

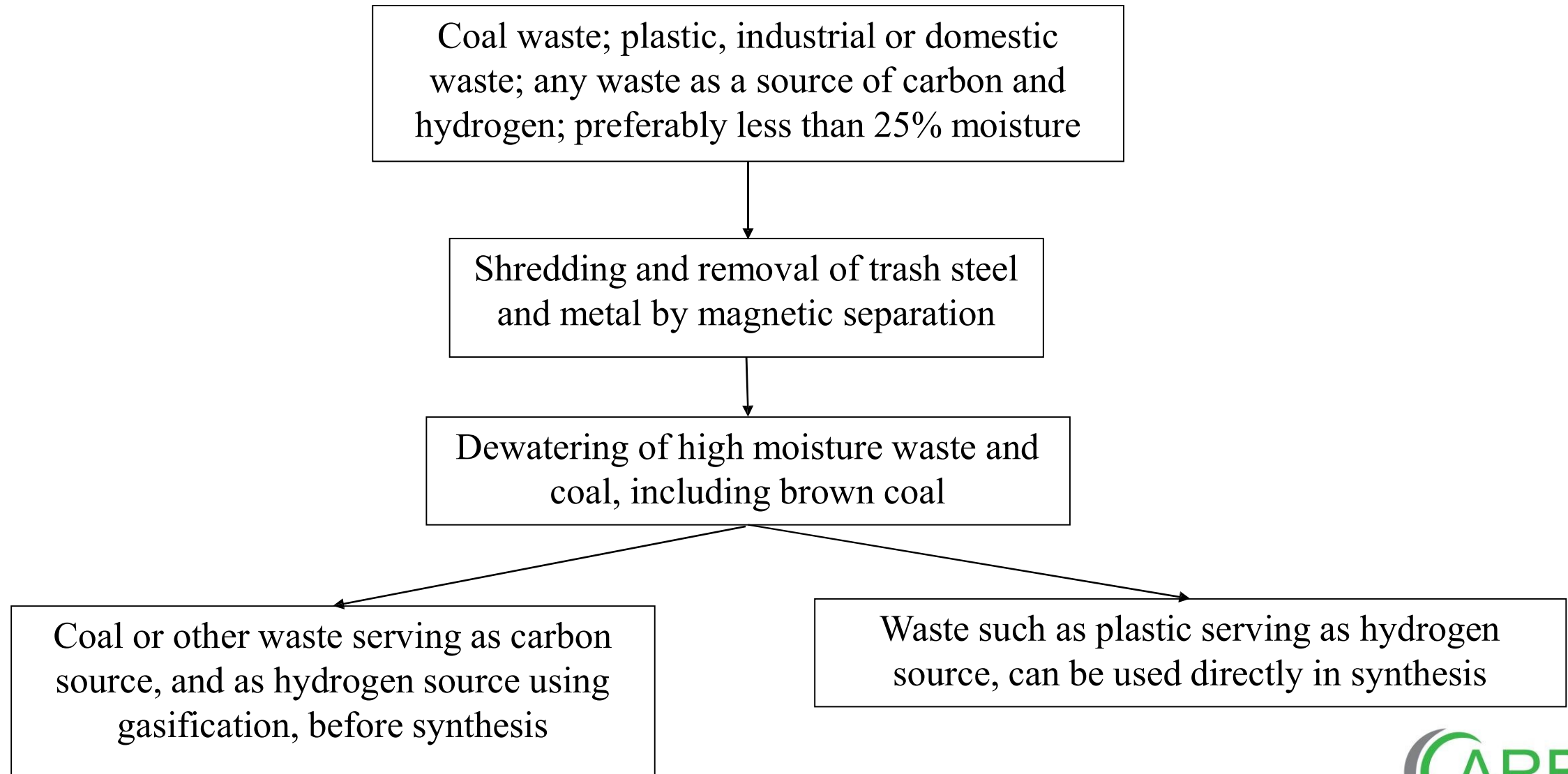
**Carbofusion -
Efficient, economical and green conversion
of waste and other carbonaceous material
into quality fuels**



Unique features of Carbofusion technology

- Innovative electrocatalysis integrated in a supercritical reactor
- One-step conversion of carbonaceous material into fuel, compared with the complex processes in conventional refining
- Electrocatalysis enables rapid chemical reactions, so compact reactor design is possible
- Capital cost of equipment is less than 25% of conventional refining
- Operating cost is very low compared with conventional refining
- Any carbon source can be used, so process is highly flexible
- High sulphur and contaminated source materials can be used
- The produced fuels are without contaminants, which are collected in the solids residue; no air pollution from process

