

CO₂ to energy

Capture and conversion of CO₂ emissions
for the sustainable production of high value
commodities

August 2009
Presentation – Process Summary

Commercial-in-Confidence



Well credentialed Board and Executive Management Team with the necessary skills to deliver large infrastructure project developments in a global market



Andrew Lawson,
B.E(Civil), Dip BM
Managing Director

Andrew is a qualified Civil Engineer with 20 years experience in the public and private sectors in Australia. For the last 15 years he has held senior management roles across a number of major civil engineering infrastructure projects throughout Australia. Andrew has a thorough understanding of project development, management and construction processes to deliver multi-million dollar projects.

Andrew has been involved in MBD since its inception in 2006. Under Andrew's direction MBD has pursued a strategy of integration with Major CO₂ emitters in Australia and New Zealand.

Tony St Clair
Agri Business Manager

Tony was Chief Executive of Federated Farmers of New Zealand for eight years (1997-2005). The organisation had approximately 19000 farm members at the end of Tony's tenure.

Prior to his time in New Zealand he was Executive Director of the Victorian Farmers Federation (1990-97) and had extensive commodity trading and commercial background in the agricultural production and processing industry.

Enrico Bombardieri
MSEng, B.Ec, B.Eng (Elec)
Commercial Manager

Enrico has in excess of 20 years experience in Energy, Funds Management and Stockbroking. He has contributed to the commercialisation of power from landfill gas as part of his Masters in Engineering. Prior to taking up his role with MBD he was General Manager of Greenerth Energy Ltd (ASX:GER) having led the Company to a listing onto the Australian Stock Exchange in February 2008.

Dan Mulder
BEng Civil/Structural (Hons)
MBD Projects Manager

Dan has 11 years experience in the delivery of property development and civil engineering projects. His most recent role was as Victorian Operations Manager for Peet Limited, an ASX-listed property developer and funds manager. This position involved responsibility for the management, delivery, sales and marketing of 25 multi-disciplinary, metropolitan projects leading to annual revenues in excess of \$150M from FY06 – FY08.

The Australian Leader in large scale, algae based bio-fuel production and CO₂ bio-sequestration...

- MBD's total-engineered approach has delivered a system that enables large scale industrial growth of algae in MBD's CO₂ to energy hybrid system;
- 100% IP owned by MBD;
- Exclusive access to, and use of, proprietary algae libraries, and world leading algae research expertise at the James Cook University (QLD);
- Established Stage 1 Test Plant with proven, positive outcomes;
- Advanced design work on the first full size, single module Stage 2 Pilot Plant;
- Partnerships with Key Tier-1 suppliers;
- Advanced discussions with several major CO₂ emitters for MOU / JV Agreements; and
- A compelling sustainable solution to three significant issues: oil, CO₂ and animal feed.

MBD's CO₂ to energy Process Overview



Sunlight



Waste Nutrient

N, P, K, S



- Sewerage
- Waste from feedlot
- Waste water
- *Supplemented with*
- Commercial fertilizer



CO₂ Emitter

Greenhouse gases from emitter collected at the bases of the flue gas chimney and piped to algae farm.

(CO₂ NO_x SO_x)

e.g.

- Power Plant , Refinery
- Cement Kiln,
- LNG,
- Coal Seam Gas

Algae Synthesiser Farm

Land (low value buffer): 300 to 1000 Ha
Each Million tonnes of CO₂ e sequestered produces the following outputs:

300,000 tonnes of algae:

