

**Landowner economic,
employment and
environmental benefits
via bioenergy**

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Bioenergy Association

- Represents all leading NZ bioenergy sector players
- 3 Interest Groups
 - Biogas
 - Liquid Biofuels and Co-products
 - Wood Energy
- Bioenergy supplying 10% of energy used in NZ
 - Potential to do much more
 - Well established conventional technologies
 - Platform for new advanced biofuel technologies and co-products
- Leading implementation of the Bioenergy Strategy
 - Achieving economic, employment and environmental benefits
- Membership based organisation
 - Quality Framework – Registered Wood Energy & Biogas Advisers
 - Training and Technical Guides
 - Workshops and conferences
 - Promotion of member's products and capabilities

Messages for landowners

- Landowners can produce revenue from energy or bio-based products.
 - Wood energy from retired agricultural land & shelterbelts
 - Biogas initiatives can integrate with existing farm activities
 - Longer term production of transport biofuels
- Energy + multi new business products
 - Heat
 - Bio-based polymers
 - Embedded electricity
- Economies of scale require collaboration
- Bioenergy is often a niche opportunity
- Technologies are proven and produce revenue

The start of a new era

- The energy drivers
 - Pre 19th Century - The charcoal era
 - 19th Century – the coal era
 - 20th Century – the petroleum era
 - 21st Century – the start of the bioeconomy
- The economic opportunities
 - New bio-based products
 - Additional value from wood and waste
 - Turning opportunities into \$\$\$\$

The bioenergy market

- ***Wood fuel production for heat***
 - Wood chips / general wood fuel
 - Wood pellets
- ***Liquid biofuels production and use***
 - *Current* – bioethanol from whey; biodiesel from canola, UCO, tallow
 - *Future* – bio-oil from algae, biodiesel & bioethanol from woody material,
- ***Biogas production and use***
 - Waste water and municipal waste
 - Animal and food waste

Feedstocks

- Forest harvest residues
- Wood from woodlots or shelterbelts
- Horticultural thinnings and prunnings
- Dairy effluent
- Reject fruit and vegetables
- Food processing residues
- Agriculture crops
- Animal fats
- Biogas

Basically any organic matter

Dairy farm benefits

- Waste disposal
- Small scale solutions – think local/act local
- RMA waste mitigation – key driver
- Integrated opportunities for coproducts
- Production of high grade farm fertiliser
- On site heat
- Reduce environmental impact
- Reduced peak electricity demand charges
- Enhance milk quality
- Reduce energy cost – energy intensive

