Pongamia Pinnata Plantation and Infrastructure Development Proposal for Northern Australia.

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Pacific
Renewable Energy

Principals of PRE, **George and Stephanie Muirhead,** were founders of and played a prime role in the development of the Australian Biodiesel Group Limited, Australia's largest publicly listed biodiesel company. In 2003 they anticipated that the key to a successful biofuels industry was the establishment of a reliable and economic source of feedstock less subject to the fluctuations of food- based commodities.

As a result they commenced private research into non-edible oils particularly from tree crops which could relate more closely to the price of crude oil. Having extensively researched overseas and local species this culminated in the selection of Pongamia pinnata as the most viable and sustainable species with the greatest potential and most environmentally sound characteristics. In particular, being a legume, it can contribute significant amounts of nitrogen to the soils on an ongoing basis reducing the fertilizer ongoing costs. PRE was founded in 2005 with seed investor in ABG, **Malcolm Fenton**, who shared the same enthusiasm for the project.

Mr Gary Seaton of Asia Carbon, who shares a similar vision with regard to addressing the issues of peak oil and climate change, has also invested in the Research and Development undertaken by UQ 's ARC CILR. Gary is enthusiastic about the fact that Pongamia covers so many of the bases in this regard.

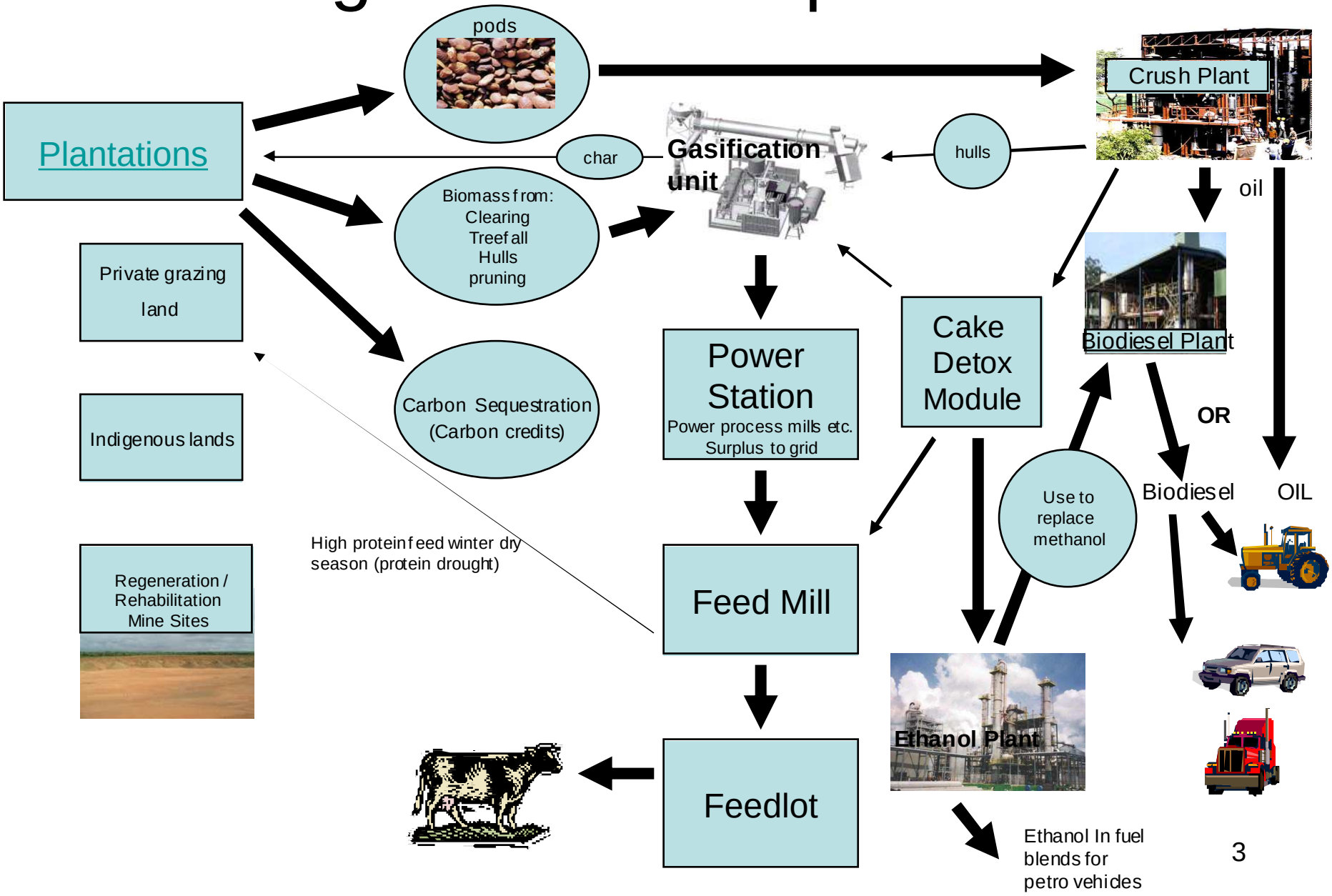
Due to the wide genetic diversity evidenced in the species, PRE considered that the selection and propagation of the right genetics is key to the establishment of a long term and viable industry. As a result a contract was entered into with **University of Queensland's** ARC Center of Excellence in Legume Research, headed by Professor Peter Gresshoff. to undertake research into key areas essential to optimize the productive potential of the species.

A further reason for the research was that PRE considers that, in order to build a strong industry, because of the high variability and the long lead time to the achievement of a yield (5-6 years), **it is imperative that such research be done to avoid the "shonk" element** that could easily deceive would be investors or producers and be long gone with the money before the yield outcomes were known. This would be a disaster for this industry particularly in the early stages of development. Research is ongoing with good results to date.

PRE believes this highly prospective crop can contribute substantially towards the twofold issues of climate change and Peak Oil as well as the added benefits of being an additional option for farmers and rural communities, uses poorer soil and areas less suited to conventional agriculture, lessening dependence on fossil fuels whilst simultaneously ticking all the environmental boxes being a drought and salinity tolerant, native, leguminous plant that produces its own nitrogen.

