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BIOGAS

LIQUIDBIOFUELS

WOODENERGY

Overview of the drivers for bioenergy solutions – a market analysis

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What are bioenergy solutions?

- Biomass based products and services
  - Energy focus
  - Many co-products valuable than the energy products
- Use of biomass energy technologies to deliver
  - Economic outcomes
    - Reduced business operating costs
    - New bio-based business opportunities
    - Regional economic growth
    - Transition to use of renewable natural resources
  - Societal benefits
    - Employment
    - Warm and healthy homes
  - Environmental benefits
    - Greenhouse gas emission reductions
    - Reduced discharge of contaminants to waterways
    - Reduced discharge of emissions to air.

Sources of biomass

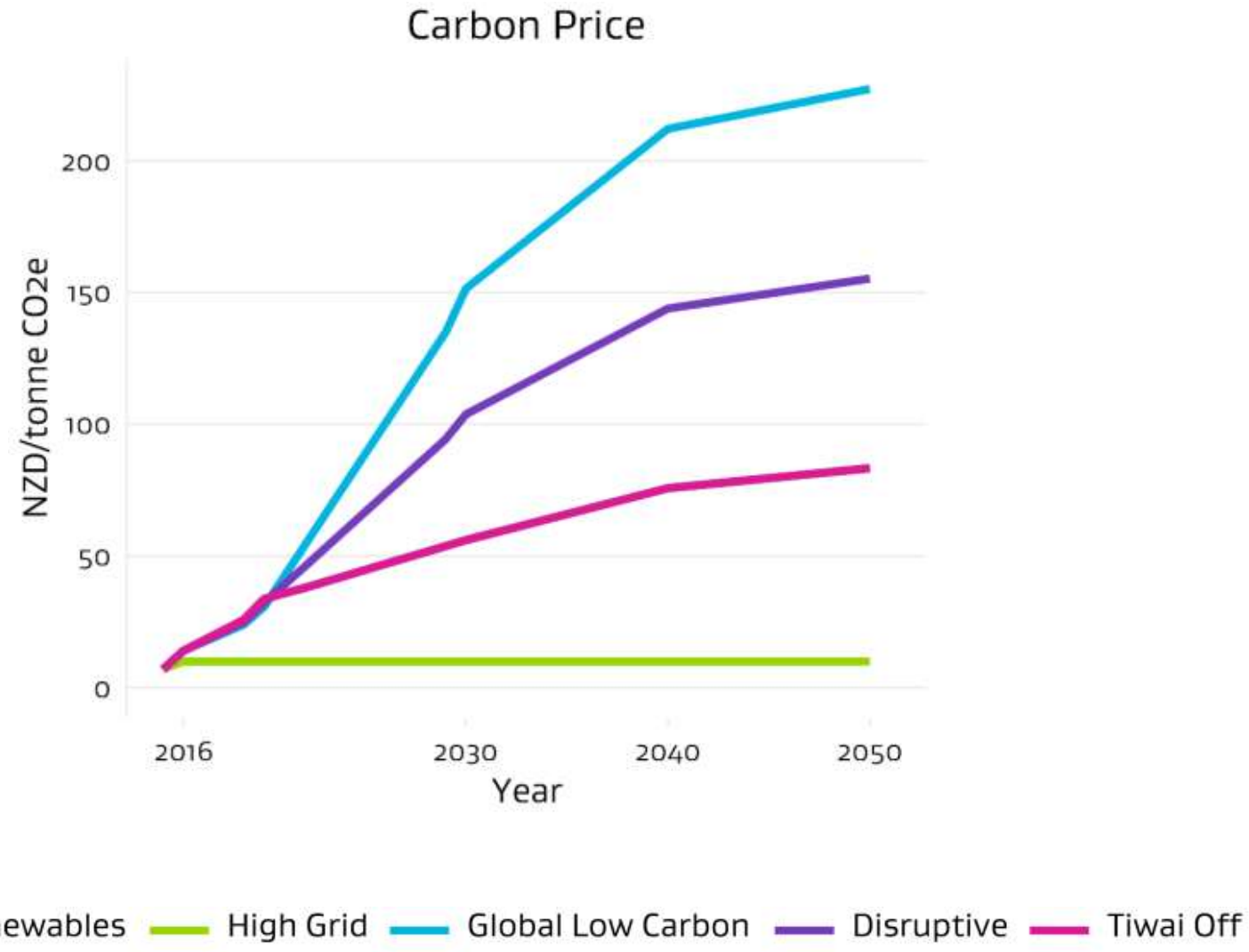
- Residues and waste from agriculture
- Residues from forestry
- Residues from wood processing
- Organic waste from municipalities and manufacturing
- Energy crops

