



Queensland Australia

... the smart choice

***Jatropha curcas* – environmental weed or bioenergy wonder crop? A biobased industry perspective**

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CWA Hall Mount Molloy

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Queensland **the Smart State**



Positive proof of global warming.



**18th
Century**

1900

1950

1970

1980

1990



A wise man once said...

“The problems we have today cannot be solved by thinking the same way we thought when we created them”

Albert Einstein



Presentation format

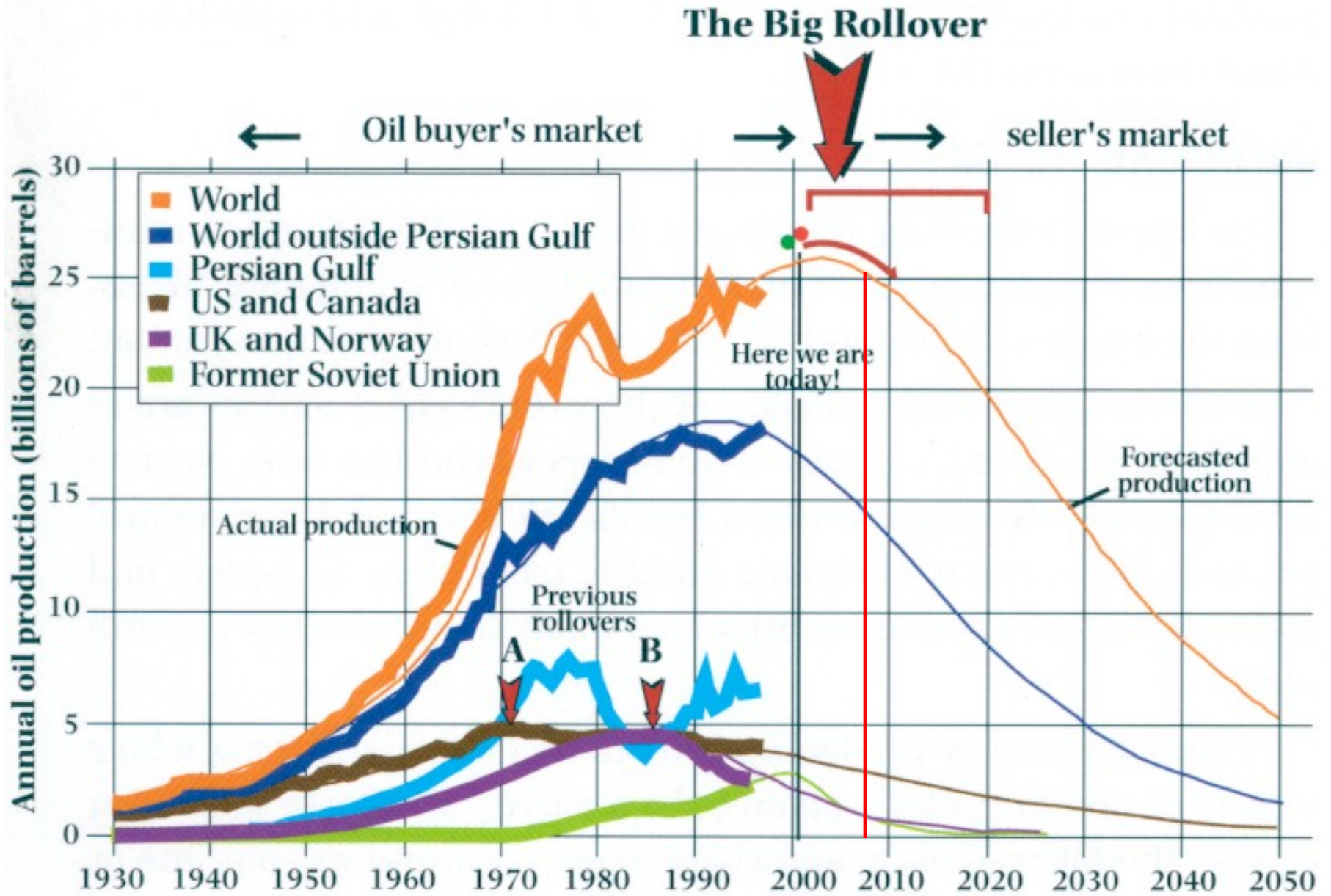
- Take a step back...
- Big Picture - biobased industry
- Biofuels as subset of biobased industry
- *Jatropha curcas* – what we know and don't know – as it is