PRE's model is that eventually the industry could develop on the basis of **regional sustainable models** including the growing and harvesting of plantations, the establishment of crushmills, biodiesel (also possibly incorporating new technology of biomass to liquid synthetic diesel), ethanol, stockfeed and fertilizer.

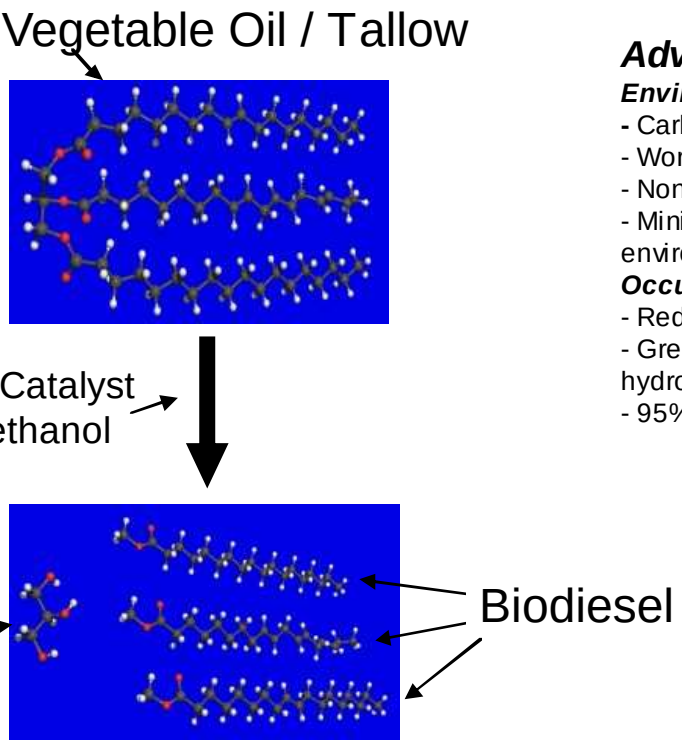
Integrated Development



Biodiesel

Possible Oils:

Food Grade Cooking oils:
(soy, rape, canola, palm, peanut, coconut)
Off quality and rancid vegetable oils
Animal fats:
lard, tallow, chicken fat ……
Used cooking oils from restaurants
Non-edible oils:
Brassica (mustards), jatropha, Pongamia

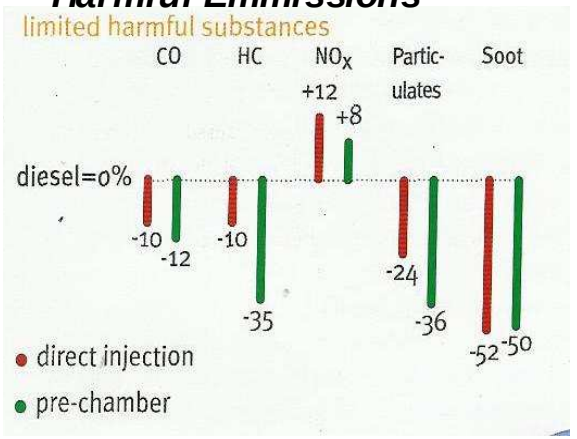


Advantages of Biodiesel:

Environmental:
- Carbon Neutral
- Works with existing infrastructure.
- Non toxic in the environment:
- Minimizes storage and handling environmental risk.

Occupational health and safety benefits:
- Reduces overall emissions
- Greatly reduced particulate, CO and hydrocarbon (THC) exhaust gas emissions.
- 95% reduction in carcinogenic compounds

Petro vs Biodiesel Harmful Emmissions



The Time Is Right For Biodiesel

-Rising crude oil prices meant the economic production of biodiesel possible.
-Availability of alternative oil sources being developed to supplement the usual feedstocks.
-World oil trends-Peak oil phenomenon
-Concerns over dependence on oil from politically unstable areas
-Global warming makes greenhouse gas reductions imperative. Plantations have the benefit of potential for regeneration of mining areas and energy crops as carbon sinks
-Potential for generation of employment and development of the northern areas of Australia
-Health issues relating to diesel usage . Recent studies indicate petro fuels generate emissions which are some of the most carcinogenic toxic chemicals known

ABG Biodiesel Plants

Initial Trial Mobile Batch Plant 2001
Design capacity 5000 l/day

First Continuous Flow Plant Berkeley Vale NSW 2003
Design Capacity 40 million litres pa

Narangba Queensland Aug 2006 Design capacity 160 million litres pa

A State Significant Project

Environmental and economic benefits

- Ensure security of feedstock for renewable energy industry enabling continuation and expansion of the newly emerging renewable fuel industry particularly biodiesel and ethanol reducing the dependence on fossil fuels with inherent supply and emission concerns.
- Carbon sequestration & renewable energy certificates- 100year life span of tree species.
- Use of a native leguminous, deep tap rooted native tree species for the regeneration of mined land with economic benefit from non–edible vegetable oil and protein meal production.
- Utilisation of byproducts
  - Stock feed(treated meal which is 36 % protein), fertiliser, bio oil, or ethanol production **from oil cake.**
  - glycerol for soap/fuel, potassium sulphate fertiliser **from Biodiesel manufacture**
  - producer gas & power generation from waste biomass
  - Char returned to the plantation for soil conditioning and carbon sequestration
- Power supply through gasification and return of char to soil
- Soil improvement from char and from nitrogen fixing Pongamia
- Decrease in fire hazard and major burns by method and fire control in plantations (reference book)-enhance biodiversity on remaining forest ecosystems

- Interdependent industries utilising products of one as energy source or raw material for another
- Benefit Indigenous landowners by involvement in an ongoing project with significant employment prospects
- Development of industries as well as related port facilties and transport systems-plantations,crush mill, biodiesel plant, ethanol plant, feed mill, biomass gasification system and power generation plant and enhanced related service industries
- National security-onflowing from population of the north and vulnerable areas.

