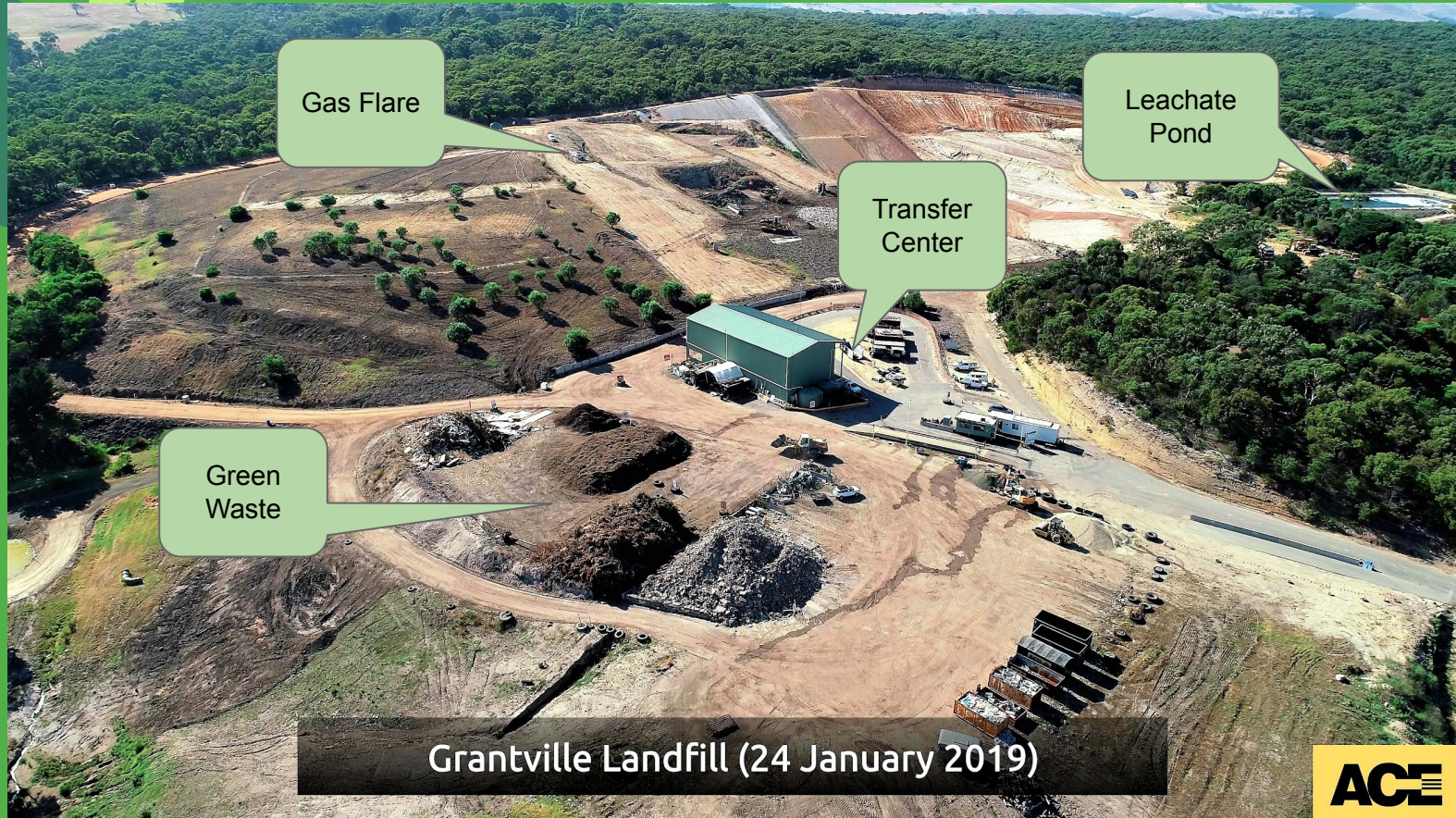




# WPI Grantville Update

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Sydney Seo, Ari Trey-Masters



Grantville Landfill (24 January 2019)