- *Not here to critique weed issue*



Biobased economy

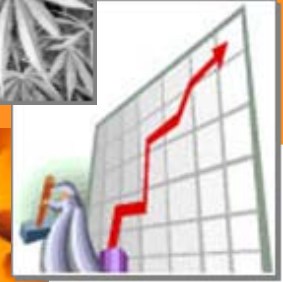
- Changing attitudes and expectations – consumers are demanding better health and an improved quality of life.
- There is a pronounced swing back to products based on sustainable (renewable) materials.
- Petroleum based fuels are non-renewable and are predicted to be in short supply ~2050.
- Advances in modern technology is driving change faster than ever before.



(Source: Australian Energy News 2001, p.31)

What is the biobased economy?

- Existing global economy is very much dependent on energy, chemicals and materials derived from non-renewable fossil fuel resources
- This development has transformed modern society, but it has come at a cost...





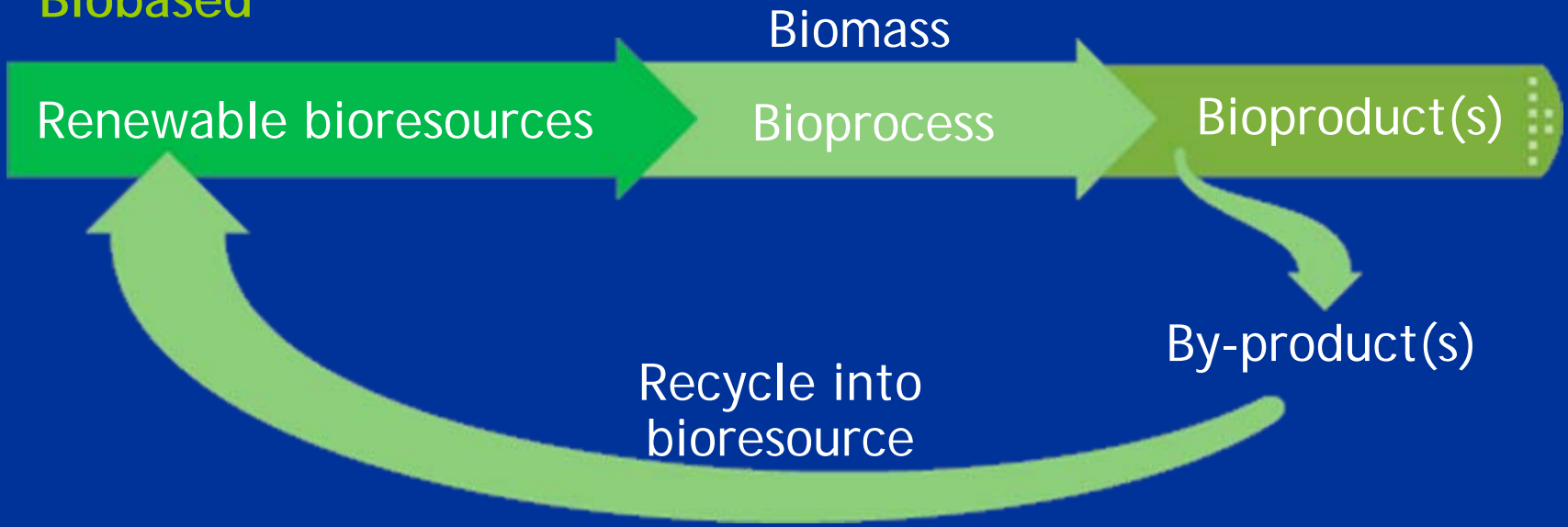
Biobased industries & products

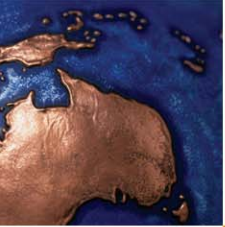
- Conversion of renewable agricultural and biological resources (bioresources) through environmentally-friendly processes to produce *bioproducts* in a sustainable way
- Environmentally preferable:
 - Products that have a lesser or reduced effect on human health and the environment when compared with competing products serving same purpose.

Conventional



Biobased





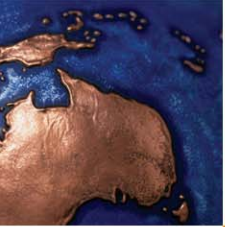
Going full circle



Before the advent of petrochemicals, many of our industrial products were derived from plants (and animals)

- Henry Ford designed the first mass-produced car to run on ethanol derived from corn (bio-ethanol)
- The first diesel engine ran on fuel made from peanut oil (bio-diesel)
- Around 1930s-1940s every Ford car that came off the production line had parts made from soybean resin and hemp fibre (biocomposite)





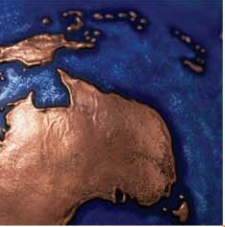
Plants as renewable resources

“The fuel of the future is going to come from apples, weeds, sawdust—almost anything...there is fuel in every bit of vegetable matter that can be fermented.”

Henry Ford 1925

- Plants are poised to become the bio-catalyst that will transition world agriculture into a biobased economy
- Most significant opportunity for agriculture in more than 100 years

