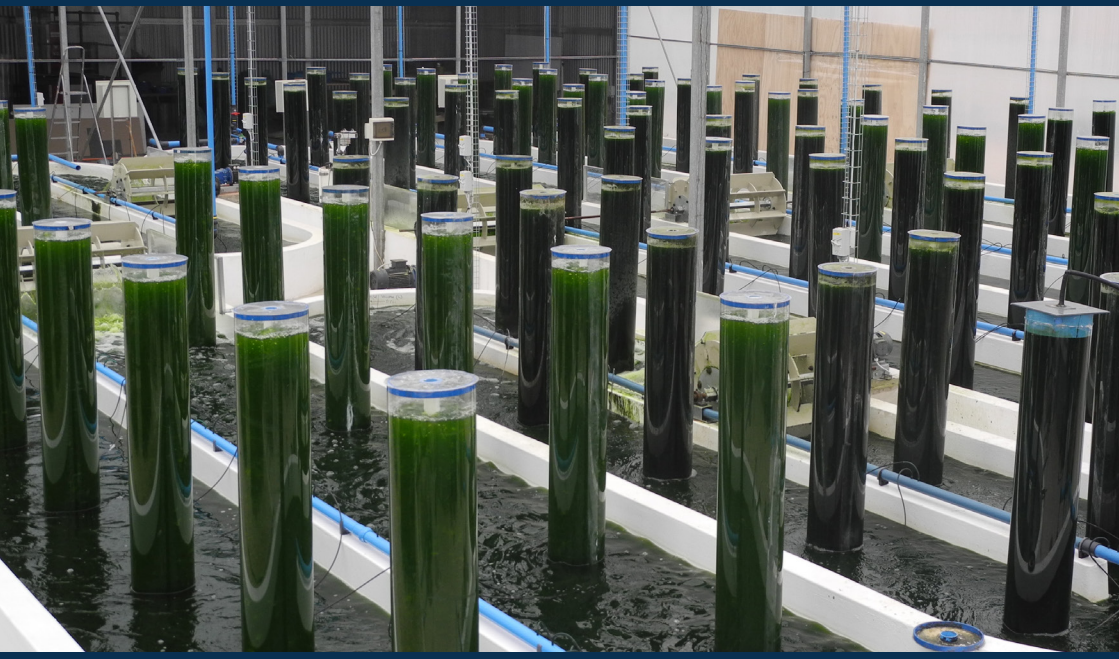
NELSON MANDELA UNIVERSITY

Innovation Office



# Microalgae to Energy

The innovation comprises several main components:

- Microalgae cultivation and recovery in photo-bioreactors;
- Beneficiation and upgrading of discarded coal and coal fines using the microalgae biomass;
- Conversion of the coal-microalgae composites (Coalgae ) into energy products such as bio-crude oil, synthetic gas and clean coal.

## Advantages

- Coalgae is a biomass-rich fuel made from a waste product that can be used as a direct replacement for coal.
- The cultivation system has lower water losses and greater microalgae yields compared to open pond raceways.
- The carbon dioxide and micronutrients required for microalgae cultivation can be sourced from flue gas emissions produced by coal-fired power stations and other industries, thus reducing point source carbon emissions.
- Better environmental management of coal fines, which can reduce costs compared to alternative methods.
- Upgrading the quality of the discard coal by reducing the ash content
- Extends the life of coal mines by depleting reserves at a lower rate
- Incorporates renewable energy into the energy mix and improves sustainability ratings
- Complies with increasingly strict environmental legislation.

## Market Application

- Fuel source for boilers/kilns to produce heat and electricity
- Fuel source for household cooking
- Raw material for Coal to Liquids process

## Opportunities

New business opportunities exist that were previously restricted by the carbon footprint of the potential customers' processes.

## Development Status

TRL 6: prototype system verified: System/process prototype demonstration in an operational environment (beta prototype system level).

## IP Protection

A substantial number of patent applications have been filed and granted. These patents focus on the energy process including production of algae and oil using photo bioreactors and direct liquefaction; and mixing of coal fines with algae to produce briquettes that can be used as a "green" coal.

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