PACIFIC RENEWABLE ENERGY

Advantages of Pongamia Plantations

- Native to Australia (map) and the region
- Food for fuel – Pongamia can be grown on marginal lands and produces stock food at the same time as producing fuel. Even if it is grown on existing crop lands, it will increase the overall food production of the land.
- Climatically suited
- Legume
- Deep tap root sources water and nutrients well down in subsoil – drought resistant , can make good use of available deep nutrients.
- Oil production & treated cake for cattle feed
- Carbon sequestration via :
  - tree growth
  - soil carbon increase due to nodulation and root growth
  - displacement when in production at year 6 of fossil fuels and beyond for a further 100years;
  - replacement of petroleum based fertilisers.
- Produces its own nitrogen thereby displacing approx $200 per hectare/pa of nitrates applied as compound fertiliser. Decreased requirement of fertilisers and reduction of cultivation results in lessening of potential soil and chemical runoff into the rivers and streams.
- Fungicidal & insecticidal action decreases pest attack
- Can be mechanically harvested.
- Management to assist fire control
- Cattle grazing in well established plantations with higher stocking rates and better quality pastures due to nitrogen fixation
- Possibly direct use of oil in modified engines (see article attached from *Power Farming* Year 117 Issue 6 28/12/07 p 14 ff "Grow Your own Fuel" re Deutche and Fendt technology)

PACIFIC RENEWABLE ENERGY

PACIFIC RENEWABLE ENERGY

Pacific Renewable Energy P/L has initiated research into Pongamia pinnata by the University of Queensland with a view to maximising production from each tree of quality oil, and as a means of guaranteeing that product supplied to clients is known to be from good plant stock, a prime concern given the proven very high variability potentially in yields, even from "plus tree" parent stock and the commercial demands and costs of propagation. PRE believes the research key to a successful and viable industry with a long term low energy input and sustainable development.

Currently PRE has a 16 hectare trial plantation and a number of planned trial plots in the tropics for research purposes prior to embarking upon commercial scale plantations.

Refer to www.pacifenergy.com

Pongamia Nodulation

PRE Pongamia seedling nursery on the Sunshine Coast QLD for trial plantations

Pongamia in flower

Pongamia in full seed production

SE Queensland Trials Elimbah

1 in 1000 have flowered 2 years after planting

2 years from planting.

12 months from planting

Hosur Village Trial

Village crush plant

Village Units are promoted as the method for Improving the incomes and lifestyle of Village people whilst contributing to the Indian self sufficiency in fuel.