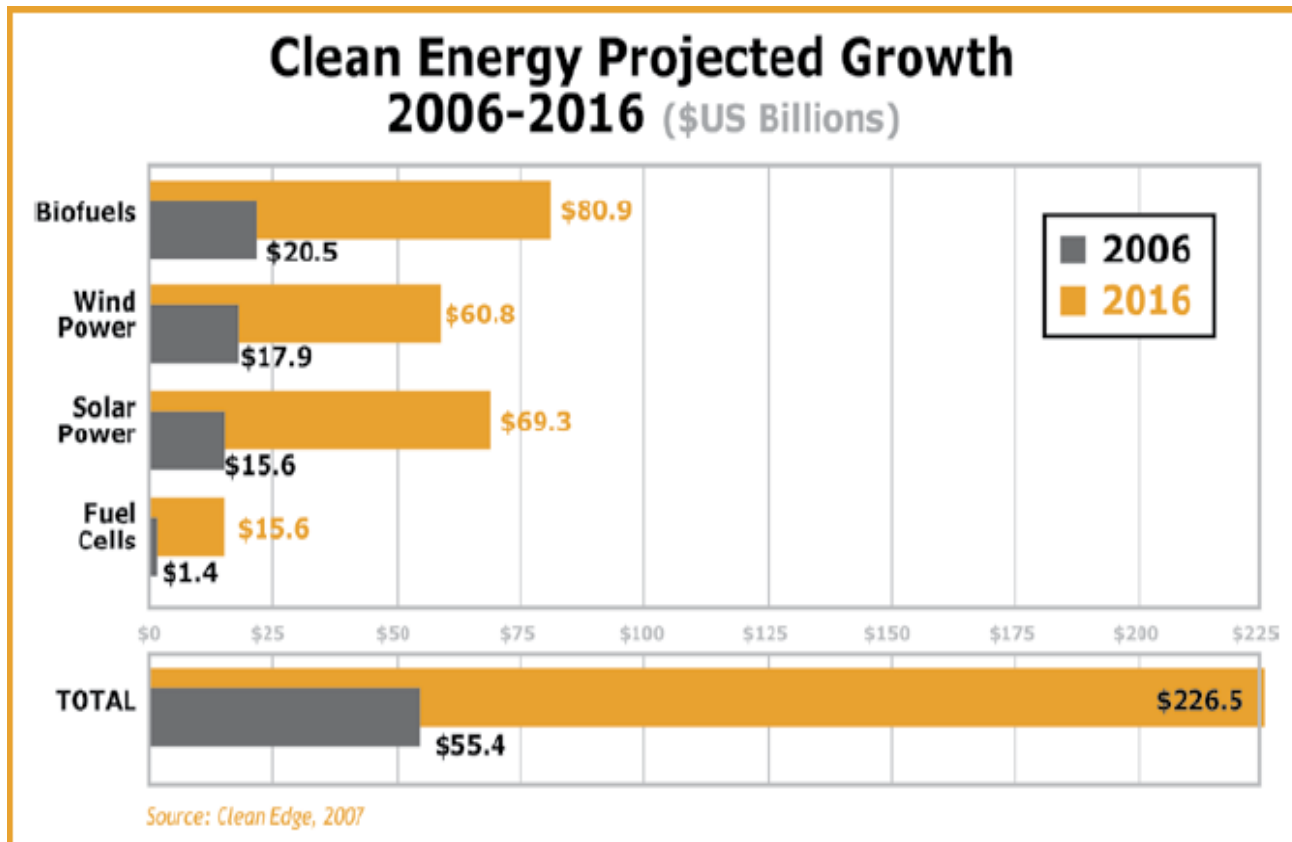
Key biobased sectors



Category	Examples of biobased products and markets	Remarks
Biopharmaceuticals	vaccines, antibodies, anti-cancer agents	20% p/a growth rate: US\$160B world market by 2010
Nutraceuticals	over the counter health-care products/ pills	6.1% p/a growth rate: US\$9.6B world market by 2008
Cosmeceuticals	personal-care products (skin, hair, anti-ageing)	US – anti-ageing products: US\$30B by 2009
Biofuels	transportation – ethanol and biodiesel	Qld. ethanol – worth up to \$1.5B by 2010
Bioenergy	green electricity and heat	Biomass (64% of green power 2003-4 Australia)
Biodegradable fibres	automobile, housing, textiles, construction	US fibre market US\$1.4B 2005; 54% p/a growth
