GIPPSLAND
Smart Specialisation

The Gippsland Bioenergy Project Development Framework

PATHWAY SUMMARY

Gippsland Smart Specialisation Bioenergy Innovation Group

Framework co-owned by Wellington Shire Council and Latrobe Valley Authority on behalf of the Gippsland region

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SUMMARY

The successful development of a biomass-to-energy project requires a methodical approach. It requires careful research, preparation and adherence to a number of planning and environmental regulations. Community and other stakeholder engagement is also vital to the success of any bioenergy project.

Following the closure of the Hazelwood power station and scheduled closures of Yallourn and Loy Yang A and B, and the Victorian Forestry Transition Plan a plan to cease native timber harvesting by 2030, the bioenergy and biomanufacturing sectors represent potential growth sectors for Gippsland. The Bioenergy Innovation Group (supported by the Gippsland Smart Specialisation Strategy), identified the need for a Gippsland Bioenergy Project Development Framework (Framework) to assist in the development of future bioenergy projects.

The Framework report will provide assistance to those who wish to initiate, develop or invest in a biomass-to-energy project. It offers a technical, financial and environmental reference for a range of biomass-to-energy projects. The Framework also describes issues related to the sale of steam/heat and electricity and grid access, as well as biomass availability, sustainability and the supply chain. It links the social, technical and planning aspects of bioenergy production.

The Framework uses a practical Project Development Pathway to start a preliminary assessment of the technical and financial feasibility of different biomass-to-energy options.

INTRODUCTION

Bioenergy is a form of renewable energy generated when biomass feedstock is processed using certain technologies. Biomass fuels come from organic materials such as harvest residues, purpose-grown crops and organic waste from homes, businesses and farms.

This Framework report describes the steps in the development of a successful biomass-to-energy project (bioenergy) using a Project Development Pathway. The Pathway provides practical starting points for a preliminary assessment of the technical and financial feasibility of different bioenergy options (Figure 1).

The pathway process is particularly well-suited to the development of small- to medium-scale biomass projects and projects seeking community ownership and benefit sharing. The report's focus is on waste products from the food and beverage industry, the forestry and wood processing industry and agriculture.

This Pathway focusses on six proven, globally deployed technologies used on a commercial scale. However, these technologies are not financially viable for all locations, feedstock types, equipment vendors or geopolitical/regulatory situations. See main report for details.