Photo of Gas Flare



Wood Waste Pile



# Researched Technologies

Technologies	Researched	Companies	Value Added Products
Incineration	✓	Currently used on site	<ul style="list-style-type: none"><li>• Heat</li></ul>
Pyrolysis	✓	Pyrotech Earth Systems Pyrocal	<ul style="list-style-type: none"><li>• Biochar</li><li>• Heat</li><li>• Diesel fuel</li></ul>
Gasification	✓	MAGS Pyrotech	<ul style="list-style-type: none"><li>• Biogas</li><li>• Heat</li></ul>
Plasma Arc Gasification	✓	Zenergy Australia	<ul style="list-style-type: none"><li>• Biogas</li><li>• Heat</li></ul>
Anaerobic Digestion	✓	Case studies CERES?	<ul style="list-style-type: none"><li>• Biogas</li><li>• Heat</li><li>• Compost</li></ul>







- Very limited feedstocks
  - Heavy pre-processing required
- Multitude of outputs
  - Biochar
  - Bio-crude oil
  - Wood vinegar
  - Syn-gas
  - Wood gas
- Utilizes fast pyrolysis, gasification, and carbonization



# Pyrotech Energy





# MAGS (Micro Auto Gas. Sys.)

- Wide variety of feedstocks with little no processing
  - paper/cardboard, food, plastics, hazardous waste, solvents, sludges, etc.
- Produces biochar, heat, and syngas
- Features:
  - Fully automated for remote monitoring
  - Automated biochar removal system
  - Uses the produced syngas to power itself
  - Hazardous Material Prevention
- Can only process ~1 tonne per day

→ 2400 kWh daily



# MAGS (Micro Auto Gas. Sys.)





# PYROCAL

PTY LTD

- Able to use a wide range of feedstocks
  - Takes care of hazardous materials
  - Seemingly no pre-processing
- Limited outputs
  - Biochar
  - Heat
- Uses solely carbonization
- Implemented in 8 countries
- Customizable to landfill



# PYROCAL

PTY LTD

1. **Plant & animal derived residues (organics)**
  - a. Carbonised with char yield approximately 25% of dry matter. *Greater than 50% moisture lessens contribution to heat balance.*
2. **Paper, cardboard and packaging**
  - a. Carbonised with char yield approximately 20% of dry matter. *Key source of heat release for autothermal operation.*
3. **Plastics (e.g. packaging, disposable nappies)**
  - a. Carbonised with char yield approximately 5% of dry matter. *Some plastics have char yields up to 35% by mass. Main source of heat release for autothermal operation.*
4. **Treated timber**
  - a. Carbonised with char yield approximately 22% of dry matter. *Some release of volatile metals which are captured downstream in the scrubber. Can be a significant source of Cu, Cr and As in the char, which can impact on suitability for end use.*
5. **Biohazardous material (used health products, unused medicines)**
  - a. Carbonised with char yield approximately 15% of dry matter. *Biohazards are eliminated.*
6. **Hazardous waste – Pesticides/Herbicides/ Paints, waste oils**
  - a. Vaporised in the hearth and destroyed in the thermal oxidiser
7. **PFOA/PFOS (PFAS)**
  - a. Vaporised in the hearth and destroyed in the thermal oxidiser. *Halogens such as fluorine are converted to safe calcium salts in scrubber.*

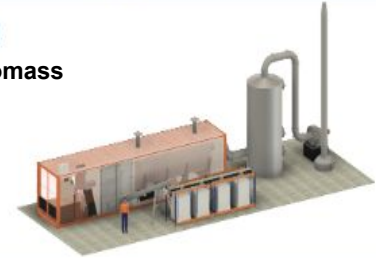
## Pyrocal CCT 12

250 kg/hr biomass  
0.75 MW<sub>th</sub>



## Pyrocal CCT 18

650 kg/hr biomass  
2 MW<sub>th</sub>



## Pyrocal CCT 18 Dual

1300 kg/hr biomass  
4 MW<sub>th</sub>





# Earth Systems 'Charmaker'

- Only accepts woody wastes
- No chipping required
  - Max 6" diameter, 6' length
  - Up to 50% moisture
- Focused on biochar production
- 7 tonnes wood waste = 1-2 tonnes biochar
  - 4-5 hours





# Plasma Arc Gasification

- Only available from Zenergy Australia
  - Doesn't have a website



# Landfill Site Data Collection

- Obtained data on incoming waste to landfill
- Toured landfill to visually assess feedstocks
  - Green waste
  - Treated timber
  - Heat from flare
- ACE's main concern is running generators and engines
  - Little concern with byproducts