Biodegradable plastics	automobile, electronics, construction, furniture	Aust. imported \$3B polymers / products in 1999
Industrial	chemicals, paints, dyes, enzymes, solvents, inks	World enzymes 6.6% p/a growth rate: US\$5B by 2009

“By 2020 it is conservatively estimated that around 20 percent of the 150 million tonne polymer market will be produced from renewable resources representing a market value of AUD\$30-60 billion.” Prof Lars Nielsen AIBN

Clean energy markets



Space to watch – biodiesel jet fuel



Green Flight International and Biodiesel Solutions - world's first successful test-flight of jet aircraft powered by B100 biodiesel in Oct. 2007



Are biofuels sustainable?





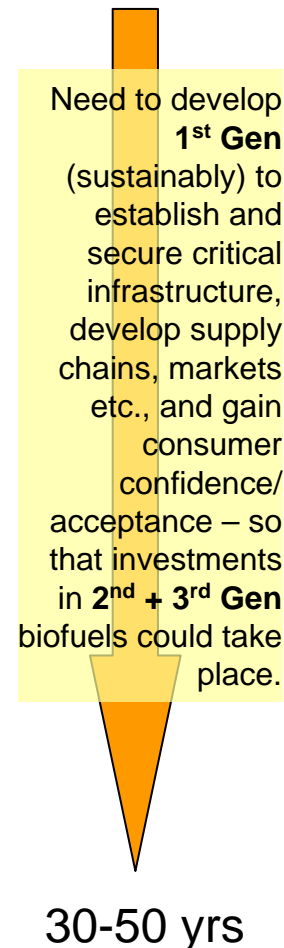
Are biofuels sustainable?