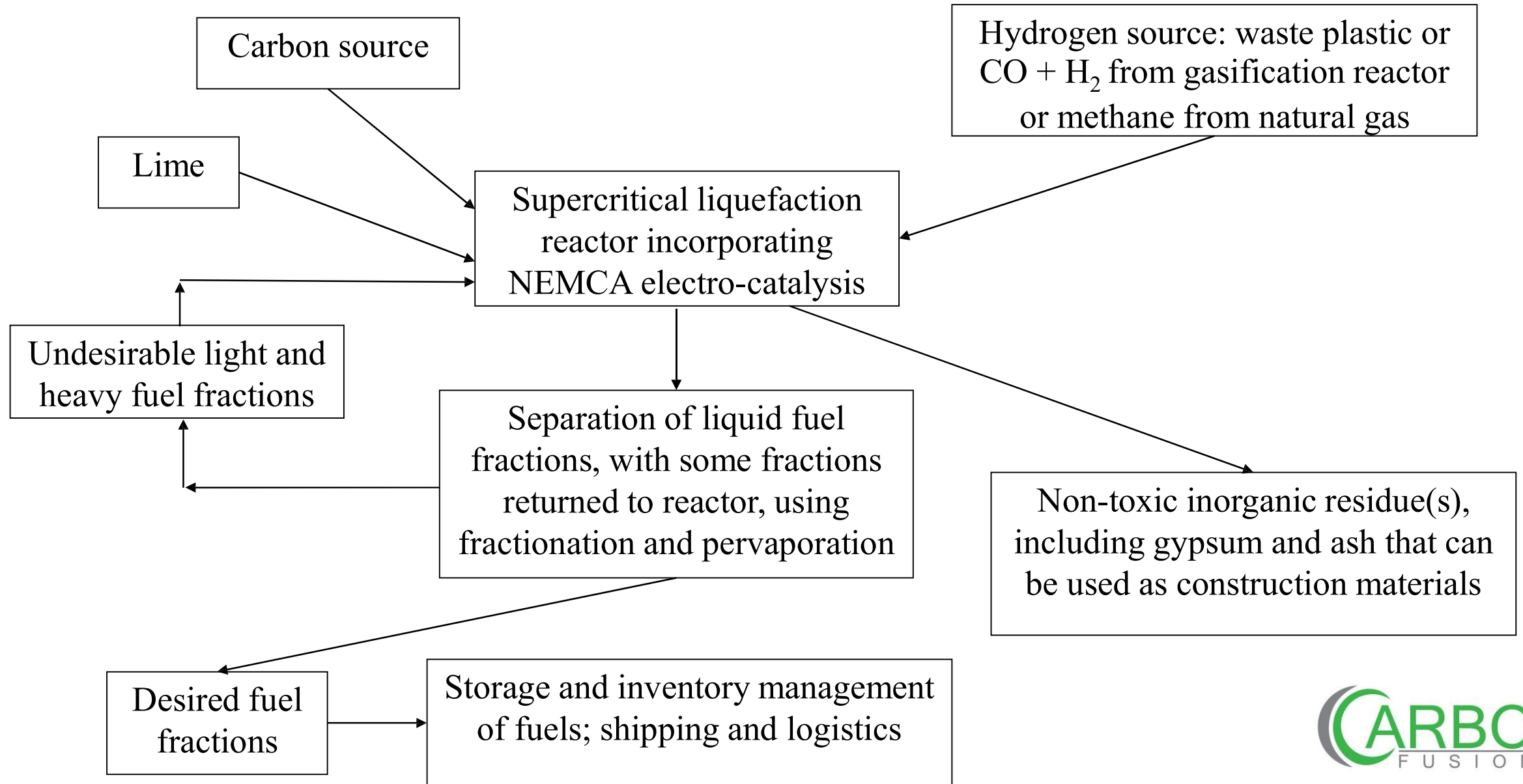
Pre-treatment of feed material



Hydrogen and carbon sources

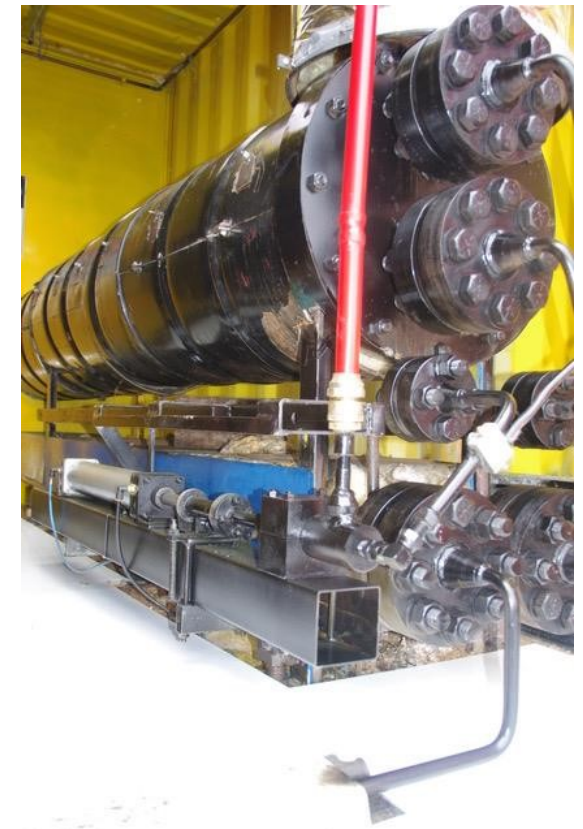
- Synthesis of hydrocarbons requires sources of carbon and hydrogen
- Carbon can be sourced from any organic material, including coal (waste), industrial waste and municipal waste
- Waste plastic provides a useful source of hydrogen
- Alternatively, carbon such as coal can be combined with water vapour to produce synthesis gas in a gasification reactor as:
- Boudouard reaction: $C + CO_2 = 2CO$
- Water-gas shift reaction: $CO + H_2O = CO_2 + H_2$
- Combining reactions: $C + H_2O = CO + H_2$
- Methane from natural gas can be used as a source of hydrogen

Carbofusion fuel synthesis



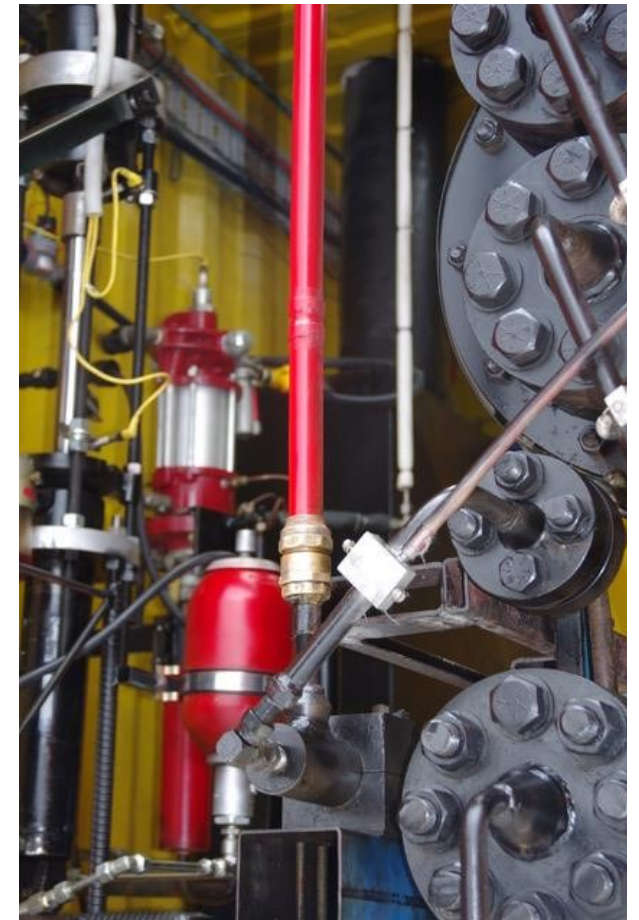
Unique Carbofusion supercritical reactor

- A patented supercritical reactor using high temperature and pressure where the liquid and gas phases become indistinguishable
- The key to this reactor is the unique feeder system that allows solids without forming a slurry to be delivered directly into the reactor while being operated at supercritical conditions
- The lack of a suitable solids feeding system has prevented the application of supercritical reactors in industrial petrochemical plants



Unique electro-catalytic technology

- NEMCA (Non-Faradaic modification of catalytic activity) has been known since 1988 to accelerate catalytic reaction rate by 100 to 4,000 times through the application of an electrical field
- However, NEMCA has not been applied commercially, because the catalysts (a) wear excessively and (b) poison too quickly
- By using a combination of novel nano material science, fabrication technology and reactor design, NEMCA catalysis has become possible
- The incorporation of NEMCA inside a supercritical reactor is unique and powerful