# Grantville Waste Summary

**Redacted  
Proprietary Data**



## Next Steps

- Gain more information on feedstock units and usability
  - Identify high value added opportunities
  - Find critical issues
- Research Anaerobic Digestion and Plasma Arc Gasification and find potential suppliers
- Narrow down technologies, then contacting companies and getting quotes
- Determine bioenergy cluster opportunity



# Thank you

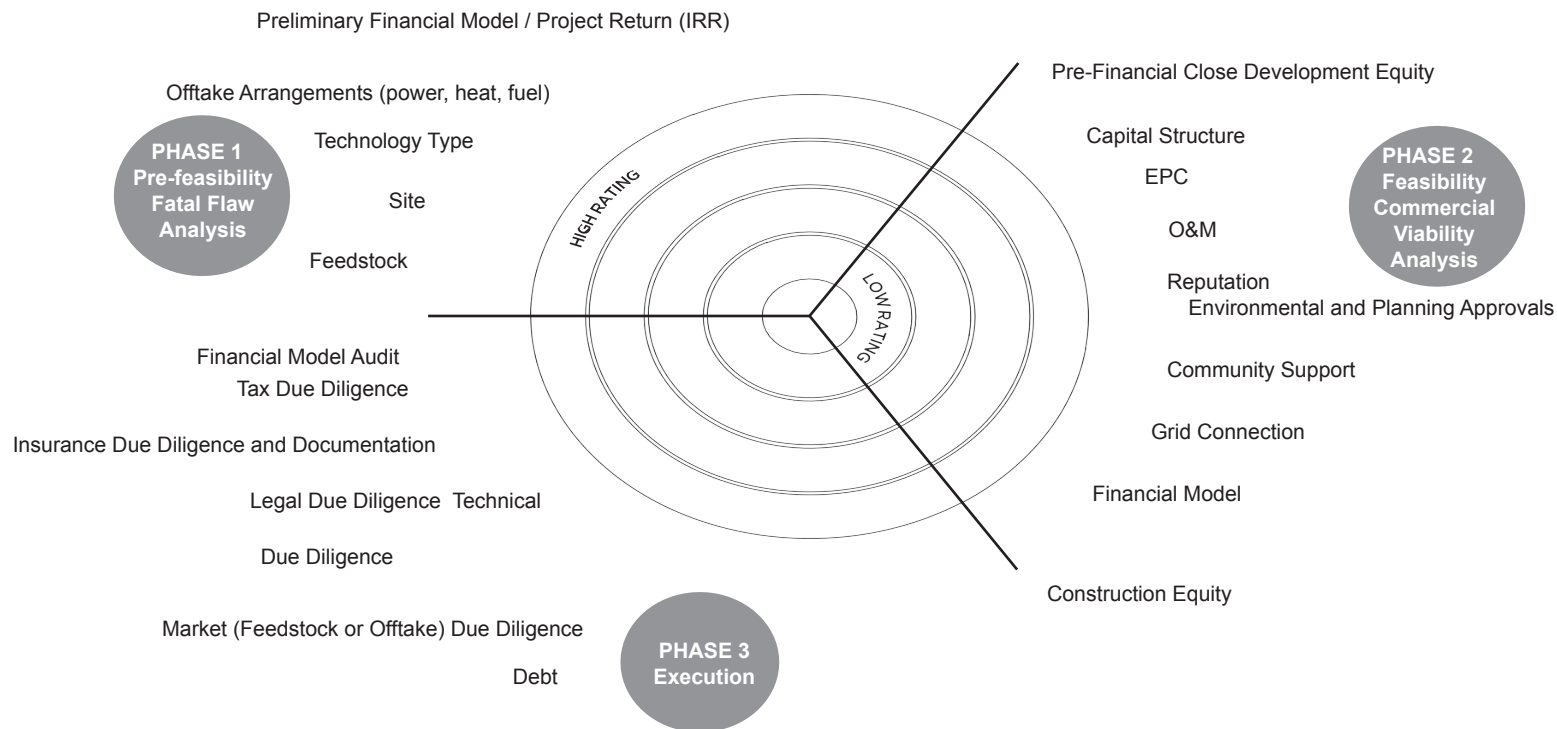
Any Questions?



