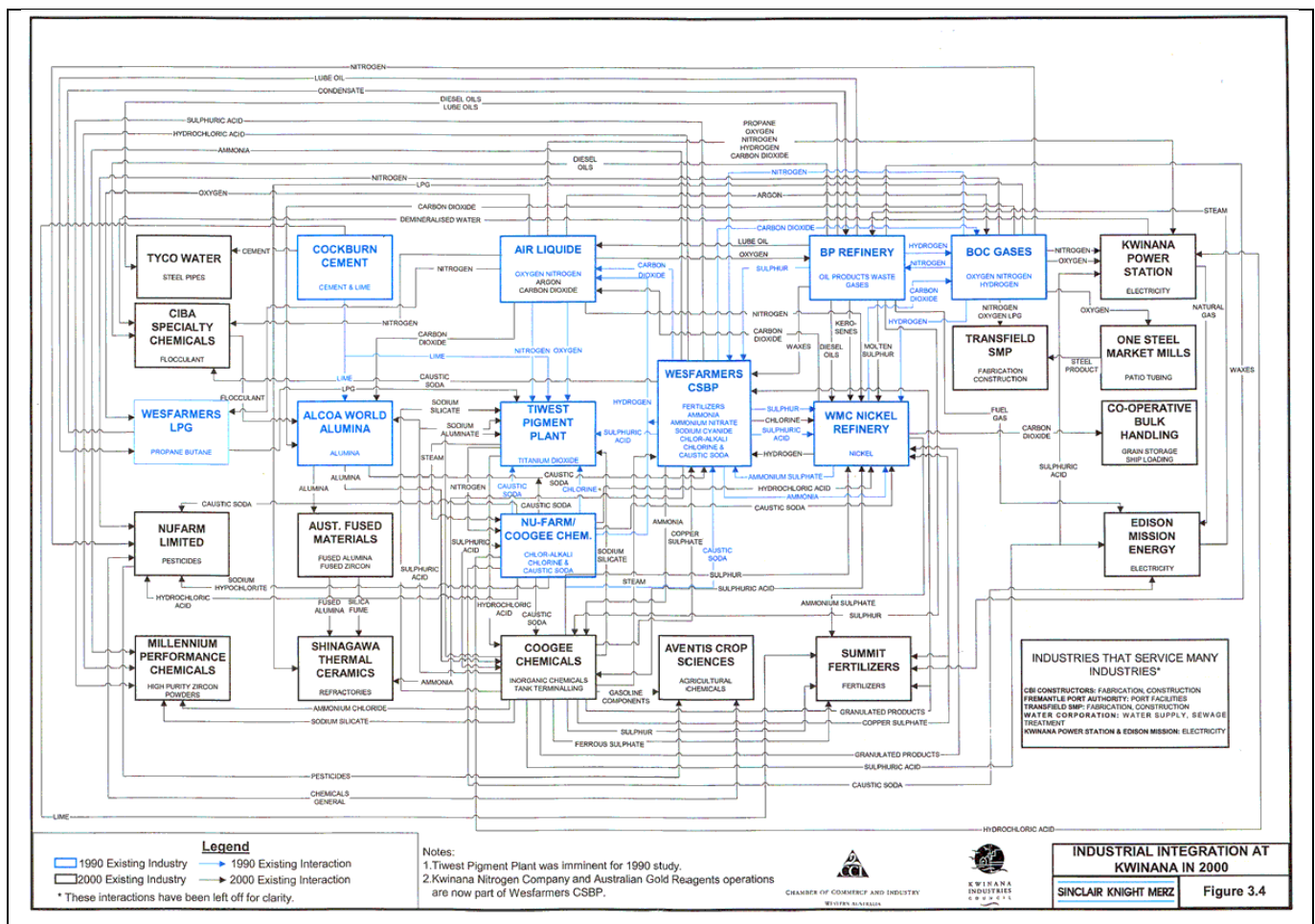


Figure 5: Material Flows: Kwinana Industrial Estate, Western Australia. The figure shows the flow of materials between businesses within the industrial area. Source: [Chemlink](#)

Figure 5 serves as a potential illustration of the potential material flows from such a project. Similarly, the Sundrop farms case study (below) demonstrates the how integrated systems thinking can lead to more holistic outcomes.

1. _____

³ Deloitte Access Economics, Employment in waste management and recycling, 2009.

Proudly supported by



Innovative Sundrop Farms Uses Sunlight and Seawater to Grow Tomatoes*

Sundrop Farms in South Australia uses more than 23,000 mirrors to capture sunlight and direct it to a central receiver at the top of a 127-metre power tower. All the seawater used for irrigating the crops is piped from the Spencer Gulf and converted into fresh water using a thermal desalination unit. At its peak, it produces 39 megawatts of thermal energy, which is used for electricity, heating and making water. The commercial facility cost about \$200 million to build, with private equity firm Kohlberg, Kravis and Roberts (KKR) investing \$100 million. The facility produces about 17,000 tonnes of truss tomatoes a year and holds a 10 year supply contract with Coles Australia. See <https://www.sundropfarms.com/innovation/>.



*Information and image source: <https://www.abc.net.au/news/rural/2019-05-15/port-augusta-sundrop-farms-sold-to-investment-fund-morrison-co/11108046>

6 Stakeholders

The working group started identifying potential stakeholders, and it is likely that opportunities could be identified by regularly assembling the group to discuss waste streams and potential opportunities. Potential stakeholders would include:

- Central Highlands Regional Council
- Neighbouring councils
- Central Highlands Development Corporation
- CQ Inland Port
- Central Highlands Regional Resources Use Planning Cooperative Limited (CHRRUP)
- Commercial businesses in a range of sectors
- Agricultural businesses
- Commercial waste removal companies



Proudly supported by



- Mining companies.

7 Assumptions and Constraints

7.1 Assumptions

Holders of data and information will be willing to participate and provide what is needed (eg. food producers, mining companies).

The business case provides a pre-feasibility level assessment of the project. It has been prepared by the Clean Growth Choices team under the direction of the Clean Growth Choices working group. The working group largely consists of volunteers who are providing guidance and input in their own time.

8 Identification and Analysis of Options

This is a high level analysis of the possible alternatives that could be employed to bridge the gap between the current situation and what is proposed, as outlined in Section 4.