Pongamia still green in drought conditions

Drying Pongamia seeds for crushing

Indian Institute of Science Pongamia Initiative, Bangalore

Professor Udipi Shreenivas & Stephanie examin Pongamia saplings at the institute

George with Neerim discuss result in running vehicle on Honge Oil

Above: Early Flowering Below: nodulation

Mature Pongamia

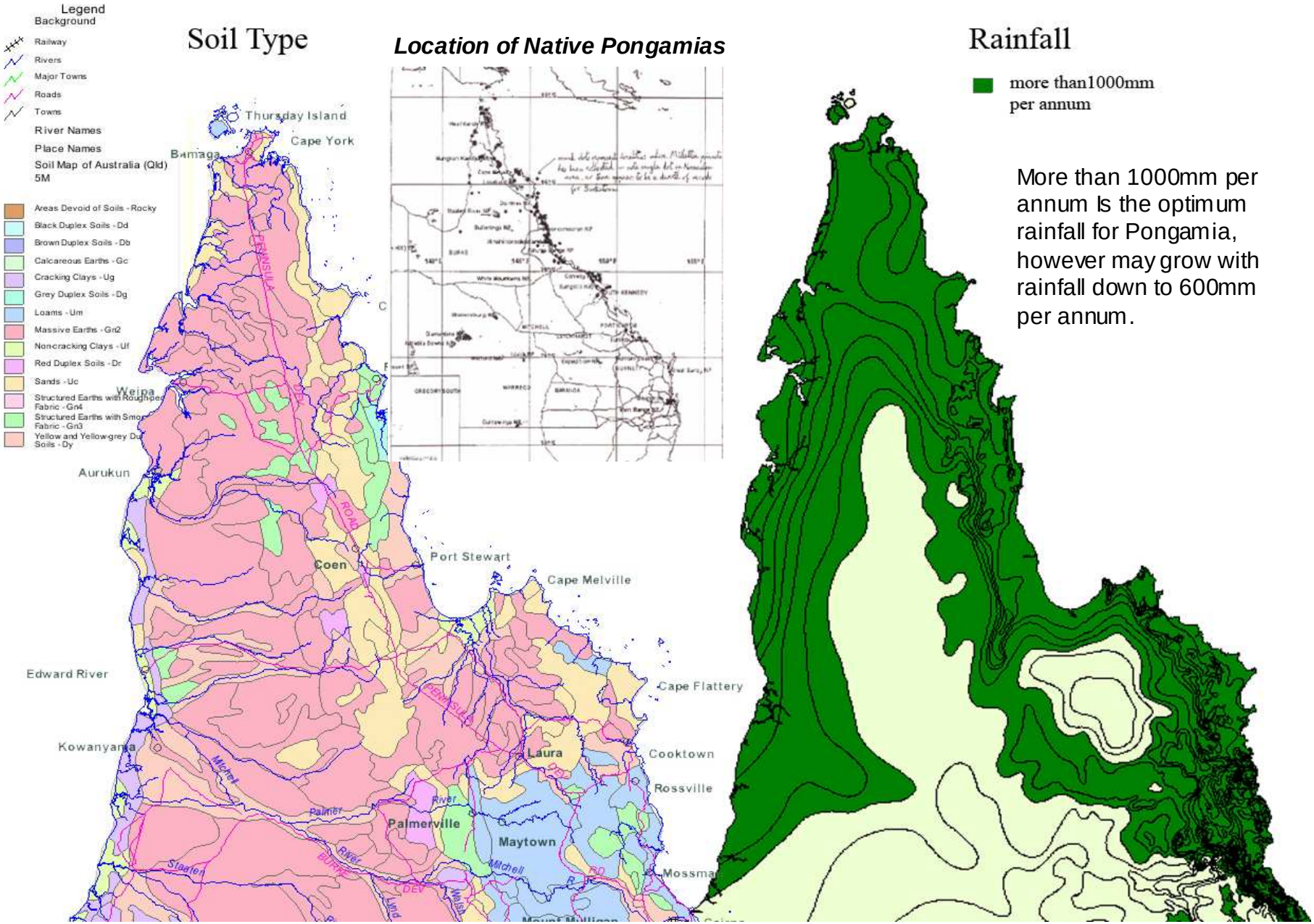
PACIFIC RENEWABLE ENERGY

Roma QLD Trials

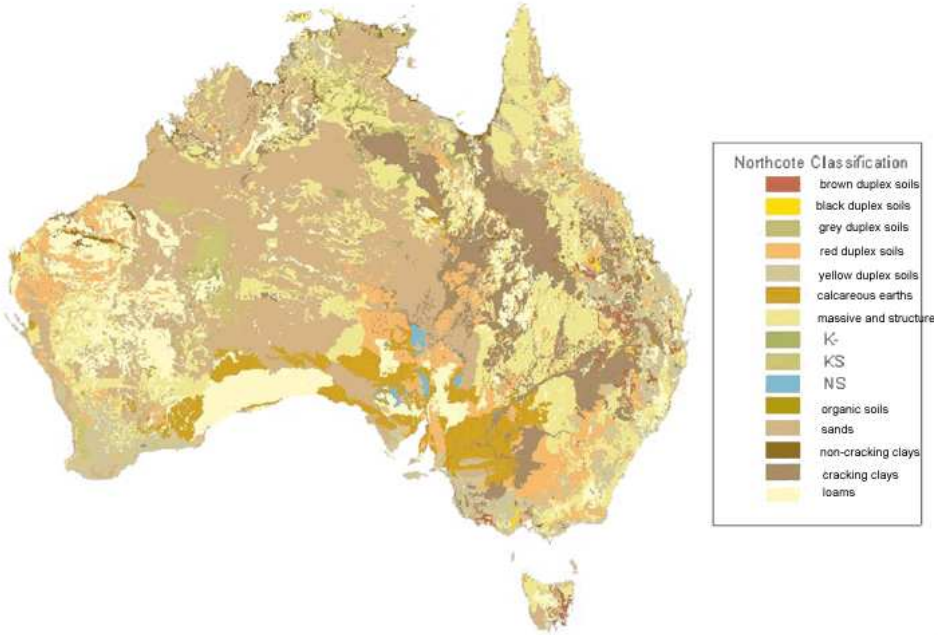
Origin Energy - Spring Gully - Planted May 2008