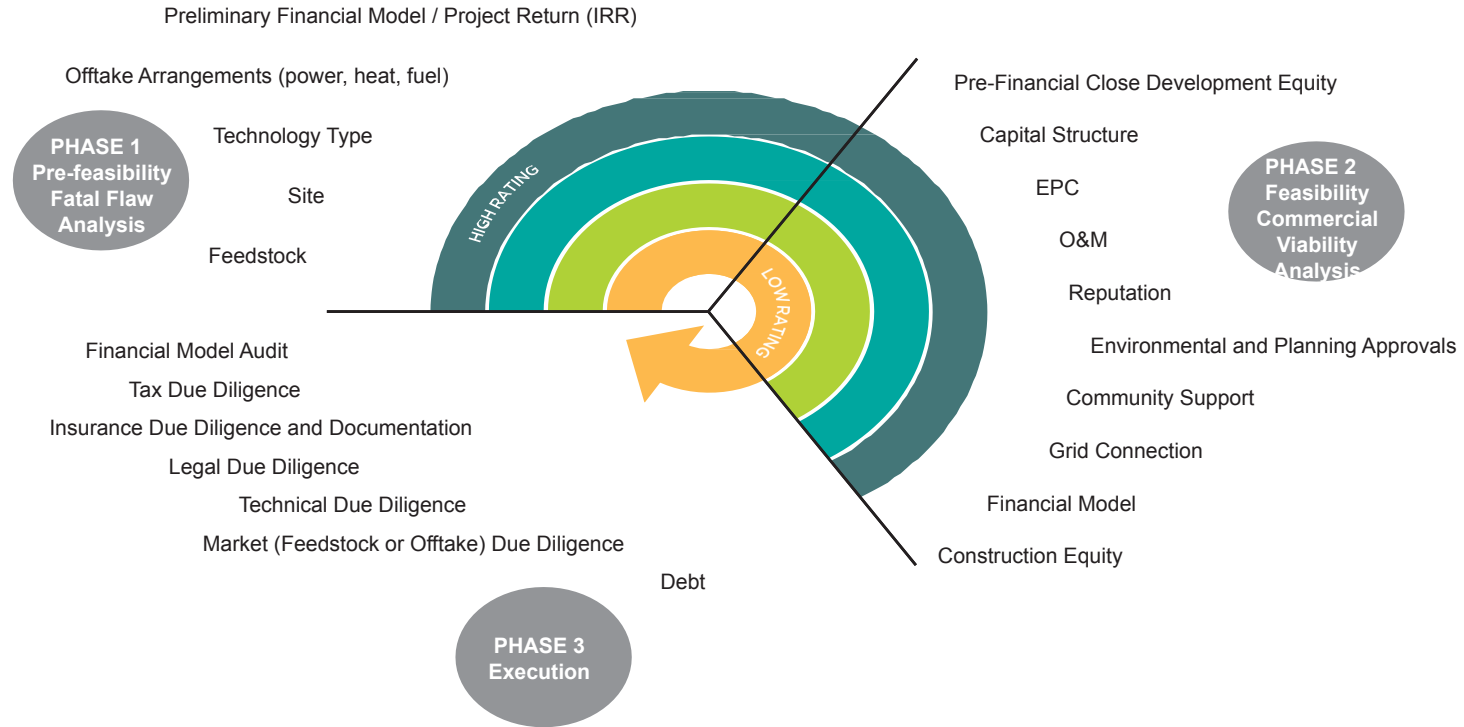
A decorative graphic on the left side of the slide. It features three green leaves with prominent parallel veins. One large leaf is positioned in the upper center, pointing towards the top right. Below it and to the left are two smaller leaves. The background is white, accented with three light gray circles of varying sizes: a large one in the top left, a medium one in the top center, and a small one in the bottom left.

# Appendix

# BIOENERGY PROJECT SELF - ASSESSMENT TOOL



# BIOENERGY PROJECT SELF - ASSESSMENT TOOL





# BIOENERGY PROJECT SELF - ASSESSMENT TOOL

Factor	Low Rating	Medium Rating	High Rating
Feedstock Type and Supply	No specific feedstock source identified yet or the feedstock is at risk of not being available for the life of the asset	<p>Feedstock type identified but either</p> <ul style="list-style-type: none"> <li>supplier(s) not identified, or</li> <li>supplier(s) identified but principles of supply not discussed or agreed with supplier(s).</li> </ul> <p>If it is unlikely that all the feedstock supply can be contracted by Financial Close</p> <ul style="list-style-type: none"> <li>evidence is in place that demonstrates that there is sufficient feedstock within an economically viable proximity to the project (aim for 3x coverage within a 1-2 hours transport time (depending on site location), and/or</li> <li>Letters of Support or MOU(s) are in place for the majority of the uncontracted portion.</li> </ul>	Feedstock contractually secured from creditworthy counterparty, including quality, volume, and price. Transport risks minimal.
Site (may either be leased or purchased).	No Site	Suitable site identified but not secured.	Site contractually secured and suitable.