8.1 Identification of Options

There are various options available to the working group:

Option 1: Central Highlands Resource Inventory

Option 2: Do Nothing Option

8.1.1 Option 1: Central Highlands Resource Inventory

Conduct a waste audit with a view to create new reprocessing industries in the Central Highlands.

This option is to have a waste inventory to determine:

1. What are the current waste streams?
2. What is the current system for dealing with the waste streams? Who processes them? What is not processed, and what capability is there in the area (or able to move into the area) to process more?
3. Identify opportunities and potential based on identified waste and residue
4. Develop a plan to match up the waste streams with opportunities.

The project could start with waste data already available from Council, following the suggested process below:

1. Establish a collaboration group
2. Gather existing and available high level data
3. Identify high level opportunities with the Collaboration Group using existing and available data including:
 - a. CHRC study on options for green and organic waste processing with two capacities tested



Proudly supported by



- b. Council waste streams data/studies
 - c. Fertilizer and ammonium nitrate demand from farms
 - d. CQ Compost inputs and outputs
4. Progress high level opportunities
5. More detailed analysis of waste streams:
 - a. Site by site collection of data on industrial waste (input-output analysis)
 - b. Site by site collection of data on farm waste
6. Matching inputs to outputs across sites from point 5 above
 - a. Establish relationships
 - b. Identify opportunities
 - c. Establish technical and financial analysis of opportunities.

Note that Actions 5 and 6 are time consuming and do not guarantee opportunities will be identified and acted on.

The initial stages may identify a number of easy-wins to divert waste to landfill such as:

1. Central points where some waste is taken for processing which could lead to other opportunities such as:
 - a. CQ Organics, where some composting occurs, where other collections might occur
 - b. DrumMUSTER or waste oil collections
2. Packaging – reduce inbound packaging
3. A cotton gin has acquired a cardboard shredder
4. Potential for local processing of e-waste (Substation 33 Model)
5. Potential for local vegetable supply (Food Connect Model)
6. Potential for sharing and reusing household items and tools (Share Shed Model)
7. Sufficient quantities for biohub opportunities, other manufacturing or waste to energy

8.1.2 Option 2 – Do Nothing Option

This Option provides for the continuation of business as usual.

8.2 Comparison of Options

It is important to compare the options by summarising the benefits, disbenefits, costs, risks and issues. The following table is an example.

Criteria	Option 1 – Resources Inventory	Option 2 – Do Nothing Option
Benefits: <ul style="list-style-type: none"> • Council • General industry • Agribusiness • Coal mines 	<ul style="list-style-type: none"> • Reduced waste to landfill • Additional business activity in Central Highlands leading to employment security and growth • Diversification of business revenues • Potential for positive branding associated with an integrated circular economy approach • Potential to build critical mass for some recycling industries through uncovering unknown resource streams • Opportunities to bring in other councils' waste, or other regions' or other industries' waste 	<ul style="list-style-type: none"> • Existing levels of service remain • Waste is removed and disposed as per current arrangements

Proudly supported by



	<ul style="list-style-type: none"> The project is a good fit with Central Highlands' innovative culture including in agricultural technology 	
Disbenefits: <ul style="list-style-type: none"> Council General industry Agribusiness Coal mines 	<ul style="list-style-type: none"> Program development costs with difficulty in predicting the possible outcomes of the project 	<ul style="list-style-type: none"> Council may not meet zero waste Central Highlands fails to capitalise on resources that might be lost to other areas Technological development opportunities may be missed

This project could lead to the opportunity to integrate with waste streams from other councils, other industries and processes.

8.3 Recommended Option

The recommended option is to proceed with the resources inventory project.

9 Risks and Benefits

9.1 Risks

There are a number of risks identified in Appendix B.

Risks generally relate to whether the project is able to deliver some outcomes. The project has some uncertainty as the success of the project will depend on the resources identified during the investigations, and whether there is the technical skill or willingness to develop the project..

There are some other risks:

Science and technology risk

- Identifying the right technology
- No providers willing to participate in the project

Supply risk: Ensuring sufficient supply of suitable materials for the life of the projects

- Green waste quality and consistency of supply
- Acceptable management of any biosecurity risks

Off-take risk

- Farms not prepared to use compost from an uncontrolled (contaminated) source

Regulation risk

- Failure to gain necessary planning and environmental approvals
- Mining and exploration leases over the large areas being discussed
- Cost of complying with regulations:

A number of considerations relating to environmentally relevant activities



Proudly supported by



- ERA 53: Organic material processing (on farm AD and AD plants associated with WWT and meat processing excluded). ERA may be triggered if the facility processes more than 200 tonnes per year (4 tonnes per week) material is imported for AD (as proposed in this business case). There may be an exclusion for this depending on the types of materials to be processed and the method of processing
- Regulated waste includes animal processing residue such as abattoir waste and some food processing waste (as per number 29 of the Schedule). Including these materials, and transport of them, would need to be done by a licenced operator (ie. exclusion would not apply). DES is developing End of Waste frameworks which may see some materials reclassified as resources - <https://environment.des.qld.gov.au/waste/end-of-waste-framework.html>
- Annual gas regulation and safety check.

9.2 Potential Benefits

Below is a list of benefits that may result from the project. They have been classified into direct and indirect.

No	Topic	Direct/ Indirect	Details
1	Reduce cost and environmental effects of landfill	Direct	Cost of maintaining and establishing new landfill facilities is significant Landfill has potential harmful environmental effects
2	Skills for future jobs	Direct	As part of the O&M considerations, can local trades be trained to accreditation by the technology providers to maintain the systems?
3	Clean energy generation	Direct	Reduced greenhouse emissions. Current energy supply projections show that some industrial facilities will have to instigate temporary shutdowns
4	Lower cost energy	Direct	Anecdotal evidence of industrial users replacing mains power with diesel generators for reliability and cost reasons
5	Reducing waste to landfill and incinerated organic waste	Direct	Diversion of green waste, which is currently incinerated at the Goondiwindi Landfill Site, to a higher value use
6	Generation of energy	Indirect	The potential to generate energy from a processor, depending on the type of technology chosen
7	Employment	Direct	The projects would secure existing employment or offer additional jobs
8	Local investment	Direct	Identifying opportunities for local businesses or other partners to invest
9	Cost savings	Direct	Avoidance of waste to landfill from businesses will save the businesses \$75 per tonne from 1 July 2019
10	Job creation	Direct	Employment opportunities in more integrated waste management



Proudly supported by



11	Household organic waste	Indirect	The projects could potentially expand to include household organic waste
12	Biosecurity	Indirect	Processing food waste may improve biosecurity outcomes

9.3 Other Opportunities

Other ideas for the project

The project provides the opportunity to be the catalyst for a larger precinct model as outlined above. Once the project reaches a level of maturity, ie. with regular participants sharing information on material inputs and outputs with the view to reusing, the precinct concept could serve to attract complementary businesses to the Central Highlands. For example, If low-grade heat is produced by the project, it could be made available to adjacent sites and advertised accordingly.

