HILTCRC

Australian Government
Department of Industry, Science and Resources

Cooperative Research Centres Program

PROJECT SUMMARY

RP2.018: DEMONSTRATING THE SUSTAINABILITY AND POTENTIAL OF BIOMASS/WASTE-DERIVED SYNGAS FOR AUSTRALIAN HEAVY INDUSTRIES APPLICATIONS: ADDRESSING TECHNICAL CHALLENGES

RESEARCH PROGRAM 2: CROSS-CUTTING TECHNOLOGIES

OVERVIEW

Many industry processes – such as alumina refining and iron ore pelletising – depend on high-temperature heat, often generated from fossil fuels like natural gas. To meet net-zero targets, these industries need reliable and affordable low-emissions alternatives.

This project explores one promising pathway: using syngas derived from locally available biomass and waste (such as refuse-derived fuel, or RDF). Syngas, primarily composed of carbon monoxide and hydrogen, is produced by heating organic material without oxygen (a process known as gasification). By producing and using syngas in existing industrial equipment, heavy industry companies have an opportunity reduce carbon emissions without needing to invest in entirely new infrastructure.

PROJECT DETAILS

This project focuses on testing whether biomass- and waste-derived syngas can be a sustainable and practical alternative to fossil fuels, such as natural gas, for high-temperature processes in heavy industry.

The project team will design and build a pilot-scale system, tailored for heavy industries, that combines a biomass gasifier with a syngas burner. This system will be tested with a range of local feedstocks – including agricultural waste, wood residues and engineered fuels like RDF – to assess fuel quality, combustion performance and emissions.

In addition to technical performance, the project will conduct a technoeconomic analysis to compare syngas with other low-carbon options such as green hydrogen and electrification. It will also engage with regulators to collect the emissions data needed for environmental approvals, helping pave the way for commercial-scale applications.

To provide guidance on regulatory risks, policy alignment and community concerns, RP2.018 will also examine the regulatory and social dimensions of biomass use, including:

- mapping federal and state regulatory frameworks
- conducting a gap analysis of conflicting or unclear policies
- evaluating social-licence-to-operate considerations, such as workforce, environmental and economic concerns.

RP2.018 follows on from RP2.012 Opportunities for bioenergy in Australian heavy industry, which identified significant local availability of biomass and waste resources capable of supporting specific heavy industries to either fully or partially decarbonise their high-temperature processes.

This project also draws on the findings of RP2.010 Utilisation of refuse-derived fuel in industrial processes: understanding the value proposition, risks and supply chains, investigated the potential of RDF and identified RDF-derived syngas as a cost-effective, low-carbon alternative fuel for decarbonising high-temperature processes in heavy industries. RP2.018 also addresses challenges regarding the consistency of feedstock supply and its effects on the gasification process.

PROJECT LEADER

Dr Vahid Shadravan, CSIRO

PARTNERS

- CSIRO
- The University of Adelaide
- South32
- Grange Resources
- Forest Products Commission
- ResourceCo
- FCT Combustion
- Sumitomo SHI/FW

INDUSTRIES

- Alumina
- Iron & Steel
- Cement & Lime

TOTAL PROJECT VALUE

$ 1,559,382 (cash and in kind)

COMMENCED

01 May 2025

END DATE

31 October 2027

CONTACT

For more information on this project, contact enquiries@hiltcrc.com.au

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HILT CRC MILESTONES

- 2.1 Integrating variable renewable energy sources into existing industrial processes
- 2.2 Technology to accommodate use of multiple energy sources
- 2.4 Blending of alternative low-carbon fuels for current industrial processes
- 2.5 Technologies to lower carbon emissions through synergistic production of industrial chemicals and fuels

RESEARCH AREAS

- Blending of alternative low-carbon fuels for current high temperature processes
- Biomass, waste and other low-carbon fuels, including new combustion technologies
- New technologies for high-temperature heat
- Green heat for industry

PROJECT OUTCOMES

- A working pilot-scale system that demonstrates biomass/waste gasification and syngas combustion for industrial use.
- A comprehensive knowledge database detailing syngas quality and combustion performance using different feedstocks under different process conditions.
- Engineering insights into how syngas can be integrated into existing industrial systems.
- Technoeconomic comparisons of syngas with other low-carbon fuels.
- Emissions data to support regulatory approval and environmental permits.

PROJECT BENEFITS

- *Lower emissions:* Enables industries to partially or fully replace fossil fuels with renewable alternatives.
- *Cost-effective transition:* Potential to avoid the need for major infrastructure upgrades by retrofitting syngas systems into existing plants.
- *Use of local resources:* Taps into regional biomass and waste streams to create value and reduce transport emissions.
- *Industry-specific solutions:* Tailored approaches for companies such as HILT CRC Partners South32 and Grange Resources based on their energy needs.
- *Roadmap to industry adoption:* A pathway for further integration of high-temperature processes – such as alumina calcination – with gasification systems, can set the stage for industrial-scale demonstrations.
- *Flexible fuel systems:* Supports hybrid approaches, such as blending syngas with natural gas or hydrogen, for greater system resilience.
- *Support for regulation and scale-up:* Provides performance and emissions data to inform environmental approvals and future pilot projects.