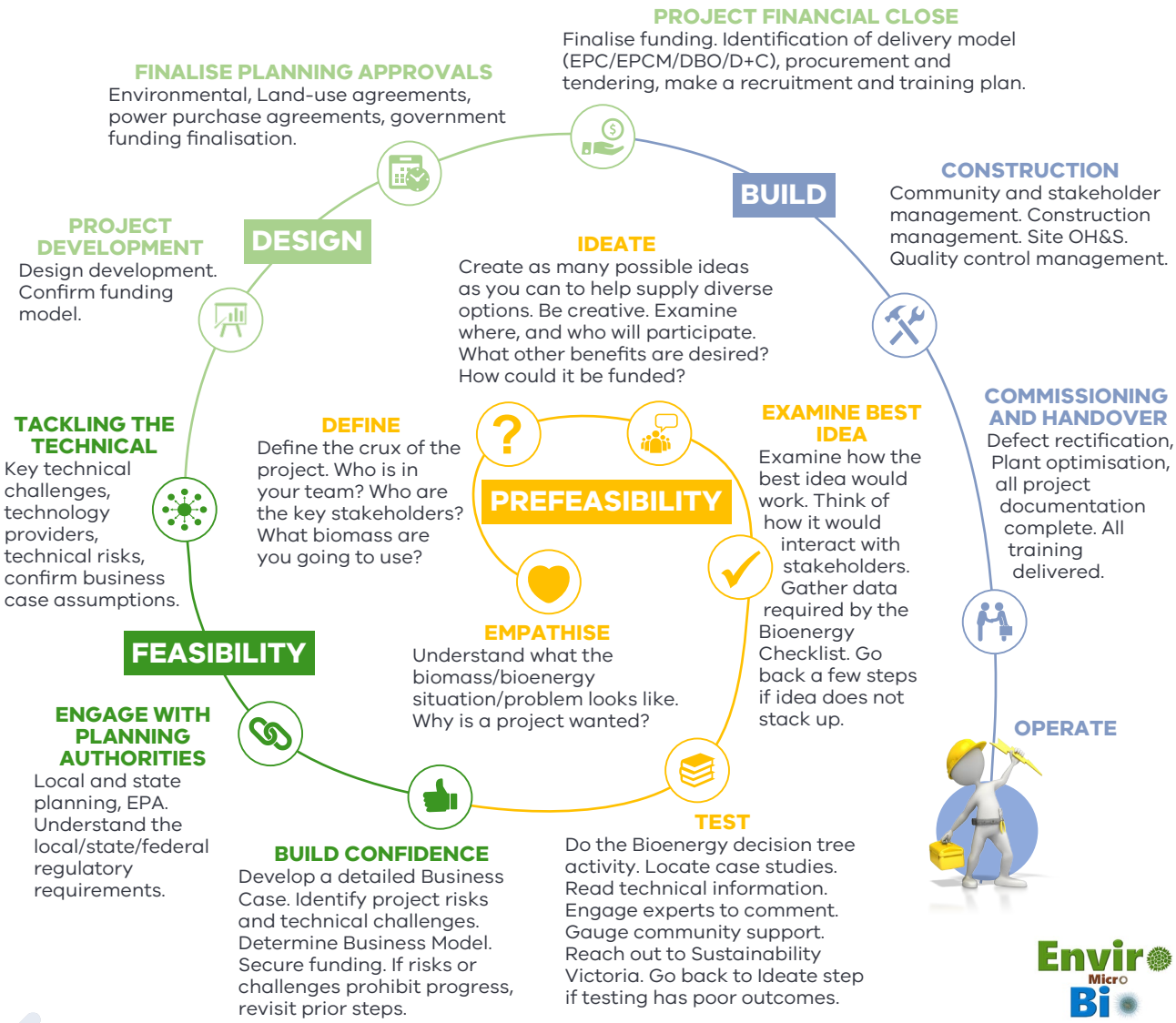


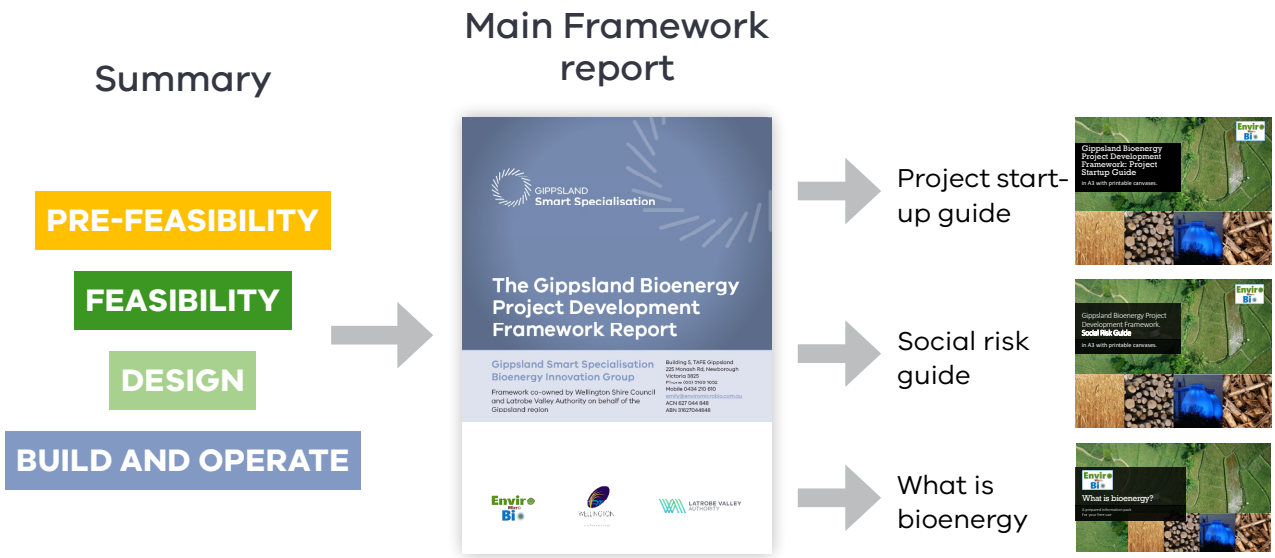
Figure 1: The Pathway in graphical format.