# BIOENERGY PROJECT SELF - ASSESSMENT TOOL

Factor	Low Rating	Medium Rating	High Rating
Technology	Not proven with same feedstock at similar scale elsewhere in the world.	Technology is proven with same feedstock at similar scale but technology providers not shortlisted.	Technology is proven with same feedstock at similar scale* and technology providers shortlisted if not selected.
Offtake Agreement	<p>For power, no offtake likely because there is either no ability to connect into the grid or no behind the meter solution for 100% of the energy output with take or pay terms.</p> <p>For other outputs (e.g. RDF, liquid fuels, wood pellets, biogas) there are no offtakers identified and/or no offtake agreements in place.</p>	<p>Offtake arrangement has been decided (e.g. export to the grid and/or third party power sales under contract) for all output.</p> <p>For any contractual sales:</p> <ul style="list-style-type: none"> <li>the counterparty is identified,</li> <li>key principles with the counterparty have been discussed, and</li> <li>the counterparty's creditworthiness has been considered and justifies ongoing engagement.</li> </ul>	Offtake for all of the project's output is contractually secured, including volume and price, with creditworthy counterparty on take or pay basis.

\*Scaling up risk may be considered if there is a sensible modularised approach

# BIOENERGY PROJECT SELF - ASSESSMENT TOOL

Factor	Low Rating	Medium Rating	High Rating
Project Internal Rate of Return ("IRR") (This can be approximated by calculating the IRR on the Projects forecast EBITDA)	Project IRR below commercial level. Material grants required to attract third party investment.	Acceptable project IRR relative to risk based on high level indicative costings and revenue streams.	Acceptable project IRR relative to risk of project including appropriate contingencies based on detailed third party procured costings and revenue streams.
Pre-Financial Close Development Equity	No or very limited development equity. Requires grants and/or new development capital raise.	Limited development equity available and/or grant funding application submitted.	Sufficient development equity and/or grants committed to fund Project until Financial Close.
EPC and O&M (While the wording of the ratings provided relates to EPC only, the principles and approach cover both EPC and O&M)	Approach not defined or no intention to lock in EPC wrap. EPC Contractors approached to submit EPC expressions of interest have limited experience, have a weak creditworthiness or have not delivered a project in Australia before and do not have a clear strategy on how to successfully deliver a project in Australia.	EPC tender process well progressed and shortlisted bidders identified. EPC Contractors participating in tender process and shortlisted are reputable, creditworthy and can demonstrate experience in successfully delivering suitable reference plant(s).	EPC Contractor selected. Principles agreed for a fixed price fixed date EPC agreement with technically experienced, quality counterparty who has previously constructed in Australia and has successfully delivered suitable reference plants (i.e. plants of similar scale, same technology, same/similar feedstock).