There is potential for the site to be an Innovation Precinct:

- Dept Industry (Aust): <https://www.industry.gov.au/strategies-for-the-future/promoting-innovation-precincts>
- CSIRO: <https://www.csiro.au/en/Do-business/Collaborative-research/Active-opportunities/Precinct-partnerships>

The CSIRO Aspire tool could be suitable for maintaining an inventory of materials to be exchanged between businesses - <https://aspireme.com/home/what-is-aspire/>

10 Implementation Strategy

10.1 Project Title

Central Highlands Circular Economy Project

10.2 Target Outcomes

The target outcomes of the project will be:

- Businesses generating revenue from the exchange of materials that may have previously been disposed of
- Additional employment of people in repurposing materials and facilitating material exchanges between businesses
- Waste to landfill reduction target to be determined.

10.3 Outputs

The outputs of the project will be:



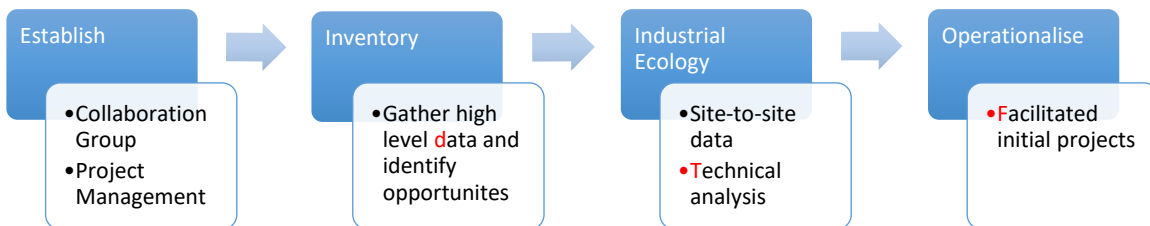
Proudly supported by



- A Central Highlands Materials Inventory and Map – a characterised inventory of waste streams generated in the Central Highlands
- An established network of innovators collaborating to improve local economic opportunities
- A more detailed, finer-grained opportunities assessment, based on business-to-business consultations
- Mini-business cases or technical analysis of specific recycling or reuse opportunities.

10.4 Work Plan

The Project would follow a general process involving four key stages:



Further Work Required to implement the strategy:

No.	Stage	Details
1	Establishment	Set up Project Management structure and collaboration group
2	Consultation	Initial consultation with regional stakeholders to gather information on suitable approaches and strategies
3	High level data gathering	Assemble an inventory of the waste available in the region from large industries from existing sources (NPI reports, NPC reports, waste reports, waste audits)
4	High level data processing	Understand any high level opportunities based on the materials identified and consult with the waste sources on their willingness to participate
5	Detailed data gathering	Invite a group of initial businesses to participate and gather data on their sites' waste inputs and outputs (select by sector or location, ie. agriculture or an industrial precinct).
6	Industrial ecology hackathon	Gather businesses together to present potential resource matches and explore potential opportunities. Include "speed dating" or rapid networking sessions where attendees can compare notes on material flows and opportunities
7	Detailed assessment	Select some opportunities that may need some technical assessment (ie. engineering, enthalpy, material science, etc) for investigation
8	Detailed business cases	Prepare business cases based on technical investigations
9	Final approvals	Gain any final approvals including financial approvals
10	Implement	Facilitate initial project(s)

10.5 Budget

A number of the major areas of work identified above will need to be carried out in the various categories below:

Work Package	Details Discipline	Est Cost.
Technical project management (project manager to have knowledge of concepts)	Establish collaboration group, steering group and coordinate all activities over 24 months initial period	\$180,000
Waste inventory	Gather and map data on known regional waste streams	\$30,000
Further business engagement	Detailed gathering of input and output data from businesses in the region to develop a micro-scale opportunities map and cross-reference opportunities Stage 1 trial	\$50,000
Technical and scientific advice	Review identified opportunities and materials and suggest technologies and assemble relevant information	\$80,000
Circular economy network development	A series of training, workshops and introductory meetings to facilitate materials exchange and circular economy thinking and industrial ecology hackathon	\$50,000
Legal advice, agreements etc	Includes contingency	\$30,000
TOTAL		\$420,000

10.6 Other Resources

There are a number of other resources that could assist in facilitating or funding the business case:

- Building Better Regions Fund with two streams for 'Infrastructure Projects' and for 'Community Investments' - <https://www.business.gov.au/assistance/building-better-regions-fund>).
- Northern Australia Infrastructure Fund (NAIF)
- Land Restoration Fund – <https://www.qld.gov.au/environment/climate/climate-change/land-restoration-fund/pilot-projects/about>
- Resource Recovery Funding: Development of Phase of the business case leading to investment decision which may be eligible for funding under Stream 3: Resource Recovery: Investment Pipeline Fund - (<https://www.statedevelopment.qld.gov.au/industry-development/resource-recovery-industry-development-program.html>)
- Clean Energy Finance Corporation Investment: The CEFC is an Australian Government-backed financial institution and is interested in investing in technologies - <https://www.cefc.com.au/media/390741/cefc-and-clean-energy-for-agriculture-feb-2018.pdf>
- Rural Research and Development for Profit: A proposal could seek funding assistance <http://www.agriculture.gov.au/ag-farm-food/innovation/rural-research-development-for-profit>



Proudly supported by



- Central Queensland Regional Organisation of Councils (CQROC) comprises representatives from the Banana Shire, Central Highlands Region, Gladstone Region, Livingstone Shire, Rockhampton Regional and Woorabinda Aboriginal Shire Councils - <http://cqroc.org.au/>
- Regional Development Australia Fitzroy and Central West facilitates economic development opportunities for the region by collaborating with Government, community and business. A number of funding opportunities are available from time to time, and might be suitable for the project - <https://rdafcw.com.au/funding/>.