- 125,000 tpa algae oil
- 225,000 tpa nutritious livestock feed

O₂

H₂O

Algae Oil 35%

Oil Options Include

- Biodiesel Production
- Plastic Production
- Jet fuel, other fuels

Algae Meal 65%

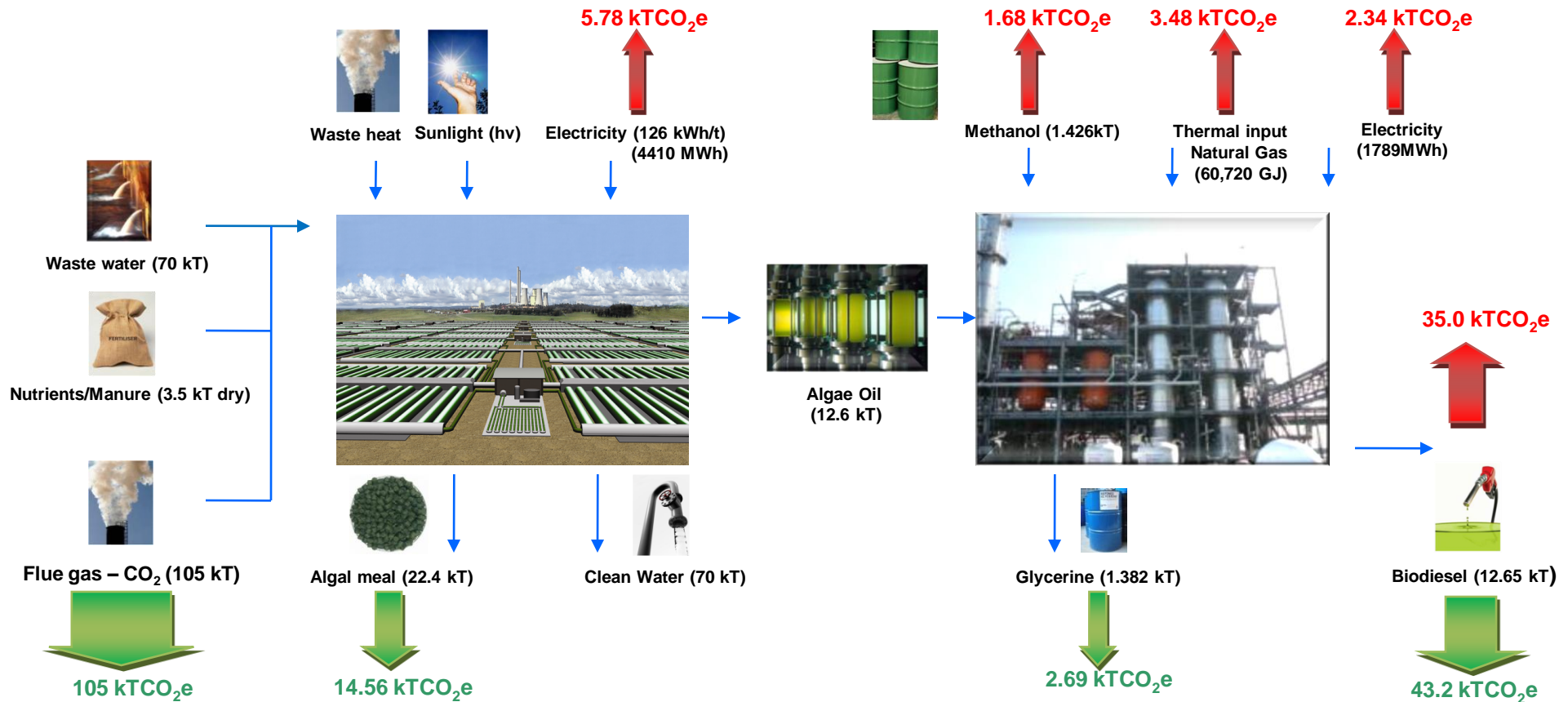
Meal Options Include

- Feed for livestock industry
- Feed for fertilizer
- Biomass for bio-plastic production
- Biomass for electricity production