# BIOENERGY PROJECT SELF - ASSESSMENT TOOL

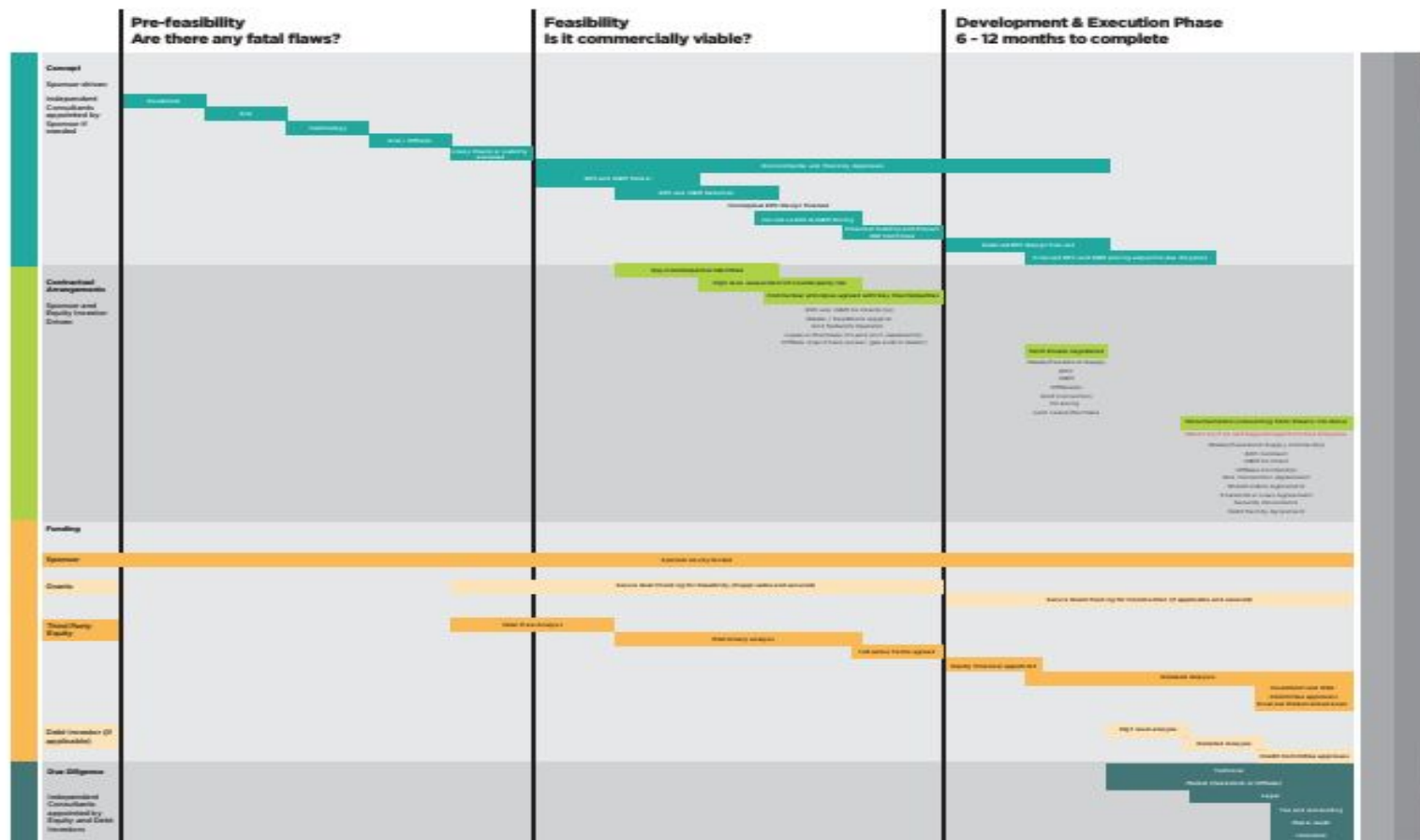
Factor	Low Rating	Medium Rating	High Rating
Reputation	Key parties involved in project have historic reputational issues which are likely to be problematic with respect to the ability to deliver and operate project successfully.	Key parties involved have immaterial historic reputational issues (e.g. small fines or negative press coverage which has since been corrected) which are unlikely to threaten the success of the project.	Key parties involved are highly reputable with no reputational issues.
Environmental and Planning Approvals	Not commenced or likely to be problematic or expensive.	Process to obtain Development approval and relevant EPA licence has commenced (i.e. pre-lodgement meetings with Council have been held) with no signals from Council or EPA that approvals will not be forthcoming.	All approvals in place including any output quality standards, and awarded without significant stakeholder objections or onerous conditions, including any output quality standards.
Community Support	No intention to engage community or have not yet engaged or engagement has occurred but Community is/likely to be against project.	Engagement commenced with community and minimal and immaterial concerns raised to date which are not likely to be a hindrance to project development and ongoing viability.	Community and other key stakeholders (eg local govt) highly engaged and supportive of project.