11 Project Management Framework

11.1 Governance

A key question for this project is “Who Owns the Project?”

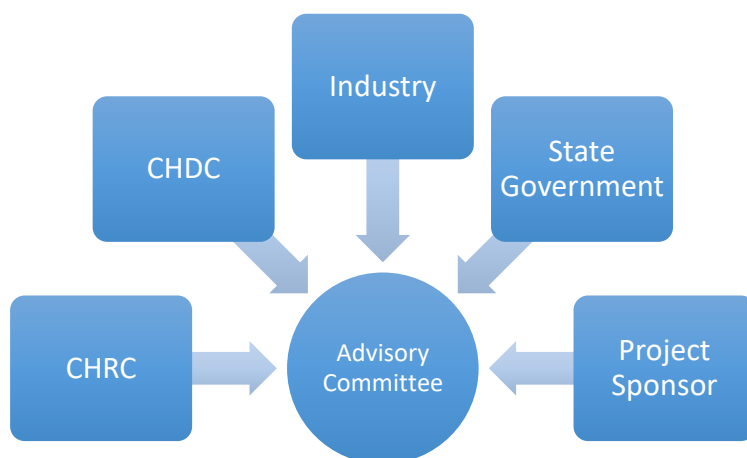
The governance system proposed to deliver the business case is as follows, with the exact representation to be determined at the commencement of the project:

- Advisory Committee: Responsible for the delivery of the project according to its objectives and on time and within budget. The Advisory Committee members will also consult strategically with external stakeholders to ensure the project has the support of a wider network
- Working Group: Responsible for advising the Project Manager on technical and operational aspects of the project and will meet to advise the Project Manager
- Project Manager: Reporting to the Advisory Committee. The Project Manager should sit within the CHDC or CHRC structures and have access to relevant expertise, including through regular meetings of the Working Group.

The Project Manager will be responsible for the delivery of the project.

The Advisory Committee should be established with representatives from the Central Highlands Regional Council, Central Highlands Development Corporation and industry representatives. The Project Sponsor should be represented, particularly if funding is provided.

Suggested Structure of the Project Advisory Committee:

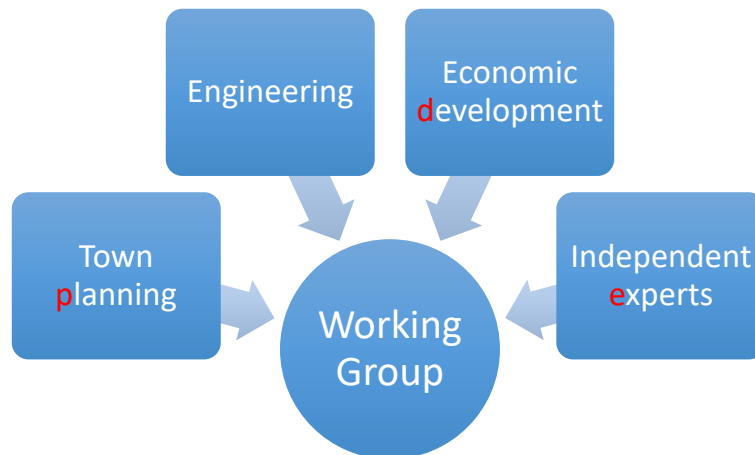


Suggested Structure of the Project Working Group:



Proudly supported by





The business case should be progressed by a Project Manager, with the close advice of key agencies and advisors in an operational working group as suggested above.

11.2 Project and Quality Management

A detailed project plan will need to be prepared for the project the incorporation of a number of factors including:

1. Organisational Impact: How the work being undertaken during the project will impact on the organisation and how these impacts will be addressed
2. Outcome Realisation: How outputs will be managed once they are delivered, and who will be accountable. This may change as the project evolves
3. Quality Management: Define suitable standards, requirements and best practices for the project to deliver against, and the internal quality requirements
4. Post-project Review: How the group will capture the lessons learnt throughout the project and what review will be done to assess whether the initiative delivered the intended benefits.

The Project Manager will need to ensure that the final project developed is robust and based on sound science. Financial analysis should be sufficiently robust to allow decision making, so initial consultation should occur with potential funders and financiers about the level of detail required.

It is suggested that the Project Manager be located within the CHRC or CHDC structures. The Project Manager may not need to be a full-time role to progress the business case as a proportion of the work relies on gathering information from other sources.

Appendix A: Benefit Analysis

This section assesses how each key stakeholder group (or individual stakeholders) may be impacted by the project and how they may impact on the project. These impacts may be positive or negative.

Option 1: Waste and Resource Audit

Stakeholder	Positive Impact	Negative Impact	Overall
Council	<ul style="list-style-type: none"> Extend life of landfill 	<ul style="list-style-type: none"> Potential capital costs or short-term cost increase 	Positive
CQ Organics	<ul style="list-style-type: none"> Potential to increase opportunities 	<ul style="list-style-type: none"> Potential competition 	Positive
Council and community	<ul style="list-style-type: none"> Reduced CO₂-e emissions 	<ul style="list-style-type: none"> Coordination time and cost 	Positive
Local agriculture	<ul style="list-style-type: none"> Potentially valuable organic outputs Potential to centralise collection and recycling of other waste streams 	<ul style="list-style-type: none"> Cost of transport/collection of waste streams 	Positive
Coal mines	<ul style="list-style-type: none"> Potential means of disposal of coal fines Potential avoidance of future levy 	<ul style="list-style-type: none"> Capital cost to allow for removal/processing of coal fines 	Positive

Appendix B: Risk Analysis

As a pre-feasibility level business case, this is an initial consideration of risks, and the strategies that can be put in place, or the investigations in further work to mitigate these risks.