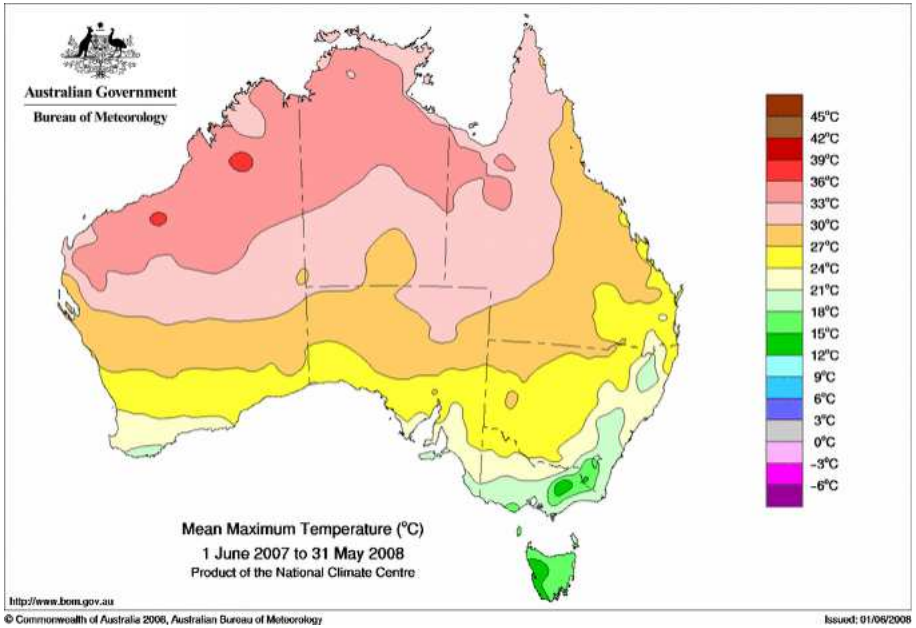
DPI Trial - Planted March 2006

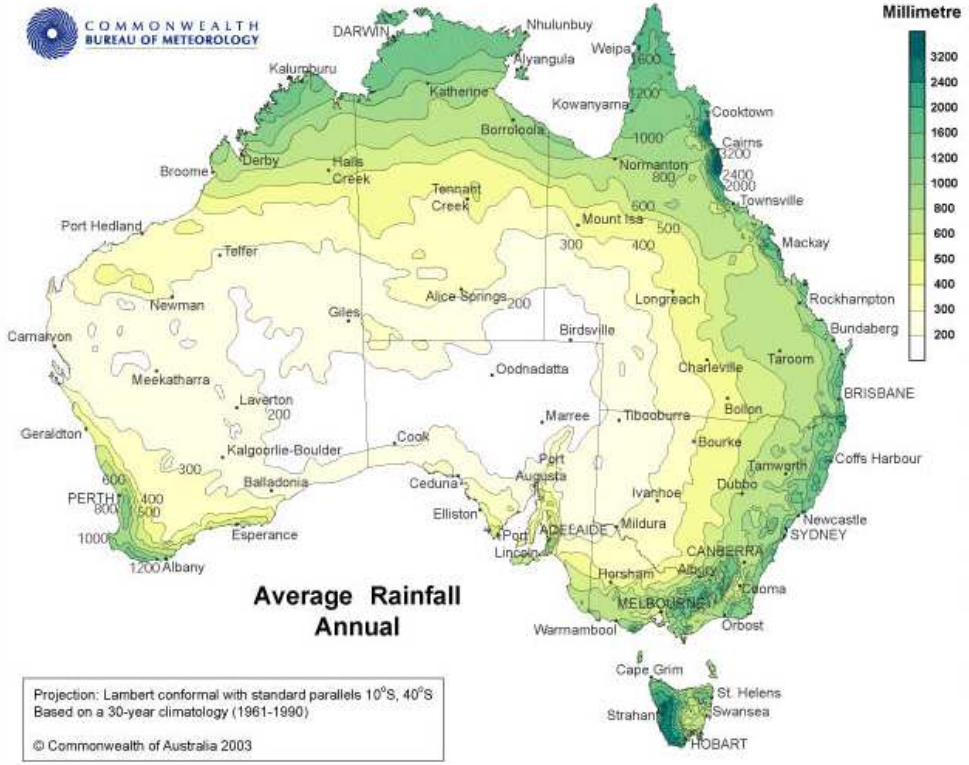
Climatics and Soils

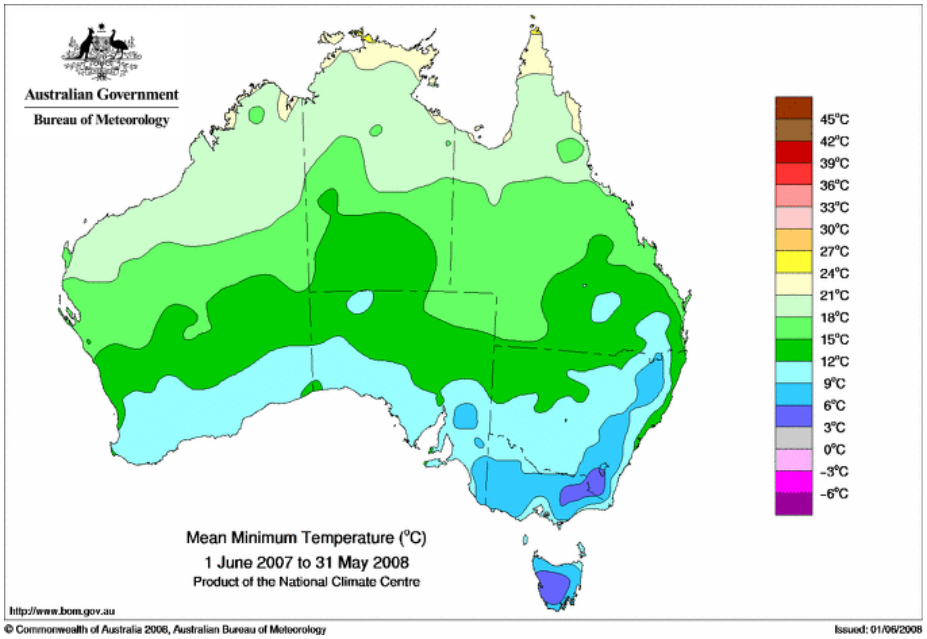


More than 1000mm per annum Is the optimum rainfall for Pongamia, however may grow with rainfall down to 600mm per annum.


Northcote Classification
brown duplex soils
black duplex soils
grey duplex soils
red duplex soils
yellow duplex soils
calcareous earths
massive and structure
K-
KS
NS
organic soils
sands
non-cracking clays
cracking clays
loams


Australian Government
Bureau of Meteorology
45°C
42°C
39°C
36°C
33°C
30°C
27°C
24°C
21°C
18°C
15°C
12°C
9°C
6°C
3°C
0°C
-3°C
-6°C
Mean Maximum Temperature (°C)
1 June 2007 to 31 May 2008
Product of the National Climate Centre
http://www.bom.gov.au
© Commonwealth of Australia 2008, Australian Bureau of Meteorology
Issued: 01/06/2008


COMMONWEALTH
BUREAU OF METEOROLOGY
Millimetre
3200
2400
2000
1600
1200
1000
800
600
500
400
300
200
DARWIN
Nhulunbuy
Weipa
Alyangula
Kalumburu
Katherine
Kowanyama
Cooktown
Borroloola
Cairns
Broome
Derby
Halls Creek
Normanton
Tennant Creek
Townsville
Mount Isa
Port Hedland
Mackay
Telfer
Alice Springs
Longreach
Rockhampton
Newman
Giles
Birdsville
Bundaberg
Carnarvon
Oodnadatta
Charleville
Taroom
Meekatharra
BRISBANE
Laverton
Marree
Tibooburra
Boilon
Geraldton
Cook
Bourke
Kalgoorlie-Boulder
Port Augusta
Tamworth
Coffs Harbour
Balladonia
Ceduna
Dubbo
PERTH
Ivanhoe
Elliston
Mildura
Newcastle
Esperance
Port Lincoln
ADELAIDE
SYDNEY
CANBERRA
Albury
Horsham
Cooma
MELBOURNE
Orbost
Warrnambool
Cape Grim
St. Helens
Swansea
Strahan
HOBART
Average Rainfall
Annual
Projection: Lambert conformal with standard parallels 10°S, 40°S
Based on a 30-year climatology (1961-1990)
© Commonwealth of Australia 2003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Mean Minimum Temperature (°C)
1 June 2007 to 31 May 2008
Product of the National Climate Centre
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© Commonwealth of Australia 2008, Australian Bureau of Meteorology
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Pongamia Pinnata

Approximate Yield/hectare @250 trees/hectare (estimates)*

Conditions for growth:	Poor	Good	Optimal
Seed in Shell (Yield)	16.30	27.17	50 t/ha
Seed (46% of Yield)	7.5	12.5	23 t/ha
oil (40% of seed)	3	5	9.66 t/ha
Meal:	4.5	7.5	13.34 t/ha
Protein	2.25	3.75	6.67 t/ha
Starch	2.25	3.75	6.67 t/ha

*Assumptions:

- Yielding starts 4-6 years; peak year 10 and continuing for next 60-85 years
- All of the estimates are premised on yield estimates achieved from existing elite specimen trees which would need to be replicated in the field. The research being undertaken includes identifying the high yielding and oil producing varieties agronomically suited to the variable field conditions.

Centurian Shielded Sprayer

Designed specifically for plantation weed management.

Mechanical Harvesting

All technology is available, and proven, for mechanical harvesting at an average rate of 2 trees a minute.

Two Row Planter

Purpose designed to allow the planting of advanced plants.