- We don’t have high sugar or high starch material
- In the short term limited to waste and residues
- Transition in association with fossil fuels
- Complementary to existing land use and business activities
  - As well as and not instead of

Government policies

- Energy
  - “Make the most of our energy potential”
- Environment
  - Aim for clean air and waterways
  - Targets for greenhouse gas reduction
  - Waste minimisation but not waste utilisation
- Business growth
  - Encourage private sector
  - Limited Government involvement
  - Require forestry and wood processing strategy
- Regulations
  - National Air Quality
  - Land use and discharge to waterways

Government carbon price assumptions



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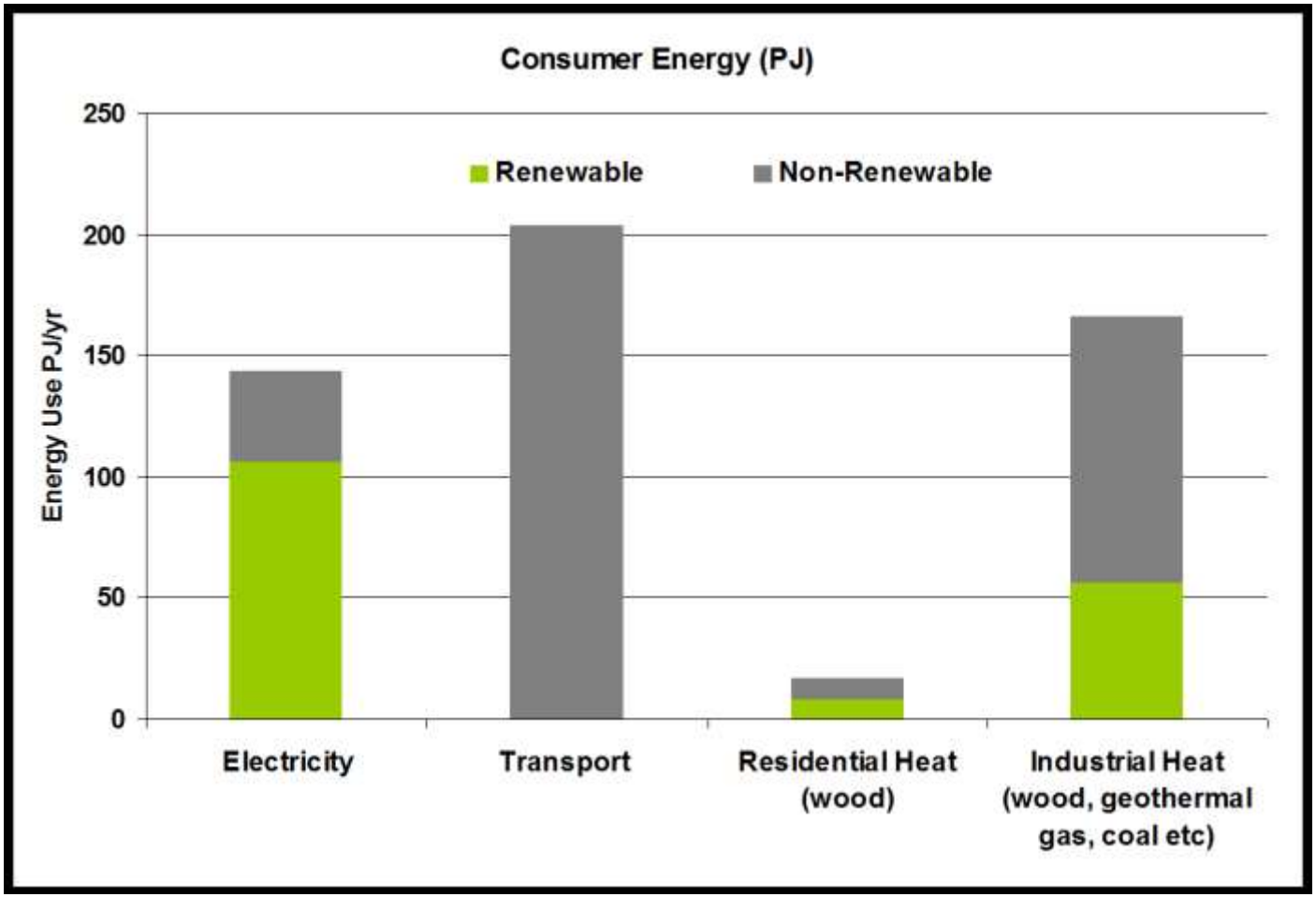
New Zealand renewable /non-renewable energy consumption