100% of Algae used as value added product

MBD's CO₂ to energy Carbon Balance

Stage 2 Pilot Plant

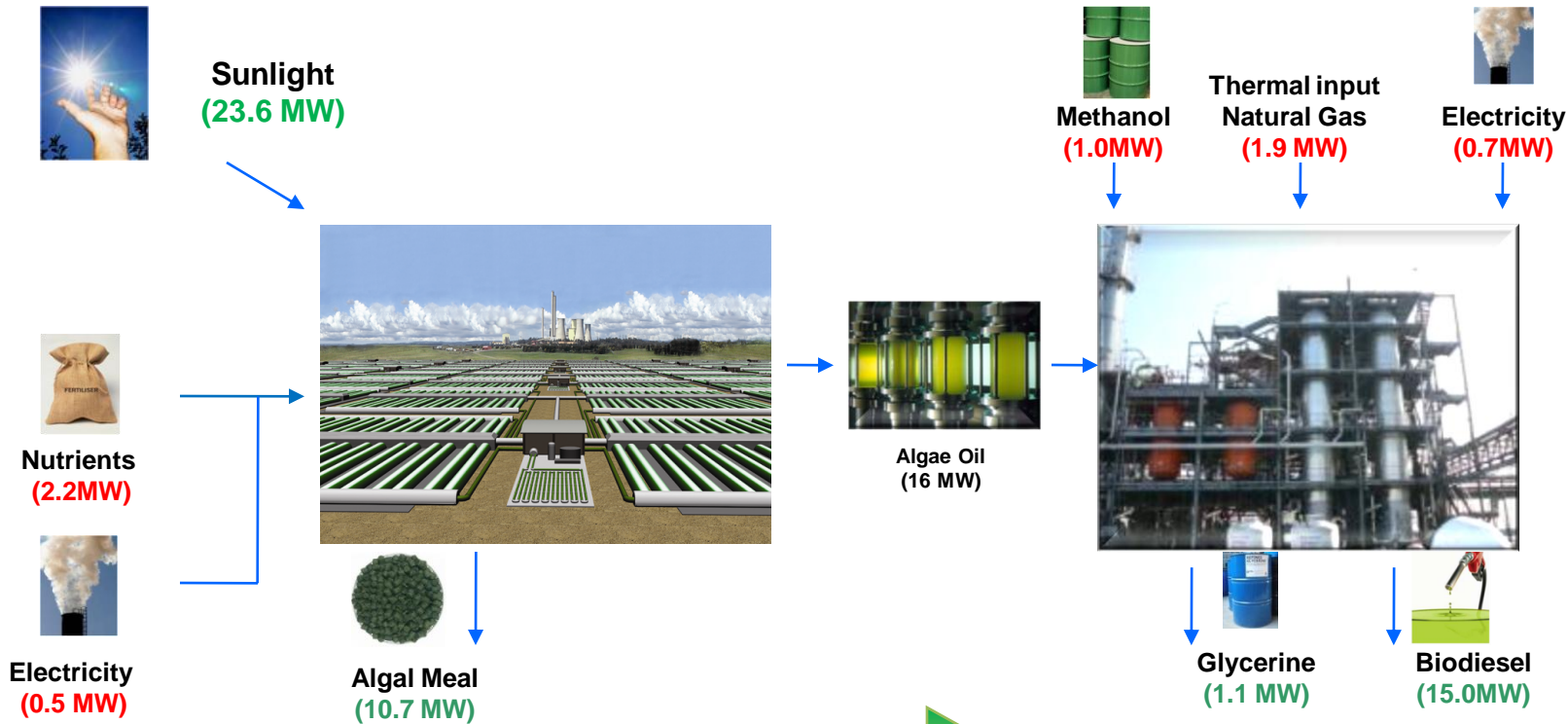


Note: Biodiesel Plant for illustrative purposes only in Stage 2

Total Emissions Created: 48 kTCO₂e
Total Emissions Avoided: 165 kTCO₂e
TOTAL EMISSIONS REDUCTION: 117 kTCO₂e
 (Stage 3 Demonstration Plant Emission Reduction: 2.34 Million Tonnes CO₂e)

MBD's Energy Balance

Stage 2 Pilot Plant



10 x

Algae Synthesiser 988 % Increase in Energy

5 x

Algae Synthesiser + Biodiesel Plant 515 % Increase in Energy

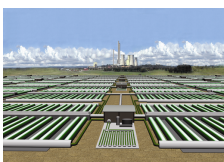
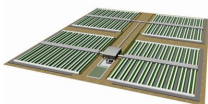
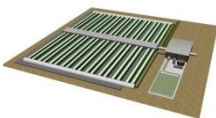
Note: Biodiesel Plant for illustrative purposes only in Stage 2

Productivity Data Chart

Base / Current / Target / Aspiration



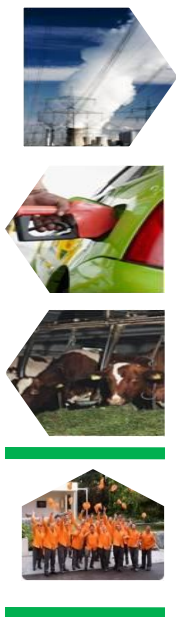
	Base - Benchmark	Current	Design Target	Design Aspiration
Dry Weight Production (g/m ² /day)	20	30	60	120
Depth (m deep)	0.3	0.3	0.6	0.9
Carbon Fixing (CO ₂ /Algae Ratio)	1.8	1.8	1.8	1.8
Harvest %	25	25	50	75
Oil Content %	30	30	40	50