ESTIMATION OF EXPECTED RETURNS
of Pongamia Plantation run in conjunction with cattle

- Figures based on current prices of crude oil, vegetable oils, starch and protein – A formula relating these factors will need to be used to calculate future earnings
- Second Generation Process for converting biomass into synthetic biofuels also known as BTL (biomass to liquid) is now a reality (Refer to the Sundiesel exhibit) . Using this process the hulls could be converted to synthetic diesel and depending upon the relative price of crude oil and protein the protein portion could also be converted to diesel. The oil component will be the least cost conversion and the starch (to ethanol) will be the second.
- Unlike the Sundiesel business model which relies upon acquiring biomass as a primary source that involves growth of crops and transport, the Pongamia hulls are a byproduct and therefore the economics of processing should be better than if as a primary crop. It may well be that the costs are therefore comparable to biodiesel and ethanol production from the oil and starch,
- Preliminary investigation could imply $150/tonne as an indicative price seed in shell, delivered to the process plants. A number of elements which yet need to be determined may cause variations of between $100-$200/tonne
- All of the estimates are premised on yields from existing elite specimen trees which would have to be replicated in the field. Part of the trial research is dependent on the outcome of field trials and the research work with UQ headed by Professor Peter Gresshoff. This research includes identifying the high yielding and oil producing varieties agronomically suited to the field conditions. (refer to University Journal attachment)
- Cattle returns would be based on a stocking rate from year 3 of from 1 to 3 hectares per beast depending on rainfall and soil type of locations diminishing after year 10 to about 1/3 of the above due to canopy cover causing a reduction in grass growth.

Second Generation Renewable Diesel Technology

ensuring product quality

http://www.uop.com/

UOP/Eni Ecofining™ Process for Green Diesel Fuel

UOP/Eni Ecofining Process for the Production of Green Diesel Fuel

Our most significant milestone to date is the successful commercialization of our Ecofining process to convert vegetable oils and wastes to green diesel fuel. Developed in partnership with Eni S.p.A, the Ecofining process uses conventional hydroprocessing technology and is focused on producing a high quality product that is compatible with existing fuel infrastructure.

Ecofining process units are in development today. Our first license is to Italian refiner Eni who plans to start-up its facility in 2010 in Livorno, Italy. Galp Energia of Portugal also plans to start-up a facility in 2010.

How Does Ecofining Work?

The Ecofining process deoxygenates biofeedstocks by adding hydrogen to produce a highly-stable green diesel fuel with a higher cetane value, lower cloud point and lower emissions than biodiesel and traditional petrodiesel. The Ecofining process is feedstock flexible, meaning that it will work with a wide range of biofeedstocks from the first generation vegetable oil options to second generation feedstock options like algal oils and cellullosic feeds.

What is Green Diesel Fuel?

Green diesel fuel has superior product properties to other options available today with higher cetane levels, lower cloud point and lower emissions. It is indistinguishable from traditional diesel fuel and can work as a drop-in replacement or as a valuable blend stock that will enhance the quality of the existing diesel pool. Because it is chemically similar to traditional diesel fuel, green diesel can be used in today's tanks, pipelines, trucks, pumps and automobiles without changes, which will save significant expense as demand for renewables grows.

Diesel Fuel Property Comparison

	Petro-Diesel	Biodiesel (FAME)	Green Diesel
NOx Emission	Baseline	+10	-10 to 0
Cetane	40-55	50-65	75-90
Cold flow properties	Baseline	Poor	Excellent
Oxidative stability	Baseline	Poor	Excellent
Energy content	Baseline	Lower	Similar

Renewable, synthetic automotive fuels will guarantee future mobility. Synthetic biofuels, also known as BtL fuels (Biomass to Liquids), are largely CO2-neutral and therefore play a major role in protecting our environment and climate. SunDiesel, one of the range of SunFuel® products, is currently being introduced to the public arena in conjunction with DaimlerChrysler AG and Volkswagen AG as **SunDiesel – made by CHOREN.**

SunDiesel

- has a high cetane number and therefore much better ignition performance than conventional diesel fuel,
- has no aromatics or sulfur and significantly reduces pollutants from exhaust emissions,
- can be used without any adjustment to existing infrastructure or engine systems,
- is largely Carbon-neutral.

Leading automobile manufacturers currently believe that "SunDiesel – made by CHOREN" is an automotive fuel with a great future.

- Synthetic automotive fuels open up new possibilities for the future: the engines and the fuel can be developed in parallel and fine-tuned to match each other. So that we will have engines that are highly efficient with extremely low exhaust emissions.

POWER FARMING EXCLUSIVE

Technology break-through that will allow you to

Grow your own fuel

Additional income is on the cards as tractors are developed to run on raw rapeseed oil – grown and processed on-farm

Extract from Power Farming, Jan 2008, issue 6, pages 14-16.

With farmers only just getting used to the idea of running their tractors and other farm vehicles on biodiesel, engine maker Deutz has now come up with a system that allows a diesel engine to run on crude rapeseed oil.

The 'green' credentials of such a system clearly outweigh the much trumpeted advantages of straight biodiesel or biodiesel/mineral diesel cocktails because the oil can be produced on-farm.

It involves no consumption of energy in refining the raw material into biodiesel or in transporting the seed to a crusher, the oil to a refinery and the biodiesel to distribution outlets.

For tractor operators, of course, the big appeal of this new approach is the potentially huge cost-saving. With no processing costs and (for the moment) no fuel tax to pay, using pure rapeseed oil to power a fleet of farm tractors would have a significant impact on what has become the highest operating cost element of running farm machinery.

At the last Agritechnica exhibition in Germany, tractor makers Deutz-Fahr and Fendt were keen to make 'world first' claims for the tractors they have built capable of using the pure oil system.

Nor is this some pie-in-the-sky concept – it's for real. Both manufacturers have tested the system and are sufficiently confident in its performance, reliability and practicality to offer the tractors as part of their standard range, backed by their service networks and fully covered by the usual warranty.

Although Deutz-Fahr and Fendt deserve due credit for installing the necessary hardware to make the system work, the major credit, of course, goes to engine maker Deutz.

The German diesel engine maker has taken a leading position in the use of bio-fuels for agricultural diesel engines. It has developed control electronics to suit the particular power characteristics of the fuel, and common rail fuel distribution and injection technologies to cope with its different physical characteristics.

Having approved the use of a 20 per cent biodiesel/80per cent mineral diesel mix in its engines, Deutz raised the bar in autumn 2006 by approving 100 per cent (B100) biodiesel use in its 2012 Series and 2013 Series four- and six-cylinder engines.

This at a time when some diesel engine manufacturers had still to approve 20 per cent (B20) biofuel, and with those that had approved it setting out plenty of caveats and conditions with regard to increased engine servicing frequency and the way the fuel is stored.