Option 1: Circular Economy

Major Risk and what does it do to the project	Mitigation Strategy
Program is too general and does not result in actual projects	Need to focus on practical and deliverable projects, focussing initially on opportunities with a higher change of success with enthusiastic participants.
Unable to find technically viable opportunities	Provide suitable technical analysis of concepts and projects once the relevant businesses have indicated a willingness to investigate
Unable to engage industry in the program and concepts	Business may consider the program too conceptual and be unwilling to engage, so needs to be kept practical and relatable.
Perceived technical or operational risks – businesses unwilling to proceed with projects because of perceived risks	Ensure the program consults with the right people in business to enable risks and opportunities to be identified and discussed early in the project development phase. Manage actual technical risks by engaging with relevant expertise to work with businesses to resolve any technical issues



Proudly supported by



Appendix C: Background Information

Economic opportunities for the Queensland waste industry: final report presented to Department of Environment and Science 29 June 2018, prepared by Queensland Treasury Corporation - https://www.qld.gov.au/data/assets/pdf_file/0027/94059/economic-opps-qld-waste-industry-fin-report.pdf

Waste Management and Resource Recovery Strategy - https://www.qld.gov.au/data/assets/pdf_file/0028/103798/qld-waste-management-resource-recovery-strategy.pdf

Queensland Treasury Corporation 2018, *Interim report: Economic opportunities for Queensland's waste industry* - https://www.qld.gov.au/data/assets/pdf_file/0021/69042/qld-waste-industry-economic-opportunities-interim-report.pdf

Australia's National Waste Policy: Less Waste, More Resources (2009), complete source details or delete comma

GHD Adani Waste Report (excellent summary of Qld Waste legislation and regulations) - <http://eisdocs.dsdiqld.gov.au/Carmichael%20Coal%20Mine%20and%20Rail/EIS/EIS/Mine%20Chapters/10-waste-mine.pdf>

BHP Mitsubishi Alliance Caval Ridge Coal Mine Project – *Environmental Impact Statement* - [https://www.bhp.com/-/media/bhp/regulatory-information-media/coal/bhp-billiton-mitsubishi-alliance/caval-ridge/caval-ridge-mine-project-draft-environmental-impact-statement-eis/creismineralwaste-\(1\).pdf](https://www.bhp.com/-/media/bhp/regulatory-information-media/coal/bhp-billiton-mitsubishi-alliance/caval-ridge/caval-ridge-mine-project-draft-environmental-impact-statement-eis/creismineralwaste-(1).pdf)

Byerwen Coal Project, *Environmental Impact Assessment* - <http://eisdocs.dsdiqld.gov.au/Byerwen%20Coal/EIS/EIS%2026May13/07-operation.pdf>

LM.M.ManyuchiabC.MbohwaE.Muzendaac, 'Value addition of coal fines and sawdust to briquettes using molasses as a binder', *South African Journal of Chemical Engineering*, Volume 26, December 2018, Pages 70-73 - <https://www.sciencedirect.com/science/article/pii/S102691851830026X>

Summary of Queensland Waste Strategy - <https://www.qld.gov.au/environment/pollution/management/waste/recovery/strategy>

Queensland's new waste strategy

Queensland's new [Waste Management and Resource Recovery Strategy \(PDF, 4.33MB\)](#), underpinned by a [waste disposal levy](#), provides the strategic framework for Queensland to become a zero-waste society, where waste is avoided, reused and recycled to the greatest possible extent.



Proudly supported by



Background Information

The strategy focuses on transitioning to the principles of a circular economy to help retain the value of material in the economy for as long as possible. It provides the framework to help deliver coordinated, long-term and sustained growth for the recycling and resource recovery sector while reducing the amount of waste produced and ultimately disposed of, by promoting more sustainable waste management practices for business, industry and households.

To support Queensland's transition to a less wasteful future the Queensland Government proposes taking the following key actions:

- Working with councils to raise awareness about locally-available recycling options
- Delivering information and education programs that support waste avoidance, repurposing, reuse, recycling, and litter and illegal dumping prevention
- Supporting councils seeking to improve waste and recycling collection services and tackle problem waste
- Working with businesses to reduce excessive packaging and make packaging waste recyclable
- Making Government purchasing decisions that avoid waste and support products containing recycled materials
- Supporting research into new uses and markets for recycled materials
- Supporting infrastructure investment in locations that help improve community access to recycling.

The [Community Summary \(PDF, 3.01MB\)](#) provides simple actions to help Queenslanders reduce their own waste, boost recycling and reduce the impact of waste on the environment.

The draft Waste Management and Resource Recovery Strategy was released for public consultation over the period 13 February to 5 April 2019. The [Consultation Report \(PDF, 2.5MB\)](#) provides a summary of the feedback provided and how proposed changes have been addressed.

Development of the waste strategy

The strategy was developed through:

- Consultation and input from the Recycling and Waste Management Stakeholder Advisory Group. View the [Advisory Group's Terms of Reference \(PDF, 419KB\)](#)
- The outcome of public consultation in a [Consultation Report \(PDF, 128KB\)](#) detailing written responses to the [Transforming Queensland's Recycling and Waste Industry Directions Paper \(PDF, 3.0MB\)](#) which included the [formal review of the Waste Avoidance and Resource Productivity Strategy 2014–2024 \(PDF, 350KB\)](#)
- Comprehensive analysis and consultation undertaken by Queensland Treasury Corporation in preparing the report on [Economic Opportunities for Queensland's Waste Industry: final report \(PDF, 3.2MB\)](#)
- Modelling and appraisal of targets included in the draft strategy in the paper [Key performance indicators for the Queensland Waste Strategy \(PDF, 1.2MB\)](#) prepared by Queensland Treasury Corporation.

Additional information

- View the [final report from the Investigation into the transport of waste in Queensland \(PDF, 662KB\)](#).



Proudly supported by



Background Information

- View the [Government response to the investigation \(PDF, 265KB\)](#)
- A report prepared by the Queensland Treasury Corporation that identifies [opportunities for Queensland's waste industry \(PDF, 3.8MB\)](#) provides further context.

Related links

- [Waste legislation](#)



Proudly supported by



Appendix D: Waste Management and Resource Recovery Strategy Highlights

Waste Management and Resource Recovery Strategy

https://www.qld.gov.au/data/assets/pdf_file/0028/103798/qld-waste-management-resource-recovery-strategy.pdf

Strategic priority 1

Reducing the impact of waste on the environment

Actions for Queenslanders

- Recycle better.
- Avoid waste.
- Reduce waste.
- Choose to reuse.
- Find better ways to dispose of waste, and not litter or dump.