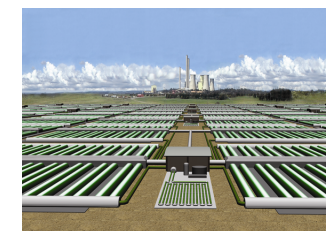
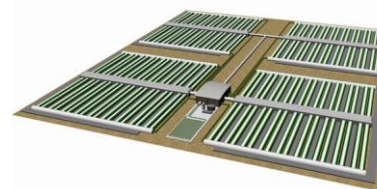
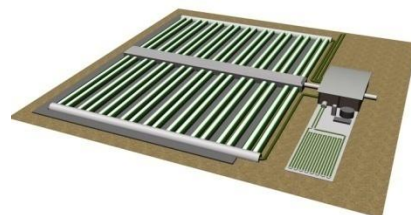
Current Yield parameters		Date July 2009
-Wet Weight (g/l)	2	
-Dry Weight (g/l)	0.4	
-Depth (m)	0.3	
-Harvest (%)	25	
-Dry Weight production (g/m ² /day)	30	

Scale Up 3 Stage Process

Test / Pilot / Demonstration



	Stage 2		Stage 3
	Display Plant	Pilot Plant	Demonstration Plant
	Phase 1 (1 Ha Module)	Phase 2 (Modular Expansion)	Commercial Roll Out
Cost (A\$M)	\$2.1M	\$23.1M	\$300M+
Operational	2010	2011	2013 -
CO ₂ e Abatement p.a	800 T	70,000 T	>1.4M T
Algae Production (tpa) (productivity 120g/m ² /d)	400	35,000	700,000
Algae Oil Production	120 T (140,000 litres)	10,000 T (11 M litres)	250,000 T (300 M litres)
Algae Meal Production	280 T	25,000 T	450,000 T
Employment			
- Construction	30	50	100
- Operation	20	30	100
- Secondary	20	100	2000