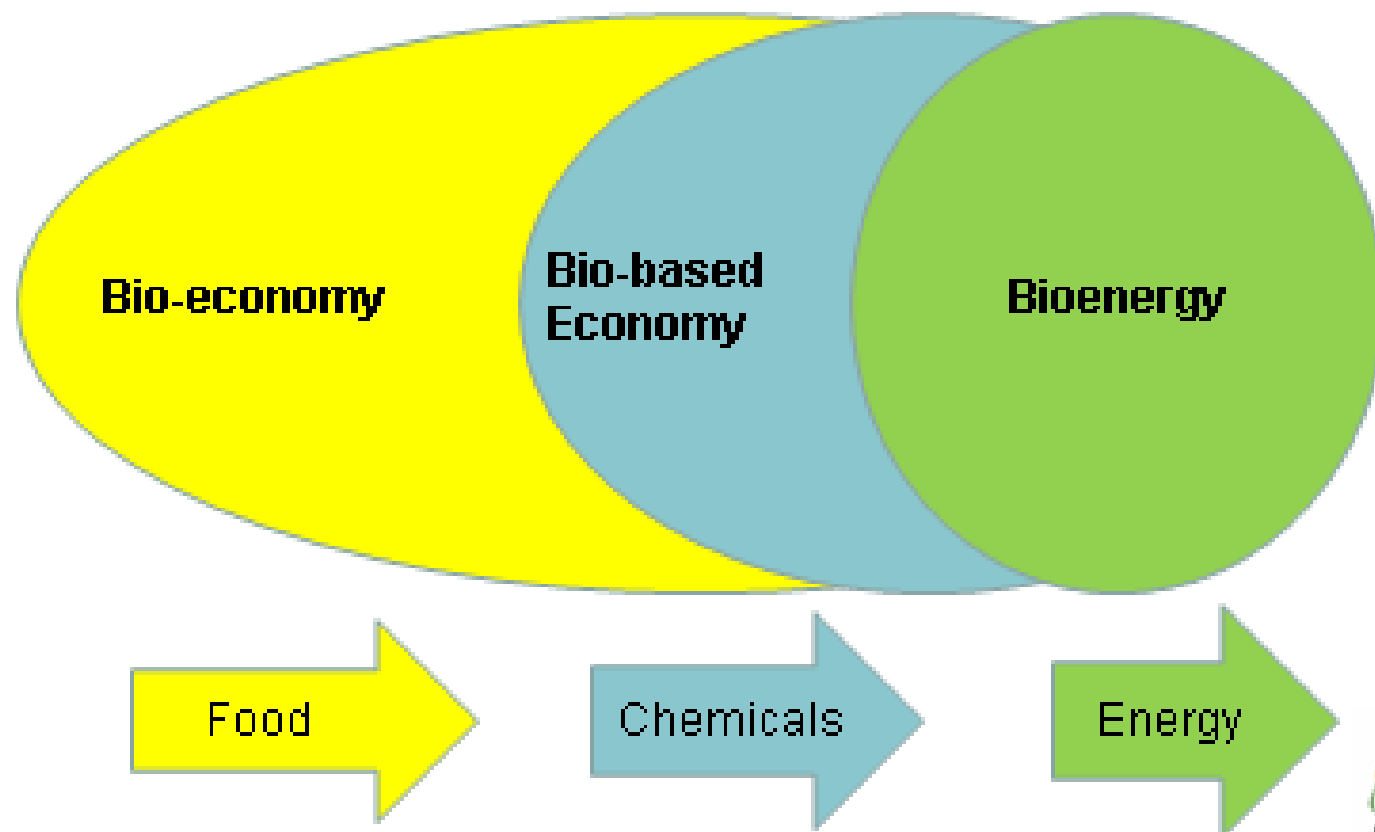
Co-products to existing business

- Farming – livestock + shelter trees
- Forestry – logs, lumber + wood fuel
- Horticulture – crop + disposal of thinnings
- Dairy – milk + disposal of effluent
- Cropping – cereal + rape
- Food processing - food + revenue from residues
- Horticulture – crop + use of spare land
- Farming – livestock + use of steep slopes

Involves thinking differently

- Focusing on additional value from farm residues (often wasted)
 - not just energy
- Energy is the pathway
 - not the end point
- Environmental solutions
 - Waste reduction
 - Reduce nutrient runoff
 - Air emissions reduction
- Green business growth
 - not greening growth

The post petroleum era



Fits within Government Business Growth Agenda



- Developing NZ's renewable energy opportunities
- Government endorsement of the Bioenergy Strategy
- Embrace new energy technologies
- Reduce energy related emissions of greenhouse gas's
- Secure and affordable energy
- Heat Sector Objectives and Targets – 9.6PJ
- Encourage greater diversity of transport fuels

A platform for us to make money from farm residues

Achieving economic, employment and environmental benefits via bioenergy