Government actions

- Implement the Plastic Pollution Reduction Plan.
- Continuously improve the effectiveness of waste sector environmental compliance operations.
- Audit landfills to test the quality of Queensland landfill infrastructure and identify non-compliance.
- Provide assistance for alternative arrangements where landfill facilities are to be progressively closed.

- Develop the Litter and Illegal Dumping: A plan for Queensland.
- Develop an education strategy to integrate waste and recycling behaviours into the education system.

Actions for local government

- Support and contribute to targets and actions under Litter and Illegal Dumping: A plan for Queensland.
- Deliver litter and illegal dumping interventions within local communities and at targeted hotspots.
- Support delivery of waste education through existing networks.
- Improve or close redundant landfill facilities.

Waste sector actions

- Strategically locate facilities in accordance with land use planning guidelines.
- Avoid and minimise the long-distance transport of waste where practicable.
- Continue to educate industry members about the appropriate management actions to take for particular wastes.

Outcomes

- Reduction in the amount of waste that goes to landfill, is littered or illegally dumped.
- Reduction in waste-related greenhouse gas emissions.
- Reduction in the long-distance transport of waste.
- Protection of Queenslanders' lifestyles and the enjoyment of our natural environment.
- Savings for households from avoiding unnecessary waste.
- Reduction in the impact from waste facilities on neighbouring communities and amenity value.



Proudly supported by



Strategic priority 2

Transitioning to a circular economy for waste

Government actions

- Assess the opportunities of the circular economy model for Queensland.
- Collect and amalgamate data to understand material flows across the economy and address knowledge gaps.
- Explore options to expand reporting of waste to build baseline datasets and inform decision making.
- Develop material-specific action plans for problem wastes.
- Deliver community campaigns and education programs that support waste avoidance, re-purposing, reuse and recycling.
- Explore scope for industry leadership in developing a voluntary specification code for minimum recycled content in packaging and products.
- Develop programs to increase business recycling.
- Support and develop extended producer responsibility and product stewardship initiatives.
- Develop an energy from waste policy.
- Work with other governments to develop quality standards for product packaging.

Actions for local government

- Optimise waste collection services.
- Improve community understanding about recycling and waste avoidance.
- Develop consistent messaging in delivery of services between councils.

Waste sector actions

- Inform and educate business clients about options to reduce waste and increase recycling.
- Offer service options that provide clients with choice about the level of recycling they want to adopt.

Strategic priority 3

Building economic opportunity

Government actions

- Develop and implement the Advance Queensland Resource Recovery Industries 10 Year Roadmap and Action Plan.
- Continuously improve and reform waste-related legislative frameworks.
- Develop proposals for landfill disposal bans.
- Work with the Commonwealth Government to standardise waste policy, legislation, regulation and messaging.
- Review the land-use planning system to ensure pathways for industry development are supported.
- Promote the development of waste precincts.
- Develop a coherent state-wide waste infrastructure-planning framework and regional infrastructure plans.
- Support the commercialisation of successful recycling and remanufacturing technologies.
- Create market development plans for key waste types and waste sectors.
- Investigate alternative end-uses and markets for recycled materials.
- Consider how procurement can stimulate demand for recycled material manufactured in Queensland.
- Develop programs to stimulate the growth of markets for recycled materials.
- Strengthen collaborative partnerships with key organisations in the sector.

Actions for local government

- Collaborate with state government planning on provisions to optimise land use and transport planning.
- Take a regional approach to infrastructure planning and collaboration.
- Collaborate across councils to create economies of scale and meet multiple infrastructure needs.
- Invest in improved infrastructure and standards for council run facilities.
- Rationalise waste facilities.

Outcomes

- Sound management of waste as a valuable resource.
- Improved data and information sharing on material flows across Queensland.
- Clear standards and guidelines for reuse and recycling.
- Clear position and policy on the role of energy and fuels from waste in Queensland.

Outcomes

- Growth in the economic value of the waste management and resource recovery sector.
- Increased number of jobs in reuse, recycling and recovery.
- Clear and transparent waste and resource recovery infrastructure planning framework.
- Stimulated markets for new and innovative products containing recycled content and demand for recycled material.



Proudly supported by

Appendix E: Synthesis on Circular Economy

What is it? Why is it important?

A circular economy (CE) involves finding ways to reduce and replace the use of non-renewable resources, keeping resources in use as long as possible, extracting the maximum value from them whilst in use, and recycling and recovering material and energy at the end of their service life.

A CE is much more than the reduction of waste through recycling or converting waste to energy. It is a regenerative production, distribution and consumption system in which resource inputs, waste, emissions, and energy leakage are minimised by slowing, narrowing, and closing material and energy loops.

It is a way of organising resource savings and profitable economic activities enabled by novel business models, innovative producers and value chain actors as well as responsible consumers. It requires supporting policy and regulation, education and behavioural change strategies and new perspectives, as well as skills and capacities to coordinate and implement activities across national, regional and local levels.

Worldwide, there is significant pressure on land and marine resources and sinks (their capacity to absorb waste and emissions) because of the increasing population and demand for material, water, food and energy consumption. While increasing demand for products and services creates business opportunities, the current predominately linear economic system which is based on “take-make-use-dispose” of resources will not satisfy demand and will deplete resources. Establishing CE is needed as an alternative to replace this linear path by closing the loop through reducing resource use, shifting to reusing, recycling and recovering material and renewable energy in production, distribution and consumption (Kirchherr et al., 2017). Producers and businesses will have to produce/provide more value with less as resources become increasingly scarce and expensive over coming decades.

1. Evidence

The possibility of establishing a fully closed CE is debated however, there is a growing number of proponents arguing that CE offers considerable potential for innovation and establishing new businesses, reskilling and new employment opportunities which will deliver substantial economic, environmental and social benefits.

CE is gaining momentum worldwide, particularly in China and Europe supported by top-down and bottom-up strategies respectively. China introduced CE in Government economic planning as early as 2008, and in 2013 released a national strategy for achieving a CE, including targets to increase energy and water productivity, and to almost double the output of the recycling industry. China has a long way to go but recent assessments of the performance of its CE initiative indicate steady improvement in resource use efficiency and circularity of economic activities in pilot areas (Mathews and Tan, 2016). In Europe, a 1% increase in resource use efficiency is estimated to save up to \$33bn and create up to 200,000 jobs (McKinsey & Company, 2015). The European Union released its CE package in December 2015 with an aim to create a more competitive and resource efficient and effective economy. It is estimated that the CE could be worth \$1 trillion worldwide and \$26 billion in Australia by 2025 (The World Economic Forum, 2014)



Proudly supported by



While there have been recycling programs across Australia, the concept of CE is only gaining attention nationally and in some states over the last three years. CE is much more than recycling waste however, even recycling alone when done properly, can generate economic, social and environmental values. The Waste Management Association of Australia (WMAA) notes that around nine jobs are created for every 10,000 tonnes of waste recycled (Senate Committee, 2018).