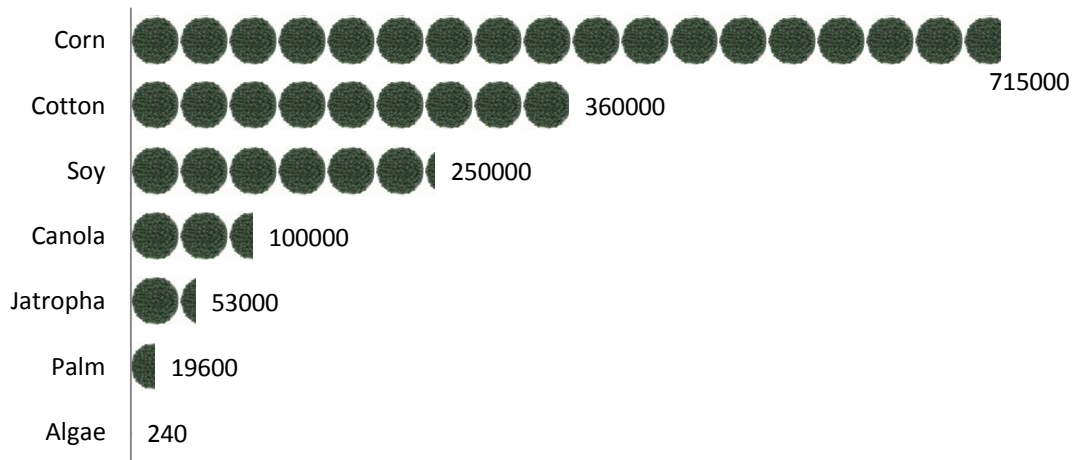


Land space requirements

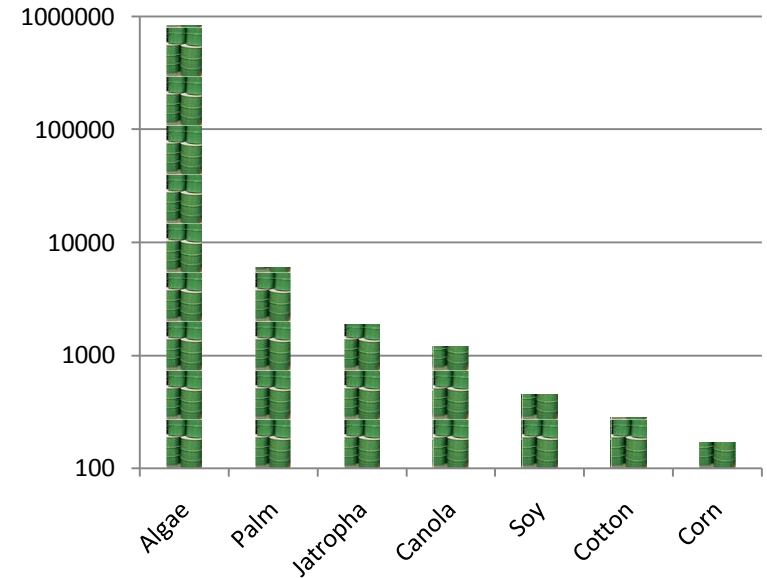
MBD CO₂ Synthesizer Compared with Biofuel Crops



Land Use - Number of Ha required to produce 100,000 tonnes of oil



Productivity on 1000 Ha of land per year (tpa)



The table top left graphically illustrates the negligible land space requirements of an MBD CO₂ fuel synthesiser to produce 100,000 tonnes of oil compared with biofuel crops. Not only is the land ‘foot-print’ small, the oil yield of an MBD CO₂ fuel synthesiser is much higher than biofuel crops – as shown top right.

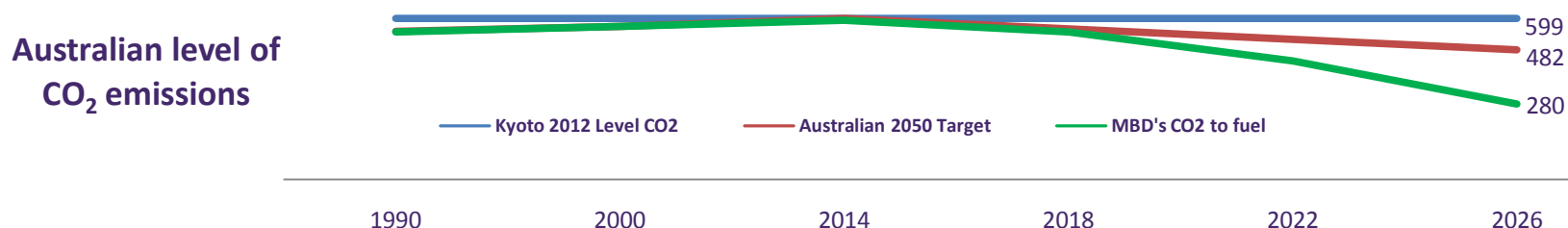
Australia’s major power stations have significant low value land buffers surrounding them. Depending on the size of the power station the land required to sequestrate its CO₂ emissions (50% - daylight hours and up to 80% if artificial light is used) will be in excess of 1000 ha. [Note: To date MBD has only explored growth of algae under sunlight.]

Australia's emissions reduction target

MBD's technology puts our emissions reductions into top gear



The following table demonstrates a full scale roll out of MBD's CO₂ to fuel system over the next 15 years



	2010	2014	2018	2022	2026
Australian 2050 target level (Assumption: linear reduction from 2012 to 2050) (2050 target, 60% reduction, 228 MT CO ₂ p.a.)	-	599 (Kyoto 2012 Target)	560	521	482
MBD CO ₂ sequestered (MT), + (Transport reduced CO ₂ output)	0.2	5, (0.4)	50, (3.1)	150, (9.3)	300, (18.5)
CO ₂ level under MBD's program (MT), (Comparison with Australian 2050 Target)	-	593, (-5)	549, (-11)	440, (-81)	280, (-202)
Barrels of algae oil produced (M)	0.15	3.7	37.1	111.3	222.6
Key highlights	Proof of CO ₂ to fuel at commercial scale.	Scale up	35% of diesel market offset	100% of diesel market offset	Australian 2050 Greenhouse Gas Emissions target met.

Carbon Capture Comparison

Sequestration of all CO₂ emissions from 1000 MW Brown Coal Power Station



Post Carbon Capture and Storage

Collection, concentration, liquefaction of CO₂ and storage in ground

Emitter to fund large capital and operating costs
 No income from CO₂ based products.
 Feasibility at \$25/T appears questionable.