- Depends on which week you read the newspaper
- Biofuels have trade-offs:
 - Carbon benefits vs other environmental benefits
 - Exports vs food security vs energy security
 - Rural/regional development vs corporate development
- Varies with technology, feedstock and geopolitical issues.
- Oil ain't oil...not all biofuels are created equal...hence need for global sustainability standard
 - addressing TBL, well-to-wheel – LCA + GHG.



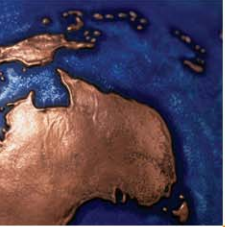
Oils ain't oils

- Current biofuels development is limited to 1st generation technology
 - Mostly crop based (not very high-tech)
- 2nd generation technology/ biofuels will greatly alleviate food / enviro issues
 - Biomass based – ag resources and municipal waste streams – highly efficient
- 3rd generation (next gen) will possibly save the planet
 - SF: based on synthetic biology – molecules & microbes constructed & “farmed” on industrial scale to produce renewable fuels etc. – leaving land for food production.



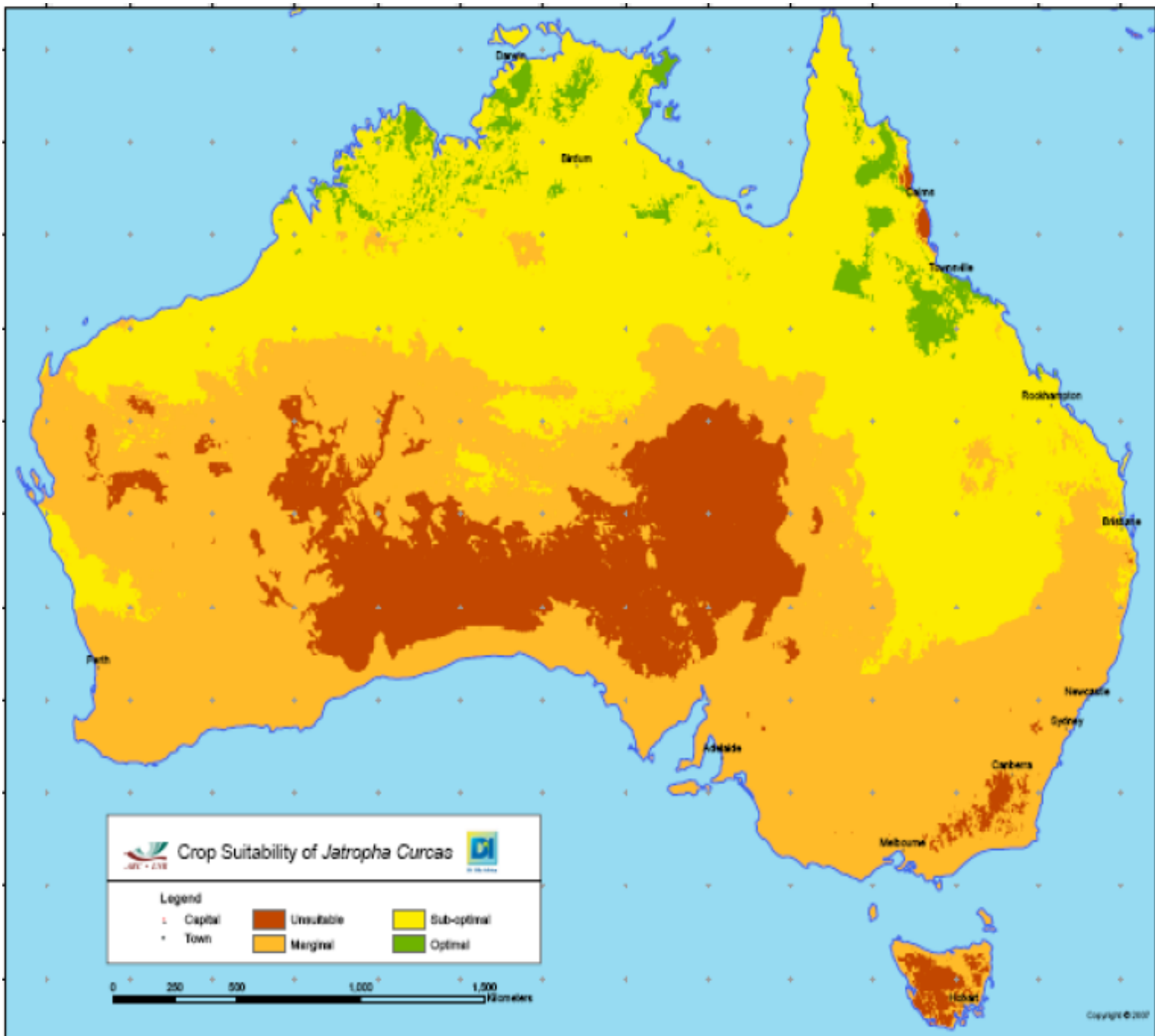


Courtesy EcoPort (<http://www.ecoport.org>) : G. Nichols



Jatropha curcas – the plant

- Promoted as a suitable perennial oil crop for biodiesel production
- Drought tolerant, hardy plant - will respond to irrigation and flower several times a year
- Yield 2000-2500L oil/ha (oil palm ~6000 L/ha) – but not quantified in Australia
- Seedcake can be used as organic mulch
- High protein stockfeed? Requires detoxification – may prove costly.



Source: D1 – BP Fuel Crops in December, 2007



Jatropha curcas – why here?

Queensland provides:

- Ideal climatic conditions for mechanised plantation management and plant yield
- Access to large contiguous land banks
- Access to port infrastructure with established road infrastructure
- A stable political environment
- And a skilled labour pool



Jatropha curcas – the weed?

- Biosecurity Qld has drafted weed risk assessment
- Policy document being completed – awaiting draft AQIS requirements
- Likely conditions imposed:
 - Restrictions on site establishment (watercourses, PAs)
 - Monitoring - escaped plants to be destroyed
 - Systems in place to prevent interstate transfer
 - Stock management program to prevent poisoning
 - Pollen transfer and hybridisation issue
 - reciprocal crosses with *Jatropha gossypifolia* (belly-ache bush) produced sterile hybrid F1 progeny (Dehgan, 1984)



Jatropha curcas – the R&D

Research needed for new industry development

- Evaluation of *Jatropha curcas* varieties for Queensland conditions – including non-toxic varieties.
- Agronomic trials on planting density, fertiliser practices, irrigation, pruning, flowering synchronisation, mechanical harvesting and pest and disease management.

Further work needed for industry assessment

- More detailed analysis of the sustainability of *Jatropha* biodiesel production.
- Economic analysis of the crop for a range of possible yields and oil prices as well as potential by-products.
- Costs of plantation establishment and production need to be determined.











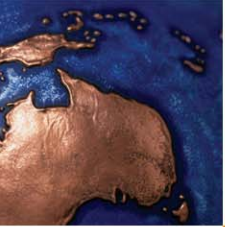












Jatropha curcas – environmental weed or bioenergy wonder crop?