NEW ZEALAND BIOENERGY STRATEGY

SEPTEMBER 2010



This Strategy will realise :

- economic growth, employment and regional prosperity;
- Supplies 25% of the country's energy needs,
- Supplies 30% of transport fuels, by 2040;
- based on existing capability in forestry, wood processing and converting organic by-products to energy
- Takes NZ into a post petroleum era

A \$6 billion sector



The Bioenergy Strategy will

- Provide additional revenue streams for land owners
 - Economic growth from improved land use and use of residues
 - Increase business resilience and wealth obtainable from diversified land use
- Use bioenergy as a leader into the wealth potential of the wider bio-economy
 - Production of value added bio-materials
- Increase the utilisation of residue so that waste is reduced and environmental outcome maximised
 - Reduce environmental impacts to air, soil and water
 - Enhance the quality of New Zealand's 'Green Image'

What is biogas production

Biogas production using anaerobic (oxygen free) digestion

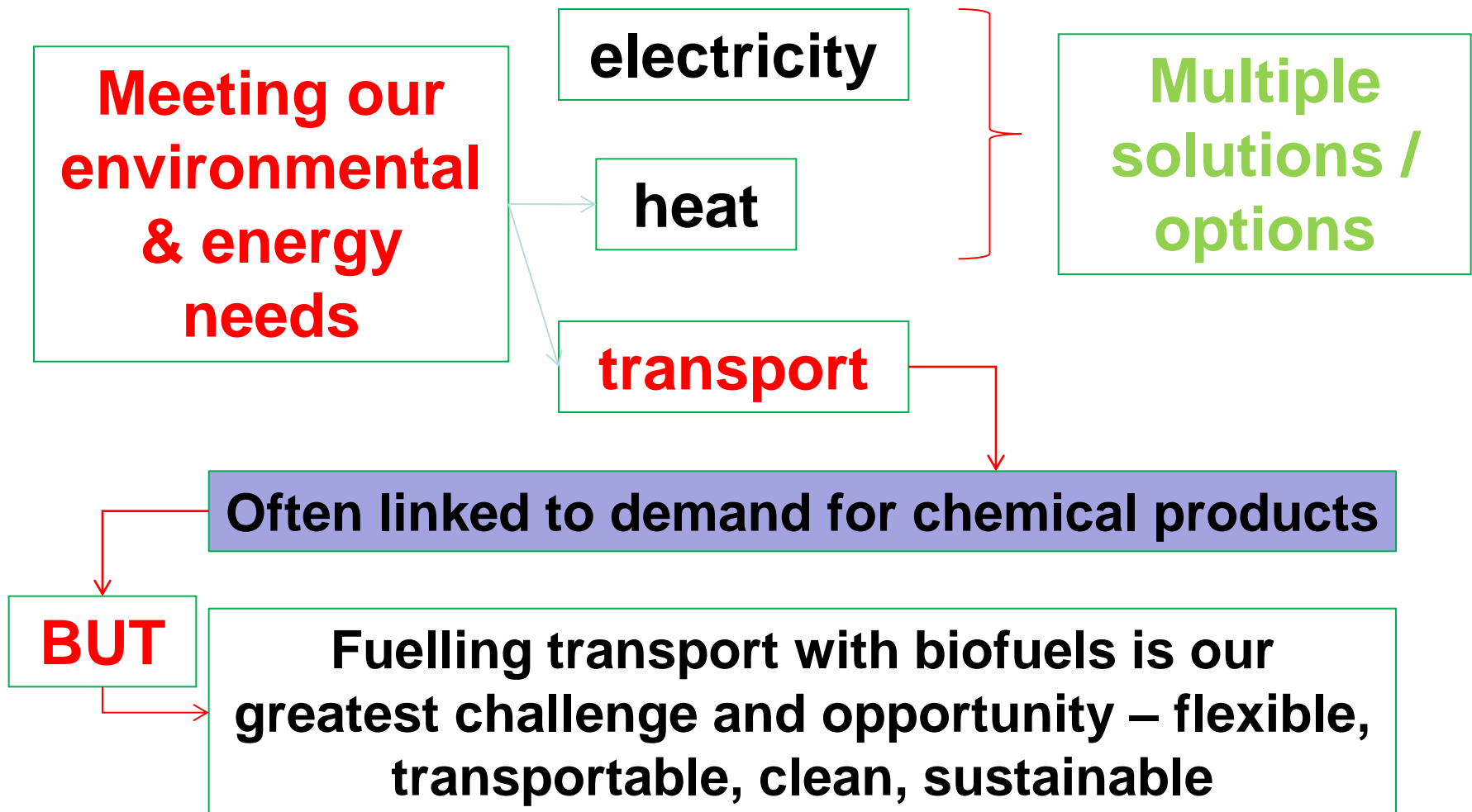
- is a biological treatment process of organic matter
- to reduce odor,
- produce energy and
- improve the storage and handling characteristics of manure.