MBD's CO₂ to fuel Solution

Collection, consumption and use of CO₂ for Algae based value added products.

Emitter not required to fund costs.
 Significant value creation from algae products
 Project feasible independent of carbon price

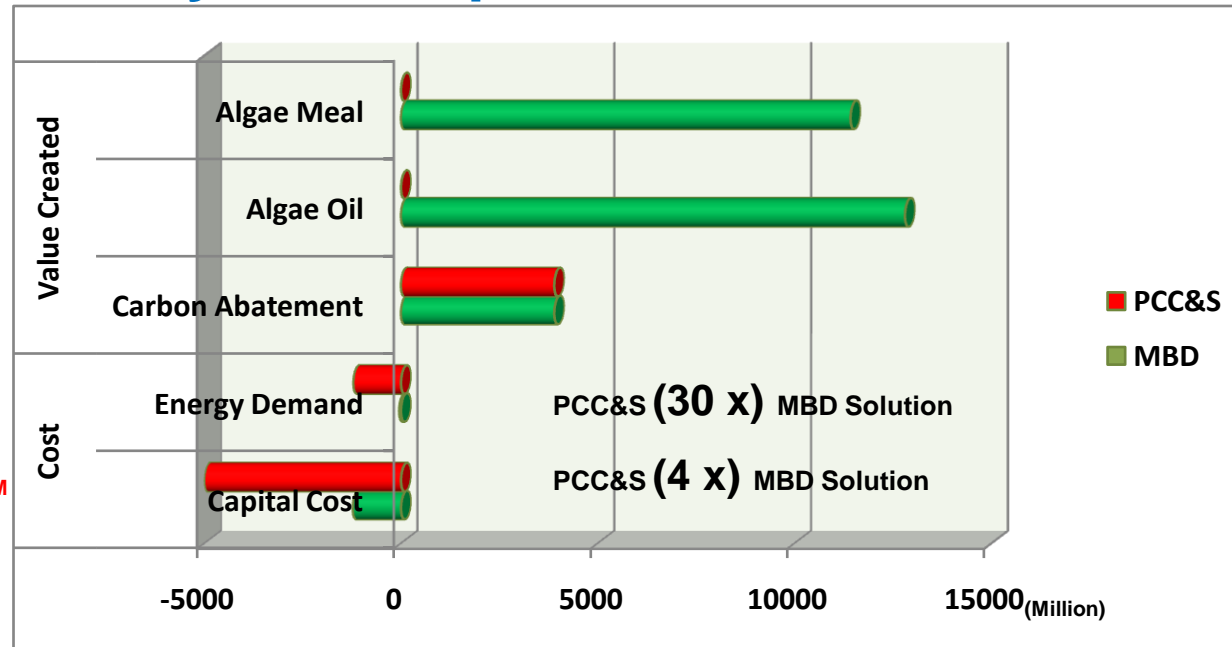
20 year comparison of value created

PCC&S Value Creation -\$2.2B

Annual Value Created
 - Carbon Abatement \$225M
 - Algae Oil income \$0M
 - Algae Meal income \$0M]

Annual Energy Demand
 30%, 300MW
 \$79M p.a. (@ \$30 /MWh)

Capital cost over 20 years \$5000 M



MBD's CO₂ to fuel Value Creation \$26.8B

Annual Value Created
 - Carbon Abatement \$225M
 - Algae Oil income \$740M
 - Algae Meal income \$660M

Annual Energy Demand 1%, 10MW
 \$2.7M p.a. (@ \$30 /MWh)

Capital cost over 20 years \$1225 M

MBD developed comparison – figures are provided for quantum comparison only.
 Detailed comparisons to be developed for each specific site and operation.
 All figures in Million Dollars

Assumptions:

Carbon Credit Value \$25/T, CO₂ sequestered 9MT, Oil \$800/T, Meal \$400/T,
 Value MW = \$30, 100% Plant operation (8760 hours per year), PCC&S 5 year scale up, MBD 5 year scale up
 All figures per tonne and based on 1 years operation.

