HILTCRC

Australian Government
Department of Industry, Science and Resources
AusIndustry
Cooperative Research Centres Program

PROJECT SUMMARY

RP2.007: FEASIBILITY COMBUSTION STUDY TO IDENTIFY CHALLENGES AND OPPORTUNITIES FOR HYDROGEN INTO IRON AND CEMENT SECTORS

OVERVIEW

Current Australian steel makers and iron-pellet producers have a need for technology that can be retrofitted to existing iron pellet kilns to provide the process heat with technology that can readily be made net-zero. The most prospective of these are hydrogen burners and thermal plasmas, for which no commercial solutions are readily available that can provide certainty in also maintaining product quality and achieve other emissions standards, such as NOx. Since the future relative costs of these two energy sources is unknown, and will depend on external circumstances beyond our control, there is a need for the parallel development of both options, starting with the one that has the lowest technical risk, namely hydrogen combustion. Hence there is a need for both the development and de-risking of the technology itself and of the establishment of a pilot-scale rig that would be suitable for optimisation and confirming the performance at smaller scale of preferred options as they emerge, prior to beginning any more expensive trials at commercial scale. Current cement producers have a need to increase the penetration of alternative fuels. However, many of the potential sources are of low quality, making it difficult to utilise them without new developments. Access to relatively small quantities of hydrogen and oxygen offers the potential to significantly increase the viability of such fuels by enhancing flame stability. However, each fuel is unique and the viability of such options cannot be evaluated reliably without complex modelling, verified by experiments at sufficient scale.

PROJECT LEADER

- Dr Alfonso Chinnici,
  The University of Adelaide

INDUSTRIES

- Alumina
- Cement & Lime
- Iron & Steel

TOTAL PROJECT VALUE

- $ 1,848,868
  (cash and in kind)

COMMENCED

01 June 2023

PROJECT DETAILS

The project aims to advance the technical development in the use of hydrogen as fuel, either standalone or together with other low carbon energy source options (electricity from renewables, alternative fuels such as refuse derived fuels RDF), in iron and integrated cement sectors, via a joint experimental and computational fluid dynamics analysis. Different classes of appliances will be targeted here, including iron pelletising and cement/lime kilns.

The key deliverables include:

- Estimate benefit and predict combustion/appliance performances of existing burner/appliance designs when operated with hydrogen.
- Development of novel, ultra-low NOx hydrogen burner designs and preliminary assessment of their performance.
- Design and costing of a pilot-scale facility in parallel to the other activities to accelerate next development and upscaling stages of the novel technologies.

IDENTIFIED PATHWAYS

New technologies for high temperature heat.

OUTCOMES

Overall, the project will inform investment options, decarbonisation opportunities, and technical barriers of utilising hydrogen as a standalone fuel or in combination with other low carbon energy sources in their processes together with identifying preliminary designs for novel hybrid hydrogen burners based on mild combustion (flameless) regime (featuring highly preheated and diluted conditions) to provide improved performance over existing appliances to be developed and tested at scale in subsequent projects.