Products

- Biogas for heat
- Feedstock for biobased materials
- Fertiliser
- On farm vehicle fuel
- Farm residue utilisation
- Farm environmental management



The biogas opportunity



Benefits of biogas production for farmers

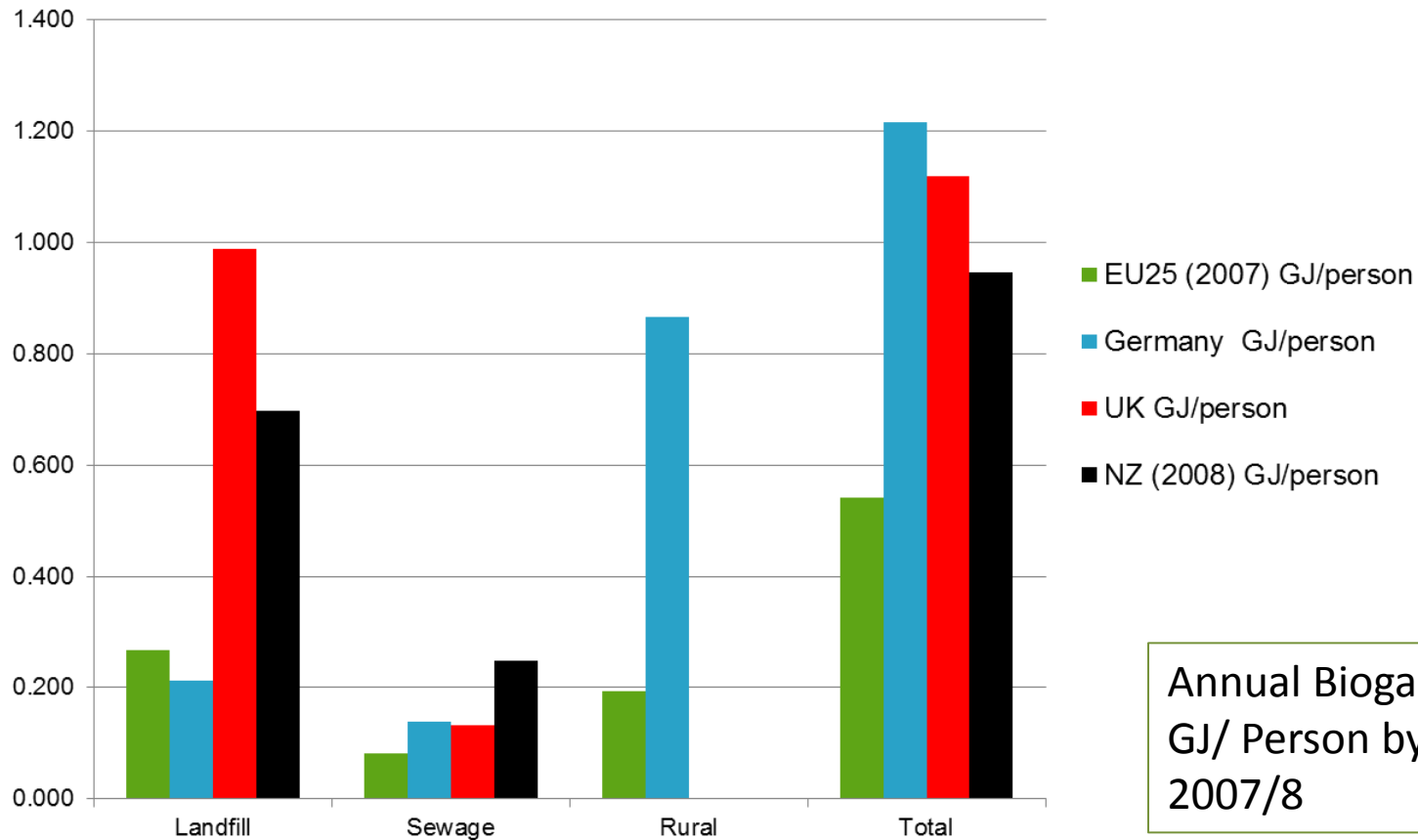
- New business opportunities
 - New products
 - Building on existing capabilities, infrastructure, and staff
 - Export of biogas production capability/skills
- Business resilience
 - Cost stabilisation
 - High quality fertiliser production
- Using organic production residues
 - Revenue from production residues
 - Reduce waste disposal costs
 - Co-product with biochemicals
- Green growth
 - New products based on sustainable resources
- Leading into the bioeconomy



Biogas in NZ

- New Zealand has:
 - Long history of biogas related developments
 - An extension of existing agricultural and process industries
 - Experienced biogas consultants
 - Innovation and leading edge solutions attracting world attention
 - Successful niche applications
- Fewer farm applications than in 1985
- Focus has been on production of biogas from landfill and food processing applications
- Resurgence of interest in farm applications
 - Larger herds
 - Increase of use of feedpad and stand-off pads