# BIOENERGY PROJECT SELF - ASSESSMENT TOOL

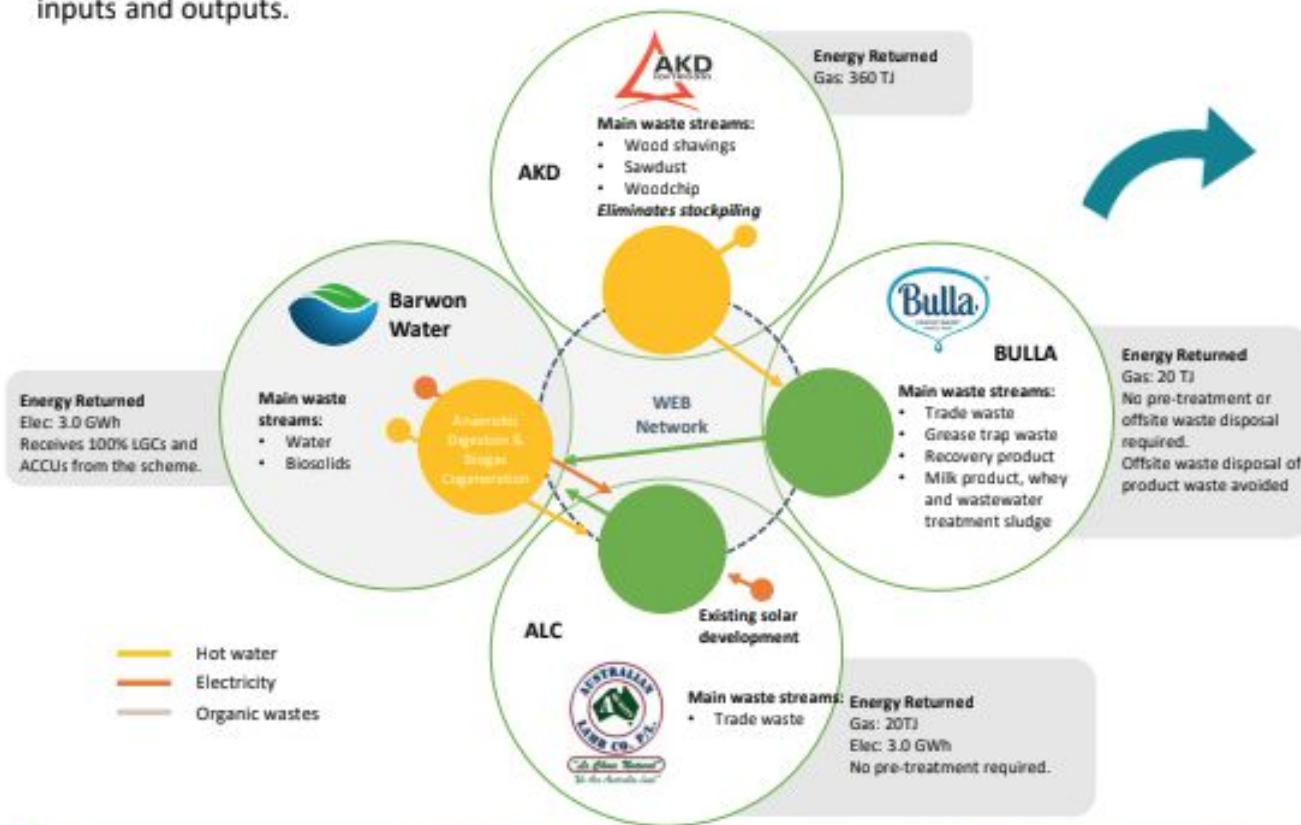
Factor	Low Rating	Medium Rating	High Rating
Grid connection (Electricity or Gas)	Not commenced or likely to be problematic, cost prohibitive or exposed to grid constraints.	Grid connection discussion with grid network operator is highly advanced and there is minimal risk that an acceptable connection offer will not materialise.	Contractually committed. Costs and delivery time locked down with transmission or distribution network service provider.
Financial Model	Not prepared or too basic.	Model prepared but detail and functionality needs to be improved.	Sophisticated financial model developed by professional modeller including a variety of graph outputs and sensitivities. External model audit proposed.

# CONCEPTUAL PROJECT DEVELOPMENT TIMELINE



# Catalyst project – the Colac WEB

The Colac WEB is a world-class, innovative waste-to-energy partnership – with 4 complementary businesses sharing inputs and outputs.



45,000 tonnes of waste turned into:

- ✓ Natural Gas reduction: 400 TJ  
That's 7000 households
- ✓ Renewable electricity: 6 GWh  
That's 1100 households
- ✓ CO<sub>2</sub> emissions reduction: 25,000 tonnes per year
- ✓ Dispatchable renewable energy

Economic growth and jobs:

- ✓ Regional economic growth of more than \$125 million
- ✓ 17 new ongoing jobs
- ✓ 100 temporary construction jobs
- ✓ 1500+ regional jobs secured

Four businesses achieving a step change through industrial symbiosis.