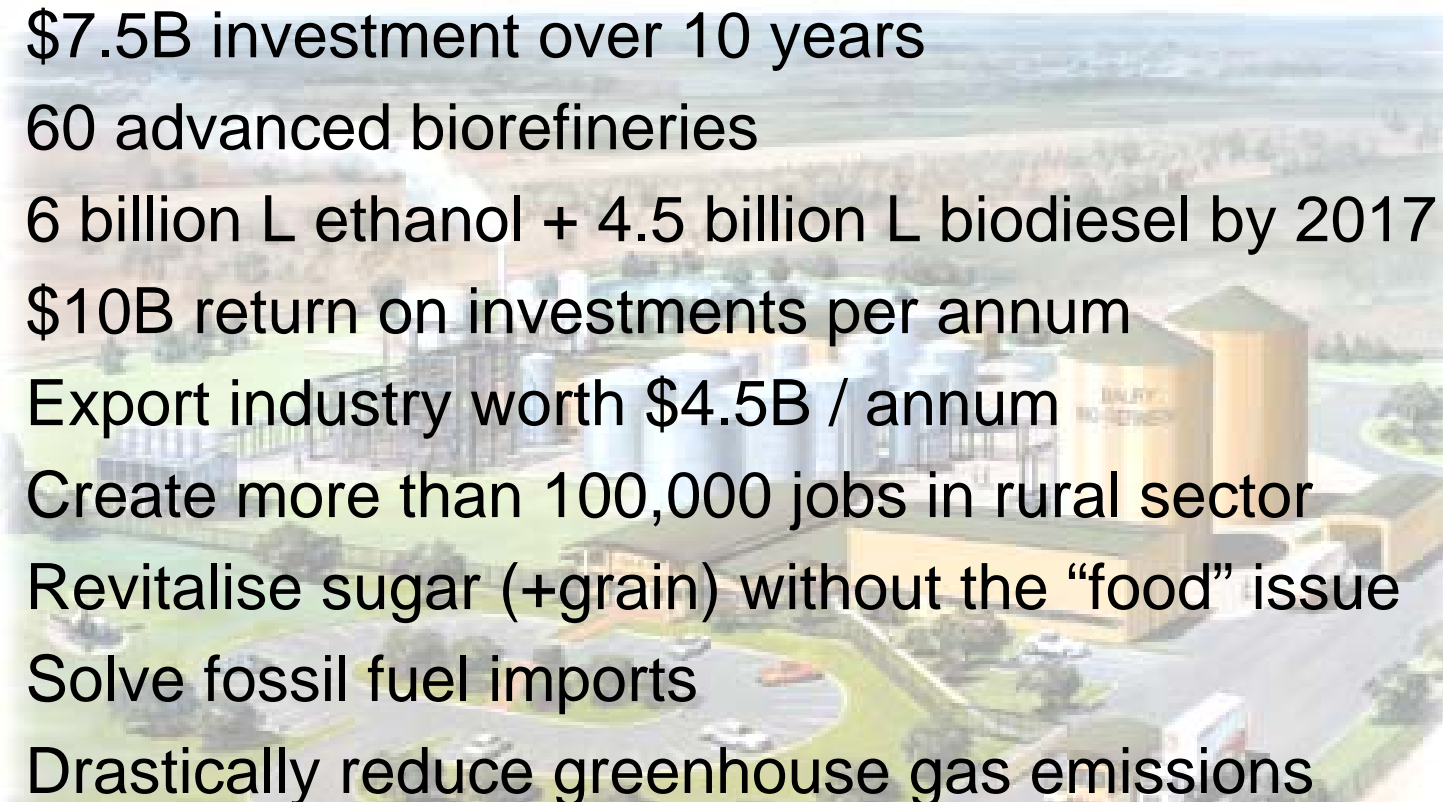
Answer:

- it's probably somewhere in between...
- I would compare it to Castor oil bush (as weed)
- Considerable R&D needs to be undertaken to prove commercial viability in Qld.
- Carefully managed trials should be allowed to be undertaken – with conditions attached.



Australia as biofuels superpower?

Project synopsis:

- \$7.5B investment over 10 years
 - 60 advanced biorefineries
 - 6 billion L ethanol + 4.5 billion L biodiesel by 2017
 - \$10B return on investments per annum
 - Export industry worth \$4.5B / annum
 - Create more than 100,000 jobs in rural sector
 - Revitalise sugar (+grain) without the “food” issue
 - Solve fossil fuel imports
 - Drastically reduce greenhouse gas emissions
- 

Study by Professor John A Matthews – Macquarie University (Oct 2007)