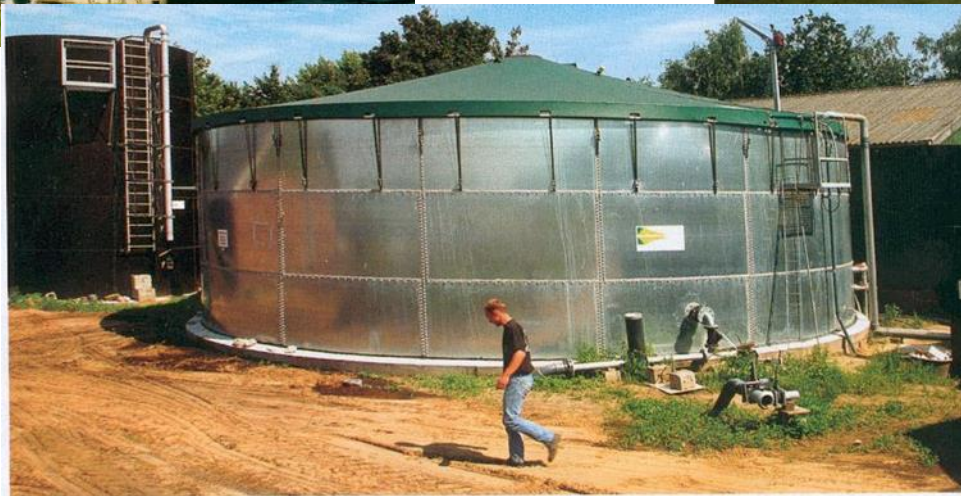
NZ already a leader in biogas



4.6PJ across NZ cf 5.5PJ residential natural gas use (2009)

Range of technology options

Tank systems



Covered pond systems

Woodlot

Supplementary wood to digester

Anaerobic digestion

Chipping Pulp and wood fuel

Biogas fuel for tractor

Supplementary wood fuel from shelterbelts and 'paddock' trees

Electricity to farm house

Gas engine

Holding Ponds

Heat & Power to milking shed

Runoff

Electricity to neighbours/grid

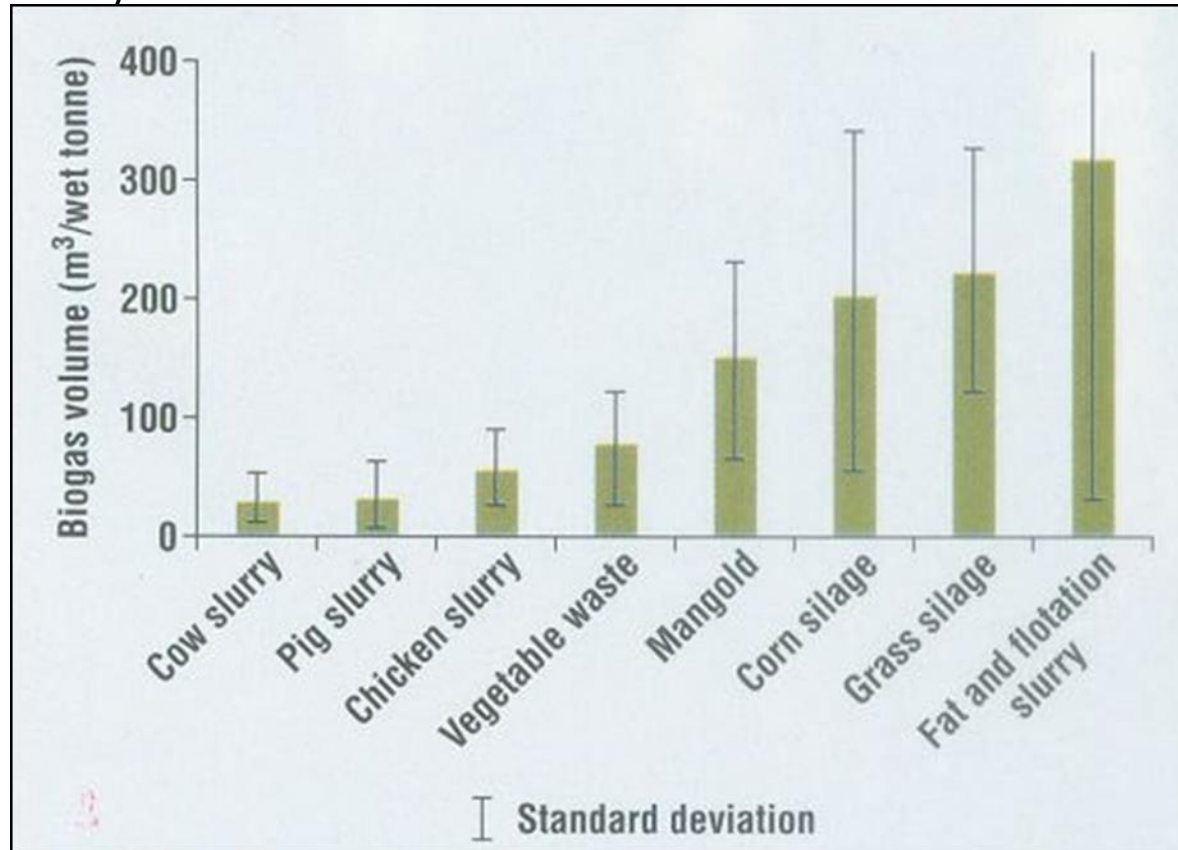
Electricity for irrigation

Milking 1000 cows on 350 hectares (effective) producing 170,000kg milk solids
Central Bay of Plenty - rolling country with peripheral steep country
Seasonal milk supply
Installation of anaerobic digester for gas production (can use effluent from neighbouring property)
Methane gas cleaned and fed into a gas engine for electricity production
Additional digester feedstock available in the off season (neighbours piggery waste and crop)