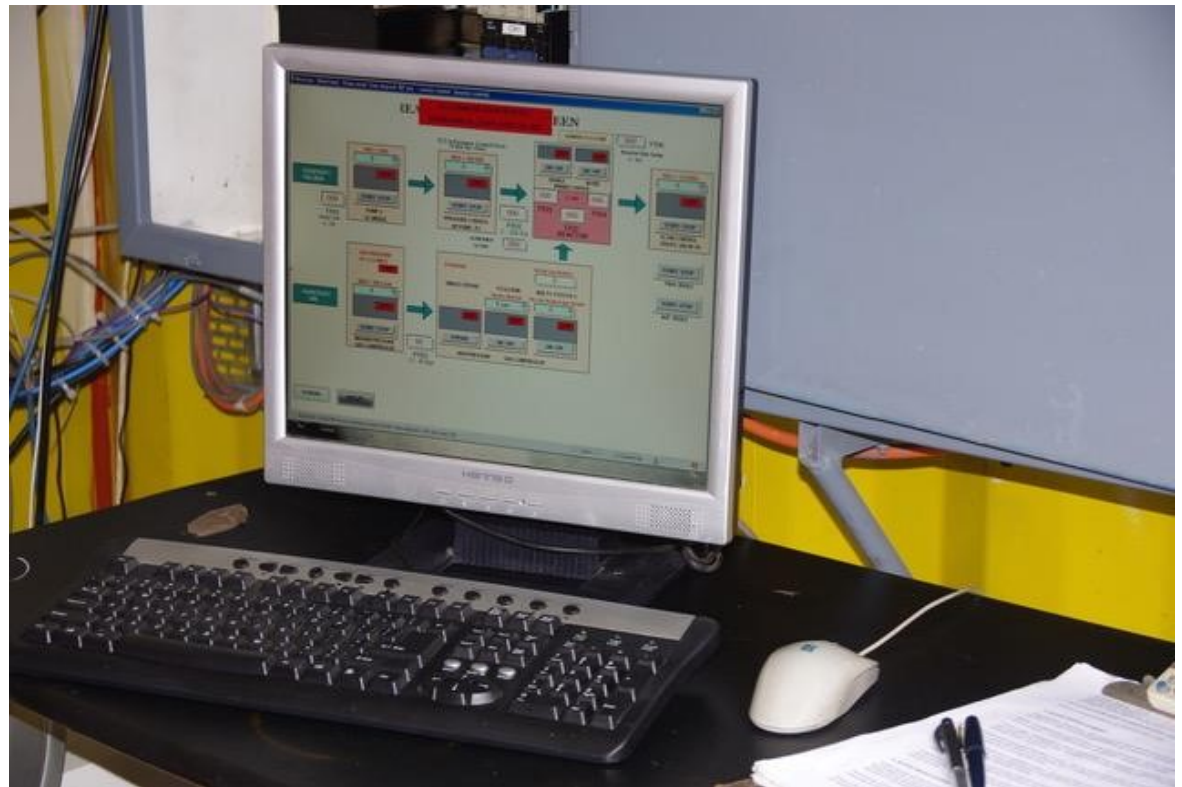


Features of Carbofusion electro-catalysis

- Cook off temperatures 200 to 300 deg C lower than normal, so gasification proceeds at 550 to 600 deg C instead of 840 deg C minimum
- Pressures 15 to 20 bar
- During 6 years of operation no catalyst poisoning or wear has been observed
- Low maintenance requirement
- No emissions from the reactor itself, with emissions below background level from the boilers and generators running on the clean fuels produced
- High sulphur and chloride feed materials can be used, as sulphur and chloride report to solid inorganic residue (ash) and not to fuels
- Conversion efficiency of carbon from waste to fuel is +90%



Control system for pilot plant



Strengths of Carbofusion technology

- Can handle a wide range of organic waste at the same time
- Can process coal and waste with high sulphur and chloride content to produce sulphur-free fuels
- Can convert untapped low value resources like natural gas into high value fuels
- Can neutralise chlorinated and fluorinated hydrocarbons
- Can produce a wide range of fuels of different carbon chain lengths, including light alcohols, gasoline, jet fuel, diesel and bunker fuel oil, by manipulating process conditions although it is preferable to set up different processing units for different fuel requirements
- Low capital cost of core processing units
- Low operating cost of core processing units, so low maintenance, low labour requirements due to automation, and no external energy requirements
- In contrast with oil refineries that are economical only at large scale, the Carbofusion process is economical even at small scale
- Carbofusion can link local waste utilisation to local fuel consumption

Capital cost of demonstration plant for waste to fuel

- Fuel production capacity = 240ton per day
that's 83,220 ton per annum at 95% plant availability
- It is assumed that fuel storage can be minimised by regular delivery to a fuel retailer
- Capital cost of core processing plant = USD 30m
- Capital cost of feed material and product storage and handling = USD 10m
- Total fixed investment = USD 40m

Key people

- Professor Jannie van Deventer: Dean of Engineering at the University of Melbourne until 2007, currently Professorial Fellow
- Dr. Natt Arian: Lecture at Faculty of Engineering, University of Adelaide, 2007, currently Professorial Fellow
- Peter Lansell: Co-inventor and developer of Carbofusion process. He has over 60 international patents, extensive knowledge of Physics, chemistry, biology, geology, mineral processing, chemical and mechanical engineering
- David Lowe Co-inventor and developer of Carbofusion process. He has extensive knowledge of mechanical engineering, mineral processing, combustion and gasification reactions.
- Dr. Ben van Deventer, has extensive experience of the incorporation of new technology in large projects