PROJECT DEVELOPMENT PATHWAY

The development of a bioenergy technology project can be analysed in four discreet phases, summarised in Figure 1:

- pre-feasibility
- feasibility
- design
- build and operate

As each phase progresses, the level of detail and information required increases. At the conclusion of the first two phases, it should be apparent whether the project is financially and technically feasible and should then move into implementation.



PHASE 1: PRE-FEASIBILITY

The first step in the development of a successful biomass-to-energy project (bioenergy) is pre-feasibility. The analysis involves initial calculations using default data and assumptions. There are five stages:

- *Empathise*
- *Define*
- *Ideate*
- *Examine the best idea*
- *Test*.

All bioenergy projects seek to solve problems or improve on existing processes. Issues can range from a demand for electricity, biogas, process steam or heat to the desire to reuse biomass residues from organic waste. Alternatively, the idea could be driven by government policy at a local, state or national level to achieve greenhouse gas reductions and the development of a circular economy by replacing dependence on fossil fuels.

This first stage (*Empathise*) asks questions to help understand the needs and who you may need to work with to complete your project. Stage two (*Define*) helps determine key stakeholders, biomass supply, local issues and the people who can help make the bioenergy project a reality.

The *Ideate* stage involves creating as many ideas as possible to address the issues defined in the first two stages. Many questions are still posed at this point, including where the bioenergy plant could be located, who will be involved and how it could be funded.

After narrowing down the options, it is time to *Examine* how the best idea would work. Engaging with key stakeholders can provide useful feedback to help model the way forward. If the best idea doesn't suit, go back a few steps in the Pathway and rethink.

By the *Test* stage, you will have detailed information about available biomass and the most suitable technology to turn it into bioenergy. This Framework focusses on six proven technologies (anaerobic digestion, advanced combustion, pyrolysis, gasification, transesterification and fermentation), and further feedback from experts and technical information can be valuable as not all technologies are viable for all locations, feedstock types or equipment.

Community support for any bioenergy project is also essential. By engaging with the community, you can understand what, if any, issues may be of concern. Concerted efforts to achieve positive social impact can help ensure community education, ownership and connection.

The result of this first round of investigations and planning is the pre-feasibility study report. It outlines the findings of your assessment, summarises the conclusions and makes recommendations regarding the worth of progressing to the feasibility stage.

PHASE 2: FEASIBILITY

If the outcomes of the pre-feasibility study are favourable, project development moves to feasibility. This builds on previous work, uses more detailed information and process designs and considers all types of operations involved in processing. It is also important to define other operational details, such as feedstock and reagent suppliers and potential plant locations.

The purpose of the feasibility study is to provide sufficient detail for potential investors and stakeholders to support the development of the bioenergy project.

The three stages of feasibility are:

- *Build confidence*
- *Engage with planning authorities*
- *Tackling the technical*.

The *Build confidence* stage of feasibility involves developing a detailed business case that captures the reasoning for initiating the project. It includes the assessment of the project's viability in technological, organisational, environmental, economic and financial terms, as well as financial and economic analyses. These assessments provide a way for key stakeholders (such as investors, the local community and regulators) to compare different technical and financing solutions.

The *Build confidence* stage also examines how to best structure your business to achieve your outcomes, including your workforce. A workforce analysis will identify skills and gaps. At this point you will need to begin establishing a workforce to develop the business case, design the plant, achieve planning approval and undertake construction, commissioning and operation of the plant.