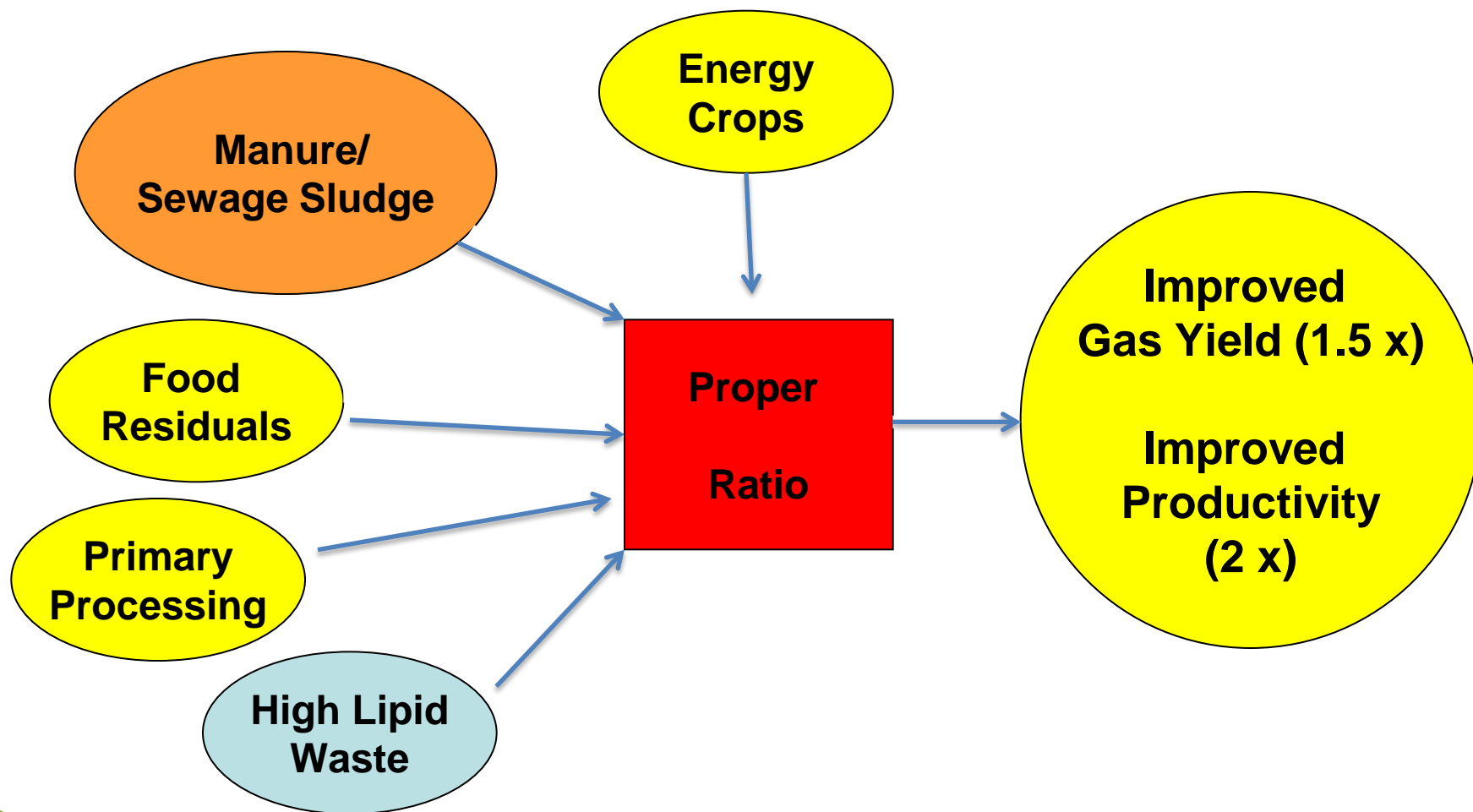


Biogas Output

Biogas yield m³/tonne



Co-digestion of waste + industrial feedstocks improves yield

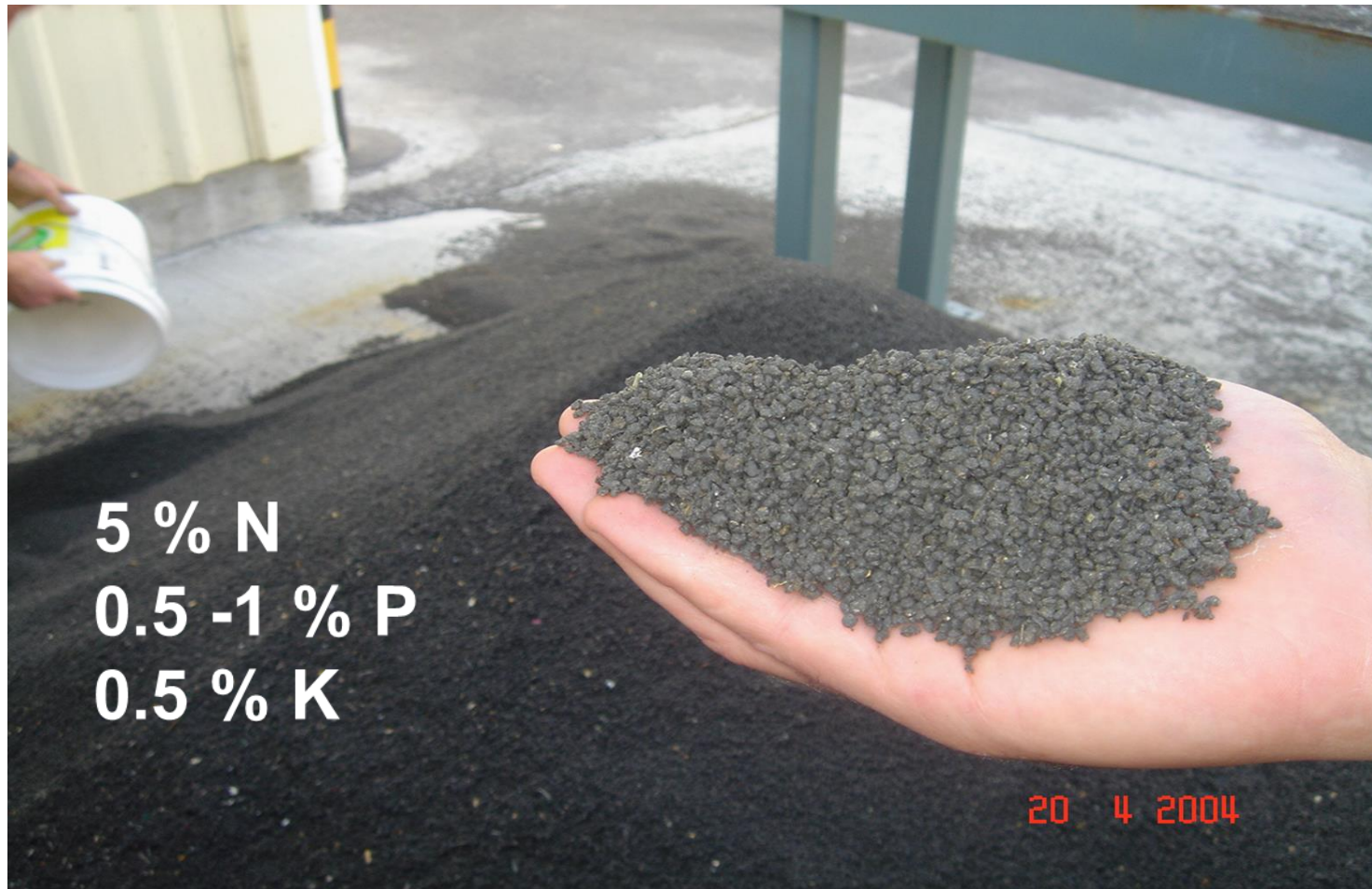


The energy economics

Co-digestion Plant	Cattle milked (hd)	Energy price (\$/kwh)	Construction costs (M \$NZ)	Industrial Waste added (t/day)	Industrial Waste gate fee (\$/t)	Manure conveyance fee (\$/year per hd milked)	Annual Power Production (kwh/year)	Simple payback period (Years)
Municipal digester upgrade	0	Spot market	2 - 3	10 - 20	30	0	5,600,000	5 - 7
Dairy Farm cluster	7500	0.15	1.6	0	0	30	317,293	15-16
Dairy Farm cluster	7500	0.15	1.6	5	0	30	609,793	11-12
Dairy Farm cluster	7500	0.22	1.6	5	0	30	609,793	8 - 9
Dairy Farm cluster	7500	0.22	1.6	5	30	30	609,793	7 - 8
Regional Digester Facility, Pork Industry	0	0.15 (diesel)	5 - 6	10 - 20 80 - 90 (piggery)	80	0	Heating fuel, 6,000,000	3 - 4 (13 - 14, no co-digestion)

Source; Jurgen Thiele, Case Study: Biogas from farm wastes and agro-industrial biosolids. Presentation to BANZ conference 2013