2. Current state and trajectory in Australia/Queensland

Recently, CE has gained the attention of Australian governments. In 2017, the South Australia government Green Industries South Australia (GISA) commissioned a study on the potential benefits and value of a CE to the State. The study found that implementation of CE could diversify the State's economic activities, creating an additional 25,700 full time equivalent jobs and reducing greenhouse gas emissions by 27% (7.7 tons of CO₂ equivalent) by 2030 (Lifecycles et al., May 2017).

In other states and nationally, CE has gained attention since January 2018 when China issued a *National Sword* policy that restricted the import of some low quality mixed recyclables. This was a major disruption to the global recycling market and led to an increased cost of recycling services, including those in Australia. The Australian recycling sector is under considerable pressure due to a lack of sustainable markets for recycled material, both domestically and internationally (Senate Committee, 2018).

The NSW government has developed the *NSW Circular Economic Policy Statement* and established an inter-governmental taskforce to urgently progress a longer-term strategic response to National Sword, in partnership with industry and local councils - <https://engage.environment.nsw.gov.au/38561/documents/88956>.

The Victorian Government is developing a CE policy and action plan, to be finalised by 2020 (Caley, 2018).

The Queensland Government has drafted the *Waste Management and Resource Recovery Strategy* - <https://www.qld.gov.au/environment/pollution/management/waste/recovery/strategy>. This draft discusses transitioning to a CE for waste as one of its chapters and is currently open for public feedback. The Queensland Government has pledged \$150,000 for a CE Lab which aims to consolidate industry, research and Government partnerships and expertise to identify and deliver initial CE pilot projects - <http://statements.qld.gov.au/Statement/2019/2/25/australian-first-circular-economy-lab-opens>, <https://circularecolab.com/>.

In July 2018, a report, *Never waste a crisis: the waste and recycling industry in Australia*, by a Federal Government Senate Committee (Senate Committee, 2018) made recommendations to the Australian Government to prioritise:

- The establishment of a CE in which materials are used, collected, recovered, and re-used, including within Australia
- Waste reduction and recycling above waste-to-energy, and seek a commitment through the Meeting of Environment Ministers of all levels of government to the waste hierarchy.

The Committee also noted the transition must include a suite of regulatory and policy changes aimed at influencing behaviour, as well as investments in infrastructure and technology.



Proudly supported by



3. *How does it work and what are the intervention options?*

Below are few operational principles and intervention options that are suggested in the literature (Suárez-Eiroa et al., 2019):

a) Adjusting resource inputs to regeneration rates

Options include: a) Reducing/eliminating non-renewable resources use, b) Substituting non-renewable by renewable inputs (e.g. renewable energy, bio-based materials, c) Adjusting the extraction rate of renewable resources to be within the regeneration rate

b) Adjusting waste and emission outputs to absorption rates

Options include: a) Prompting the design of out effluents, pollutions and emissions, for example b) Promoting eco-efficiency and eco-effectiveness to reduce wastage and waste

c) Closing or slowing the material use loops

Options include promoting the use of renewable resources (e.g. energy) and connecting waste management with resource recovery b) Designing products that are durable, repairable, easy to upgrade, and reuse recycle and/or recover.

d) Shifting production and consumption culture

EC requires shifting perspective on the part of businesses that are accustomed to generating income by producing products with rapid obsolescence on the part of consumers accustomed to using disposables and preferring to own the latest product instead of accessing the value and services the product provides (Lewandowski, 2016)

Options include developing value-focused business models and strategies to change customer behaviour such as through the sharing economy, collaborative consumption, shifting from products to services, and from ownership to access arrangements

e) Coordination and collaboration

Establishing successful CE will require the coordination of efforts along the value chain actors and across governments as well as collaboration between businesses, community and governments. For CE to work, those in a value chains have to coordinate adjustments required to reduce resource input, circulate outputs and value for longer and recover material and energy from waste for recirculation. CE also provides establishing new markets and value chains. Adjusting existing value chains or creating new ones will require significant policy, regulatory and program support from governments.

f) Use of digital innovation

Digital technology is starting to play a critical role in improving resource use efficiency and facilitating the sharing products and services. Agriculture is the least digitised sector in the world and in Australia, and presents a significant opportunity to employ AgTech that reduces resource input and waste, assists with shifting to renewable resources, and improves resource use efficiency, recycling and recovery; all contributing to CE.



4. Challenges and Opportunities for implementation

Implementing CE options faces some challenges and opportunities

Studies note the need for national leadership in CE which has been lacking in Australia. Australia is behind many nations in transitioning from the predominantly linear to CE and utilising waste as a resource (Dominish et al., 2017). However, industry-led and bottom up approaches may help in translating CE into practice to build resilient and competitive state and regional economies.

Another challenge is that CE can easily be politicised as a “greens” agenda despite studies showing that countries who implement CE will be resource use efficient and highly competitive economies. It is also equated with recycling and managing waste while it is primarily about designing to reduce resource use, optimise value from products and eliminating waste along the life cycle from extraction to production, distribution and consumption.

Limited awareness about the potential of CE to reduce wastage and provide economic, social and environmental benefits is significant among consumers, distributors and producers (Kirchherr et al., 2018). The concept and its benefits are not widely discussed and accessible to practitioners or the wider public (Merli et al., 2018). Recent policy responses by State and Federal governments can create opportunities to develop business cases for regional circular economies. Digital technology such as big data, sensors, and 3D printing will make reusing and recovering material and energy efficient and effective, helping decouple economic growth from natural resource depletion and environmental degradation (Murray et al., 2017)

5. Examples/stories of implementation

There are several recycling examples that provide resource use efficiency, and economic and social benefits in Australia that form part of CE. A more substantive example of transition to CE is what has been happening in the industrial and horticultural sectors in the Spencer Gulf in South Australia.