A year on, Deutz is still the only manufacturer with 100 per cent biodiesel approval.

By further developing the fuel system and engine management electronics of the 2012 and 2013 power units, Deutz has stolen a further march on its competitors with the pure rapeseed oil fuelling concept.

The key elements of the system aim to tackle two characteristics of vegetable oil – it is not as viscous as bio – or mineral diesel at low temperatures and it has a lower flash point.

Upgraded electronic engine management software controls the fuel feed and injection process to develop the required power outputs while meeting Tier 3 exhaust emissions limits.

Heating the oil gives it much the same viscosity as biodiesel so that it will pass through distribution and injection systems unhindered. This is achieved on the Deutz natural fuel engines by passing it through a heat exchanger plumbed into the engine's coolant system.

Since the vegetable oil can only be used once it has reached the required temperature, the engine must be started on diesel – which means the tractor must be equipped with two tanks, some sophisticated valves and a flushing mechanism.

One tank is for the diesel to supply fuel when first starting up or when the tractor is running at idle for extended periods, the other is for the rapeseed oil.

The 'greentec' version of the 153kW (205hp) Fendt 820 Vario - the first model in the Fendt range to get the green fuel treatment – has an 80-litre diesel tank and a 340-litre oil-fuel tank.

The Deutz six-cylinder engine is started on diesel and continues to run on it until warmed up. Then, when it has been pre-heated to 70 degrees Celsius, a switch-over valve automatically changes the fuel feed.

It will do the same when the engine power output is at least 25 per cent of maximum load for more than 30 seconds.

Once these parameters are no longer met, the system switches back to running on diesel, once the fuel line has been flushed (a process that takes only a few seconds) to prevent the oil from entering the diesel supply.

Before switching the engine off, the driver must manually switch back to diesel ready for the next start-up, unless the automatic system has already done so through the tractor being allowed to idle briefly before switching off. The fuel currently being used is indicated on the tractor's VarioTerminal monitor.

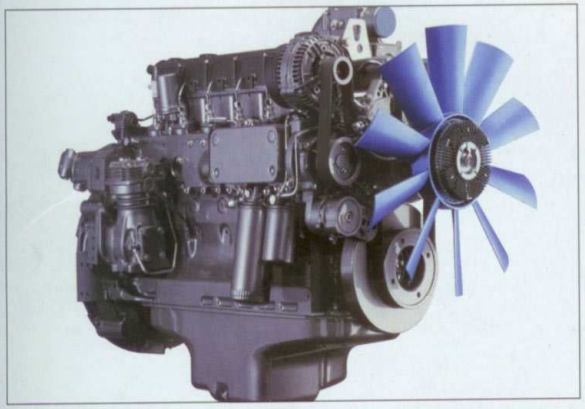
Deutz-Fahr's natural power system has been applied to the latest 98-137kW (131-184hp) Agrotron M Series tractors, similarly using a twin fuel tank installation with the necessary control valve safeguards.

The manufacturer emphasises that it guarantees that the technical characteristics of the engine and fuel injection system are suited to the use of vegetable oil; the durability and service life of the engine and its ancillaries; and that the engine can be used in all types of operating and load conditions.

Moreover, Deutz-Fahr applies a 24-month, 2000hr warranty to its NaturalPower tractors.

Fendt also warrants the 'greentec' versions of its 820 Vario tractor and claims that this, together with the service back-up provided by its dealers, should mean owners are not put at a disadvantage when they come to sell the tractor. □

With fuel one of the major components of tractor running costs – being able to use vegetable oil produced locally and at low cost should have plenty of appeal – with enterprising farmers setting up shop as local distributors and depots



The liquid cooled 2012 Series diesel engine is one of two Deutz power units to get the company's patented Natural Fuel treatment

Like all tractors using the Deutz Natural Fuel engines, the 153kW (205hp) Fendt 820 greentec has a special electronic engine management system controlling injection and the fuel feed from separate tanks for rapeseed oil and diesel

Tractor manufacturing group Same Deutz-Fahr – which is the biggest shareholder in engine maker Deutz – has been quick to promote the use of B100 (100 per cent) biodiesel in its Same, Lamborghini, Deutz-Fahr and Hurlimann tractors

University of Queensland Research Program

PRE has negotiated a contract with the University of Queensland Centre of excellence for Integrative Legume Research headed up by Professor Peter Gressoff for research into key areas of plant growth and genetics, continuing on from PRE's research, on selection and development of high yielding cultivars.

biodiesel

Biodiesel is the name for diesel fuels derived from vegetable oils or animal fats. Chemically, Biodiesel is a methyl ester and due to its similarity to petroldiesel is the only alternative fuel that can be used directly in any existing diesel engine.

Biodiesel is a low emission alternative fuel, releasing less smog and greenhouse gases compared with petroldiesel. Use of biodiesel does not leave residues in diesel engines, contains no sulphur and is more lubricating than petroldiesel. Production of biodiesel, from the growth of oilseeds to the burning and use of the fuel, emits approximately 80% less carbon dioxide and almost 100% less sulphur dioxide than petroldiesel.

If the input oilseeds are sourced from leguminous plants, such as soybean, peanut or Pongamia, biodiesel production can become even more environmentally friendly. Plants absorb carbon dioxide and use solar energy to convert it into chemical energy. Legumes have an additional advantage in that through symbiotic relationships with rhizobia bacteria they can produce their own nitrogen fertiliser. Nitrogen fertiliser production for agriculture requires burning of a large amount of fossil fuels.

Pongamia pinnata

Pongamia pinnata is a little known leguminous tree common to coastal areas of India, Malaysia, Indonesia, Taiwan, Bangladesh, Sri Lanka, Myanmar, eastern Africa, northern Australia, and Florida. Pongamia grows well in most soil types, even with its roots in fresh or salt water. It has high drought tolerance and grows well in both full sun and partial shade. Pongamia oil is currently commonly used to fuel lamps and stoves in parts of Asia and reportedly as a tonic or balm for medicinal purposes. A single tree can yield anywhere between 9 and 90 kg of seed and each seed can contain up to 40% oil. Pongamia also has the ability to grow on agriculturally marginal land (low nitrogen and high salt). Furthermore, Pongamia oil contains a large percentage of C16 and C18 fatty acids, thus making it highly suitable for biodiesel production.