Fertiliser product



Source: Jurgen Thiele BANZ conference 2010

The value of fertiliser

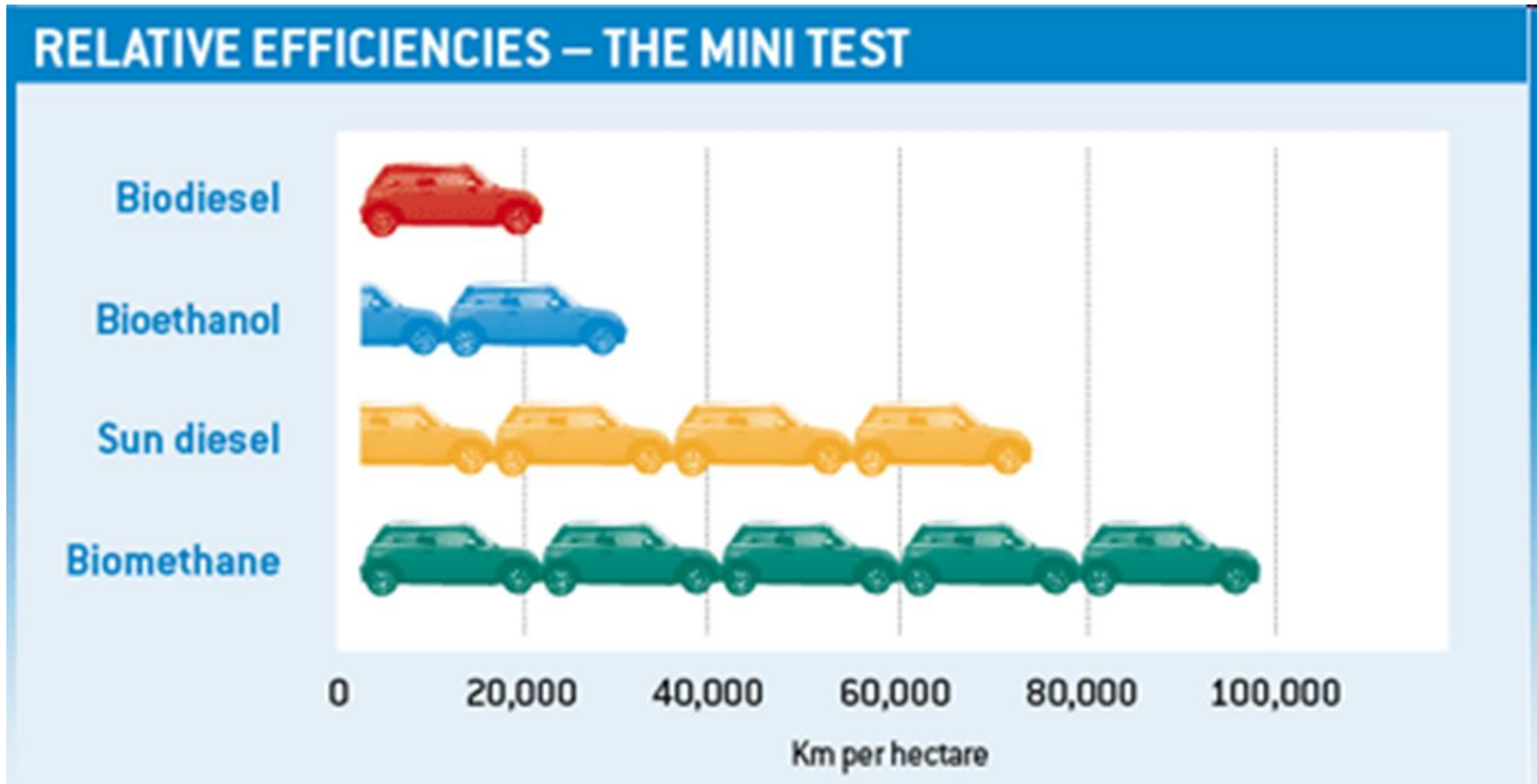
Example of relative product values from food processing AD facility

Process Options	Tipping fees	Electricity sales	Fertiliser sales	Operating cost	“EBITDA”
5% contam.	11.1	4.5	2.3	9.4	8.5
0% contam.	3.8	5	2.6	8.8	2.6
35% contam	14.6	3.8	2	14.3	6.1
Europe (2002)	39.2	4.5	0 (Compost)	9.4	34.3

Figures are percent of capital cost
“EBITDA” Earnings Before Interest, Tax, Depreciation, Amortisation.

Source: Jurgen Thiele, BANZ conference 2010

Km travel per hectare – Land efficiency



Source: www.biodieselnow.com/forums/t/19315.aspx

Methane to plastics

Biodegradable plastics from waste biogas (methane) that are economically competitive with conventional oil-based plastics.



The heat market

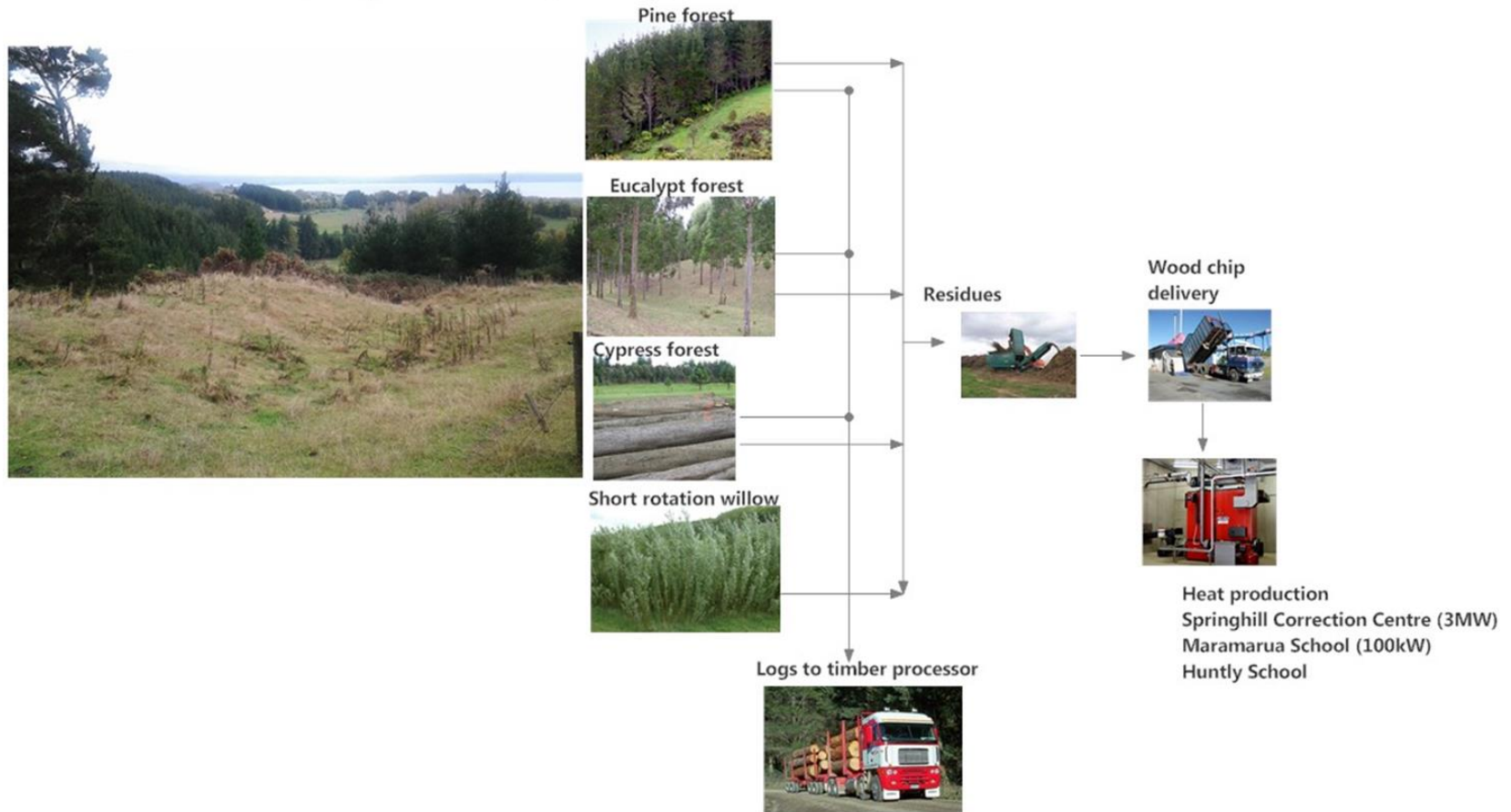
- An opportunity to develop a wood fuel business
- Leads to future biofuel and bioproduct markets
- Uses proven technology
- 10-15% of wood production is currently wasted
- Demand from heat plant owners exists
- Yet the wood fuel market is currently poorly developed
 - Quality of wood fuel
 - Reliability of supply
 - Long term contracts