* Estimated plant capital costs for 20 year project.,

Systems Analysis of CO₂ Fixation by Algae

INPUTS

- Concentrated CO₂ sources
- Nutrient rich waste water
- Add-on nutrients
- Light

PROCESSES

MICROALGAE MASS CULTURE SYSTEMS

- Ponds / Inoculum
- CO₂ supply / transfer & O₂ removal
- Harvesting & processing

OUTPUTS

- Algal oil
- Algal cake
- Reclaimed water
- Oxygen
- Abated CO₂

SCIENCE

ALGAL STRAINS

- Selection
- Genetics
- Metabolism
- Physiology
- Pond Ecology

ENGINEERING

PROCESS DESIGN / EPC(M)

- Basics Of Design mass & energy balances, PIDs, layout, equipment, R MS, HAZID/HAZOP
- Development Application
- Execution & commissioning

ANALYSIS

ECONOMICS & MARKETS

- Market, supply chain & costs analysis
- Resources
land, water, energy, human, financial
- Financial modelling

DEVELOPMENT PHASE

TEST REACTOR

- Selection of algae strains
- Process conditions
- System benchmarking

PILOT PHASE

PROOF OF CONCEPT

- Build & operate single unit including all algae production steps
- Proof of harvesting, processing, pre-marketing of products & economics

DEMONSTRATION PHASE

PROOF OF OPERATION

- Build & operate multiple algae units inclusive optimised harvesting & central processing
- Proof of processing, marketing of products & economics

Algal Strain Selection

James Cook University (JCU)

- Exclusive access to, and use of proprietary algae libraries (>185 strains), and world leading JCU algae research team led by Prof. Rocky de Nys and Dr Kirsten Heimann
- Algae strain selection for lipid profile analysis, bioreactor suitability, biomass;
- Current assessment focusing on ~ 10 salt water and fresh water based algae strains.

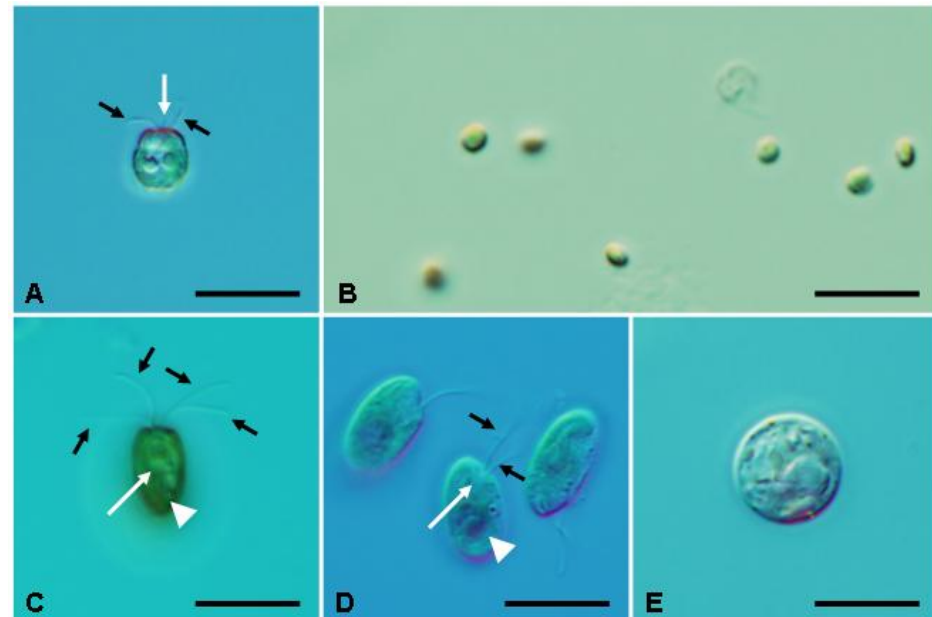
Isochrysis aff. galbana (A)

Nannochloropsis oculata (B)

Tetraselmis chui (C)

Pavlova salina (D)

Nitzschia closterium (E)



Contact



Andrew Lawson
Managing Director
MBD Energy Ltd
T: +61 3 9415 8711
F: +61 3 9415 8911
M: +61 (0) 412 299 678
E: andrew.lawson@mbdenergy.com

Enrico Bombardieri
Commercial Manager
MBD Energy Ltd
T: +61 3 9415 8711
F: +61 3 9415 8911
M: +61 (0) 408 011 921
E: enrico.bombardieri@mbdenergy.com

Tony St Clair
Agri Business Manager
MBD Energy Ltd
T: +61 3 9415 8711
F: +61 3 9415 8911
M: +61 (0) 438 880 905
E: tony.stclair@mbdenergy.com