Making Biodiesel

Once vegetable oil has been extracted from crushed oilseeds, such as soybeans or canola, it undergoes a simple chemical conversion to a form more usable by today's diesel engines. This process involves trans-esterification of the vegetable oil in the presence of excess methanol with alkalines, to create the methyl ester known as biodiesel. The methyl esters are usually C16 – C18 fatty acids. After the reaction, the excess methanol is distilled and re-used. During this process, glycerol is created as a side product and can be used in the cosmetic and chemical industry.

The CILR's Biodiesel Progam

The CILR has received funding from Queensland-based company Pacific Renewable Energy to begin research into Pongamia as a source of oil for biodiesel production. This is the first time the CILR has received industry funding for a research project.

For more information on Pongamia or biodiesel, please contact the CILR directly.

Pongamia pinnata tree

011

LEGUMES 2006. The fuel that drives the future.
[BIO FUEL].[PHARMACEUTICAL].[FOOD].[ENVIRONMENT].

Biofuels:

- Ethanol from sugars
- Ethanol from cellulytic digestion
- Biohydrogen from algae

- Diesel from plant oils
- Palm oil (5 tons/ha/year!!)
- Canola (0.8 tons/ha/year)
- Soybean (0.8 tons/ha/year)
- Pongamia (5 tons/ha/year)
- Jatropha (1.2 tons/ha/year)

Present sources for feedstock:

- CRUDE Oil (US$80/barrel)

- ~~Tallow~~
- ~~Waste oil~~
- ~~Palm oil*~~, ~~coconut oil*~~ FOOD
- ~~Soybean oil*~~ FOOD
- ~~Canola oil*~~ FOOD
- ~~*Jatropha* oil~~
- ~~*Pongamia* oil~~
- ~~Algae oil~~

ARC Centre of Excellence

Information extracted from "Global Problems, Legume Biotechnology and Functional Genomics" – Peter M. Gresshoff, Australian Research Council Centre of Excellence for Integrative Legume Research. director.cilr@uq.edu.au www.cilr.uq.edu.au

Energy Crops and "Carbon Sinks"

Carbon Sink Effect

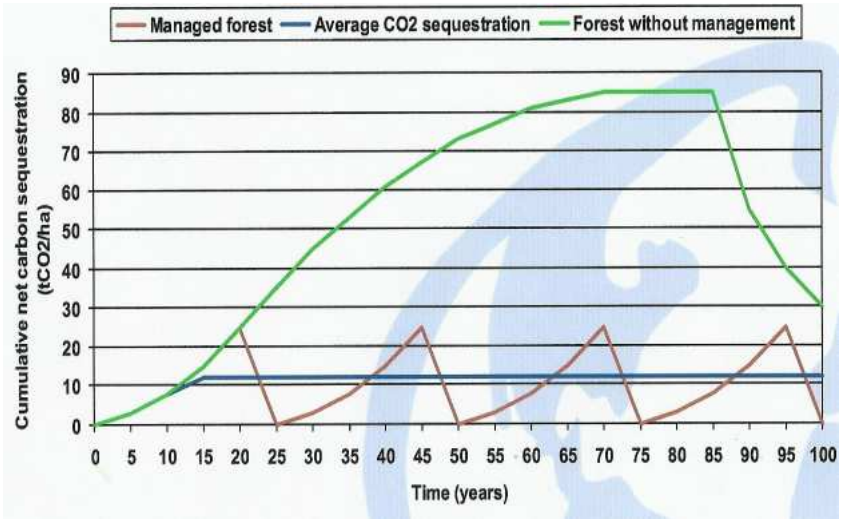
- Calculations of Emission reductions by photosynthesis estimated
- Forest inventory – calculation for trees yearly
  1m3 wood 240 kg X 3.66 X 1.5 = 1.3 t /ha
- Annual Sequestration in a tropical plantation
  20 X 1.3 = 26 t CO2 / ha
  (does not represent Pongamia)

Ref :CoP9 Milan 2003-Global Woods AG Submission

Carbon Sequestration

- Trees in the plantations grow for approx. 100years
- Carbon sequestrated at an estimated 5 to10 t/hectare/year
- Char incorporation into soil with approximately 40% of the dry weight of the biomass put through the gasification plant.
- Exploration of European pricing per tonne for possible credits.

Carbon Sink Accounting



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Investment Uncertainties

- Land tenure and acquisition
- Clearing restrictions
  - State significant project implications
  - Need for large areas of land suitable for plantations to make the project viable since
    - Isolation leading to high costs including transport, communications and labour.
    - Lack of infrastructure
- The R & D nature of the project-still unknowns to be clarified including
  - Nature of soil on regeneration sites and capacity to support plants
  - Yields
  - Stock supplies in quantity required
  - Further research on Pongamia yields
- Establishment of carbon credits system not in place in Australia at this point.
- Lack of government support or apparent awareness of benefits

PACIFIC
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Preservation of Native Species at risk

- Fires

Plantations and their management would minimise the risk of fire, thereby reducing the threat to biodiversity.

  - Excessive heat caused by build up of fuel (grasses / undergrowth) during the prolonged wet season is destructive to native species – both flora and fauna
  - ***"….in the north…the Top End and Cape York- as much as half the area is burnt either every year or every second year , typically late in the dry season…As these late fires are generally intensely hot and extensive in area, they have the potential to devastate populations of fire sensitive native plants and animals, to be costly and disruptive to pastoral operations, to pose a threat to communities and property, while having implications for greenhouse gas emissions…..Further south… fires become less frequent because of lower annual rainfall and generally more intensive grazing…there is evidence that this reduced burning has contributed to the unchecked growth and increasing dominance of native trees and shrubs in the once open grasslands and woodlands "*** Savanna Burning (by Rod Dyer and others) p1 The issues
  - Characteristically strong seasonal variation in fire weather with the monsoon

- Biodiversity threatened by regular fires

Further stated is that there is "***a decline in the abundance and richness of this of biodiversity- and evidence that inappropriate fire regimes may be partly responsible …..fire has a role to play in managing biodiversity on these lands"*** (p3)

Managing for biodiversity involves the development of habitat patchiness, weed control and wildlife management

PACIFIC RENEWABLE ENERGY