Demand for heat

- NZ total consumer energy 537 PJ
- Industrial heat 168 PJ
 - Pulp and paper 54 PJ (32%)
 - Food processing 30 PJ (18%)
 - Chemicals 21 PJ (12%)
- Heat plant (6200 MW_{th})
 - Wood processing 1,798 (29%)
 - Dairy processing 1,860 (30%)
 - Other sectors: meat processing (496), hospitals (496), glasshouses (186), education (310)

More than logs from forestry

Development Block (Forestry)



Re-establish shelterbelts on dairy farms to be multi-functional

- Production of bioenergy co-products for increased farm income.
- Provision of shelter for stock.
- Increased pasture production.
- Improved water use efficiency.
- Increased functional biodiversity.
- Improved public perception of dairying.



Using shelter as a crop



The demand for wood fuel

- **Wood fuel**
- Sourced from wood processing plant or forest residues
- High quality wood pellets, quality chip unsorted forest residues
- **Uses**
- Heat
- Electricity generation
- Production of transport fuel (ethanol, bio-oil, biodiesel)

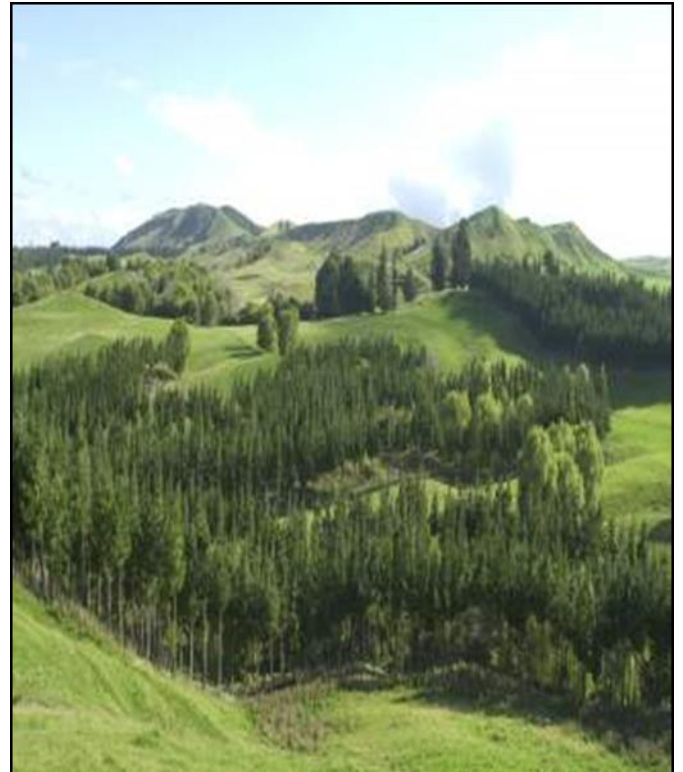


Short rotation crops



Advanced biofuels

- Uses waste or co-product with wood processing
- Lots of technologies being developed internationally
- Economic in 5-10 years
- Resources for advanced biofuels are near unlimited
- Wood produce more GJ per ha than oil / seed / nut crops
 - Canola to biodiesel = 1265 litres/ha/yr
 - Wood to diesel = 2470 litres/ha/yr
- A drop in fuel



High Value Products: Multiple applications

Xylose

\$1.5B Market

- Food Additives
- Xylitol
- Personal Care Products
- Pharmaceuticals



Lignin

\$64B Market

- PVC Additive
- Adhesive & Epoxy Resins
- Polyurethane
- Carbon Fiber



Cellulose/Ethanol

\$35B Market

- Transportation Fuels
- Fuel Additives
- Solvents
- More Economical Feedstock for Pulp & Paper plants



A serious business decision for farmers

- By extracting additional value from organic wastes, and diversified land use
 - Proven technology and we have the expertise
- Leading to new business opportunities
 - Economic and employment value from under-utilised dairy effluent
 - Increased value to farmers from biogas as bioenergy and as a feedstock for biomaterials
- Waste reduction - > value of energy + coproducts
 - Clean integrated solutions for rural applications
 - A tool for environmental land management
- Requires
 - Requires application not R&D,
 - Drive and champions
 - Economies of scale from working together
 - Development of tools and Technical Guides to reduce development costs