Thinking about your future workforce needs, you may need to engage with a training partner to identify and/or develop training programs, adapt those available or seek expertise from overseas.

All bioenergy projects must comply with the Victorian planning rules and the scheme that regulates the use, development and protection of the land. The *Engage with planning authorities* stage ensures you understand and fulfil the requirements of stakeholders such as planners, regulators and economic development officers in the Gippsland councils.

Bioenergy is a relatively new sector in Australia, so design, engineering and construction experience is limited. *Tackling the technical* may involve running a laboratory or pilot scale process in order to understand and quantify the technical aspects that can affect financial and technical viability at a minimum. The original biomass and any by-products or residues should be extensively tested to ensure that they are of the required quality, purity and do not contain higher than expected levels of contaminants. You need to work with the technology supplier to understand the quantity of energy produced and the properties of the byproducts.

PHASE 3: DESIGN

The design phase involves final calculations and design of equipment, building sites, equipment installation, internal configuration, modes of operation, stabilisation times, building permissions and environmental licences. This phase also includes an early exploration of the job/role training that may be required for the operators.

At the conclusion of the design phase, all the design, tendering and procurement documentation should be complete, allowing engagement with the construction market.

The three design stages are:

- *Project development*
- *Finalise planning approvals*
- *Project financial close*.

Project development involves creating a concept design. This provides detailed technical descriptions, plant layout, plant equipment list, civil design and geotechnical assessment. Sufficient detail is necessary to estimate the capital and operating costs with a degree of confidence to satisfy investors.

It includes financial models and the business case demonstrating the economic and financial viability of the bioenergy project to the satisfaction of investors and stakeholders.

This phase also incorporates *Finalise planning approvals*, including all environmental, land-use agreements, power purchase agreements and other approvals. Investors normally require proof of these approvals being granted before financial closure.

The *Project financial close* stage finalises funding, identifies the delivery model, begins procurement and tendering processes and develops a recruitment and training plan.

Procurement processes can be structured in many ways and the size of the project will influence the approach. The procurement strategy is of significant interest to investors. It is also important to choose the right form of contract; technical and legal advice will help determine which form of contract is best for your bioenergy project. The tendering process must comply with state and national laws covering construction contracts.

At the end of the design period, you will have a good idea of the important processes to produce bioenergy from your chosen feedstocks and your plant design should be largely fixed. You should therefore be able to identify the specific roles and skills that will be necessary to operate the plant and associated critical procedures.

A job skills/task analysis will identify the types of roles for each major task on site. A recruitment and training plan will help guide when and who to hire, and when and what training should be delivered. Some operational staff should be involved in the commissioning process so they can learn from the technology vendors and commissioning engineers.

PHASE 4: BUILD AND OPERATE

The final three stages of the Pathway are:

- *Construction*
- *Commissioning and handover*
- *Operate*.

The build and operate phase commences with the appointment of a preferred contractor through an appropriate procurement process and finalisation of the construction contract(s).

Construction of a bioenergy plant is complex and is the responsibility of a suitably qualified and experienced contractor. It includes construction activities, site management, environmental management, health and safety management, community engagement and commissioning.

When all equipment has been installed, the project moves into *Commissioning and handover*. During commissioning, all equipment should be tested using a logical and systematic approach. This aims to demonstrate that all installations are complete and comply with contractually specified requirements, have completed electrical safety checks and are safe to operate.

During this period, it is common to construct a list of defects and a plan for who will fix them and pay for the work.

Operating staff are trained during *Commissioning and handover* so they become familiar with the equipment and ensure efficient and safe operation and maintenance. As the operations team becomes skilled in operating the plant and learns its strengths and limitations, it is common for process improvements and optimisations to be made during the late commissioning stage.

After commissioning, the plant moves to the *Operate* stage. It is handed over to the operator and the plant enters its warranty period as per any contractual agreements.

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This document is a summary of The Gippsland Bioenergy Project Development Framework Report. A full report is available at ***