Transitioning to a new more circular economy in the Upper Spencer Gulf

By mid-2016, industry in the Upper Spencer Gulf region of South Australia had hit a crisis point. Two ageing power stations were no longer economically viable, and the mine that supplied them with mostly low-quality brown coal, had closed. Nearby in Whyalla, the steelworks were placed in voluntary administration and operations were wound back. Over a two year period, more than 2,000 jobs were lost across the region (Upper Spencer Gulf Common Purpose Group 2016; Reid 2016).



Proudly supported by



Two years on, the region is transitioning into a showcase for technological innovation with an expected injection of \$5bn in clean energy projects over the next five years. Thirteen clean power projects are under way, generating up to 3,000 jobs during construction, and hundreds of jobs on an ongoing basis. In one vast project, the Bungala solar power plant is installing more than 1.2 million solar photovoltaic (PV) panels over 800 hectares, making it Australia's biggest solar farm to date. In another case, British industrialist Sanjeev Gupta has purchased the steelworks with plans to revive the industry and invest in solar, hydro, waste gas and battery energy. Gupta's logic behind his investment in renewables and storage is that it is now cheaper than coal (Morton 2018). Agricultural industries in the region are also taking advantage of new technologies. Sundrop Farms is a 20-hectare site in the arid Port Augusta region. Seawater is piped 5.5 kilometres from the Spencer Gulf. A solar-powered desalination and energy supply plant uses the seawater and solar thermal power to create energy and enough fresh water to grow tomatoes hydroponically inside a greenhouse - <http://www.sundropfarms.com/>.

With high unemployment and only 11.3% of the local population holding a qualification above certificate level, there was a shortage of skilled local people to fill jobs in existing and emerging industries. Few opportunities existed for locals to gain the necessary qualifications without moving away from the region. Responding to this shortage, The Upper Spencer Gulf Community Owned Tertiary Education Centre (COTEC) was established (Tonkin Consulting Pty Ltd. 2017). Linking industry, community and educational providers, this new model aims to deliver tailored flexible education, from Certificate to Degree level, providing locals with the necessary skills and qualifications to meet industry needs. For example, if there is a demand for a Certificate 4 in Horticulture, a course can be developed in partnership with industry and the education provider to train local people while providing them with a qualification (ABC 2018).

6. Links and Resources

The Queensland Chief Entrepreneur Speech on Circular Economy:

<https://www.chiefentrepreneur.qld.gov.au/news/2018/the-brisbane-innovate-speech>

The Institute for Sustainable Futures (ISF) is leading the Wealth from Waste Cluster ISF-
<http://wealthfromwaste.net/>

<https://www.greenindustries.sa.gov.au/circular-economy>

<https://www.epa.nsw.gov.au/your-environment/recycling-and-reuse/response-to-china-national-sword/inter-governmental-taskforce>

<https://www.eventbrite.com.au/e/circular-economy-for-regional-victoria-tickets-56599215778>

References

ABC 2018. Future Tense: Transitioning to a new economy. Sunday 4 November 2018.
<https://www.abc.net.au/radionational/programs/futuretense/transitioning-into-a-better-future/10451930>



- Morton, Adam. 2018. Life after coal: the South Australian city leading the way. The Guardian, 20 Jul 2018. <https://www.theguardian.com/environment/2018/jul/20/life-after-coal-the-south-australian-city-leading-the-way>
- Reid, Kharma. 2016. Upper Spencer Gulf region loses 2,000 jobs; mayors call for more government support. ABC News, Posted 8 February 2016. <https://www.abc.net.au/news/2016-02-08/sa-spencer-gulf-region-suffers-from-2000-jobs-losses/7148020>
- Tonkin Consulting Pty Ltd. 2017. Transforming the Upper Spencer Gulf. A report prepared for the Upper Spencer Gulf Common Purpose Group. Port Pirie, South Australia.
- Upper Spencer Gulf Common Purpose Group. 2016. Transforming the Upper Spencer Gulf: Concept Report – Upper Spencer Gulf Community Owned Tertiary Education and Research Centre. Upper Spencer Gulf Common Purpose Group. https://upperspencergulf.com.au/download/initiatives_and_priorities/COTEC-Overview-Report.pdf
- CALEY, O. 2018. The Circular Economy. Department of Parliamentary Services Parliament of Victoria: Parliamentary Library & Information Service.
- DOMINISH, E., NICK, F. & DAMIEN, G. 2017. TOWARDS RESPONSIBLE PROSPERITY: PROGRESSING A CIRCULAR ECONOMY IN AUSTRALIA In: CHRISTIAN, L. & CECILIA, M. (eds.) *Boosting Resource Productivity by Adopting the Circular Economy* Switzerland: A World Resources Forum Production
- KIRCHHERR, J., PISCICELLI, L., BOUR, R., KOSTENSE-SMIT, E., MULLER, J., HUIBRECHTSE-TRUIJENS, A. & HEKKERT, M. 2018. Barriers to the circular economy: evidence from the European Union (EU). *Ecological Economics*, 150, 264-272.
- KIRCHHERR, J., REIKE, D. & HEKKERT, M. 2017. Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221-232.
- LIFECYCLES, E., INDUSTRIES, C. & QUEENSLAND, T. U. O. May 2017. Creating Value: the Potential Benefits of a Circular Economy in South Australia
- MATHEWS, J. A. & TAN, H. 2016. Circular economy: lessons from China. *Nature News*, 531, 440.
- MCKINSEY & COMPANY 2015. Europe's circular-economy opportunity. McKinsey Center for Business and Environment
- MERLI, R., PREZIOSI, M. & ACAMPORA, A. 2018. How do scholars approach the circular economy? A systematic literature review. *Journal of Cleaner Production*, 178, 703-722.
- MURRAY, A., SKENE, K. & HAYNES, K. 2017. The circular economy: An interdisciplinary exploration of the concept and application in a global context. *Journal of Business Ethics*, 140, 369-380.
- SENATE COMMITTEE 2018. Never waste a crisis: the waste and recycling industry in Australia. Canberra, Commonwealth of Australia.
- SUÁREZ-EIROA, B., FERNÁNDEZ, E., MÉNDEZ-MARTÍNEZ, G. & SOTO-OÑATE, D. 2019. Operational principles of circular economy for sustainable development: Linking theory and practice. *Journal of Cleaner Production*.