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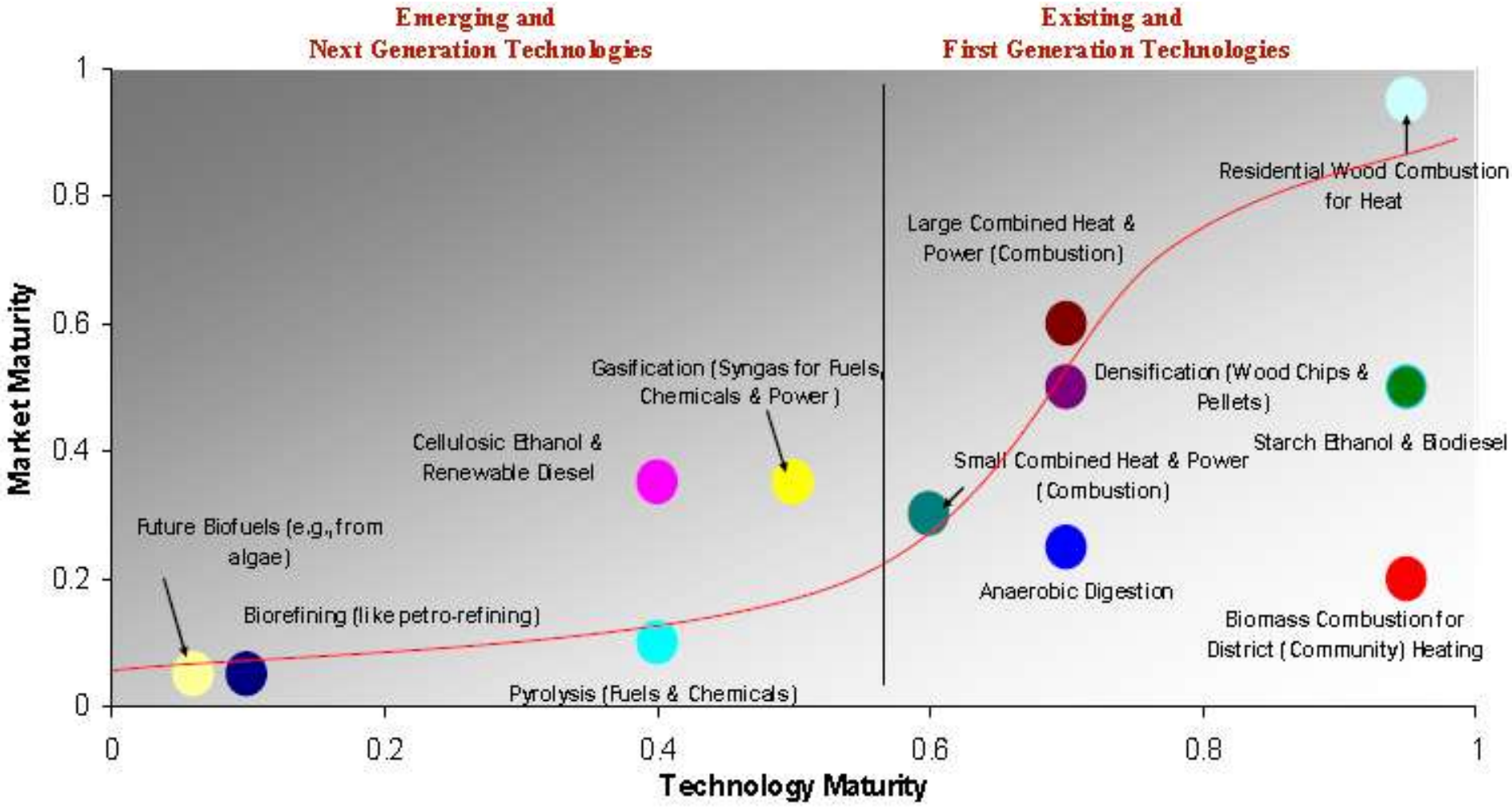
Emerging technologies



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A complex market

- Transitioning to a post petroleum era
  - Uncertain time line
  - Transitioning to the bioeconomy
- Multi-feedstock and multi-product
- We are a small part of the economy
  - Need to prioritise
  - Need to focus on the easy wins and do them well
  - Have to do what we can within our limited resources
- We can leverage off collaboration with our partners
- Rich in renewable natural resources – a comparative advantage
- However small market limits economies of scale

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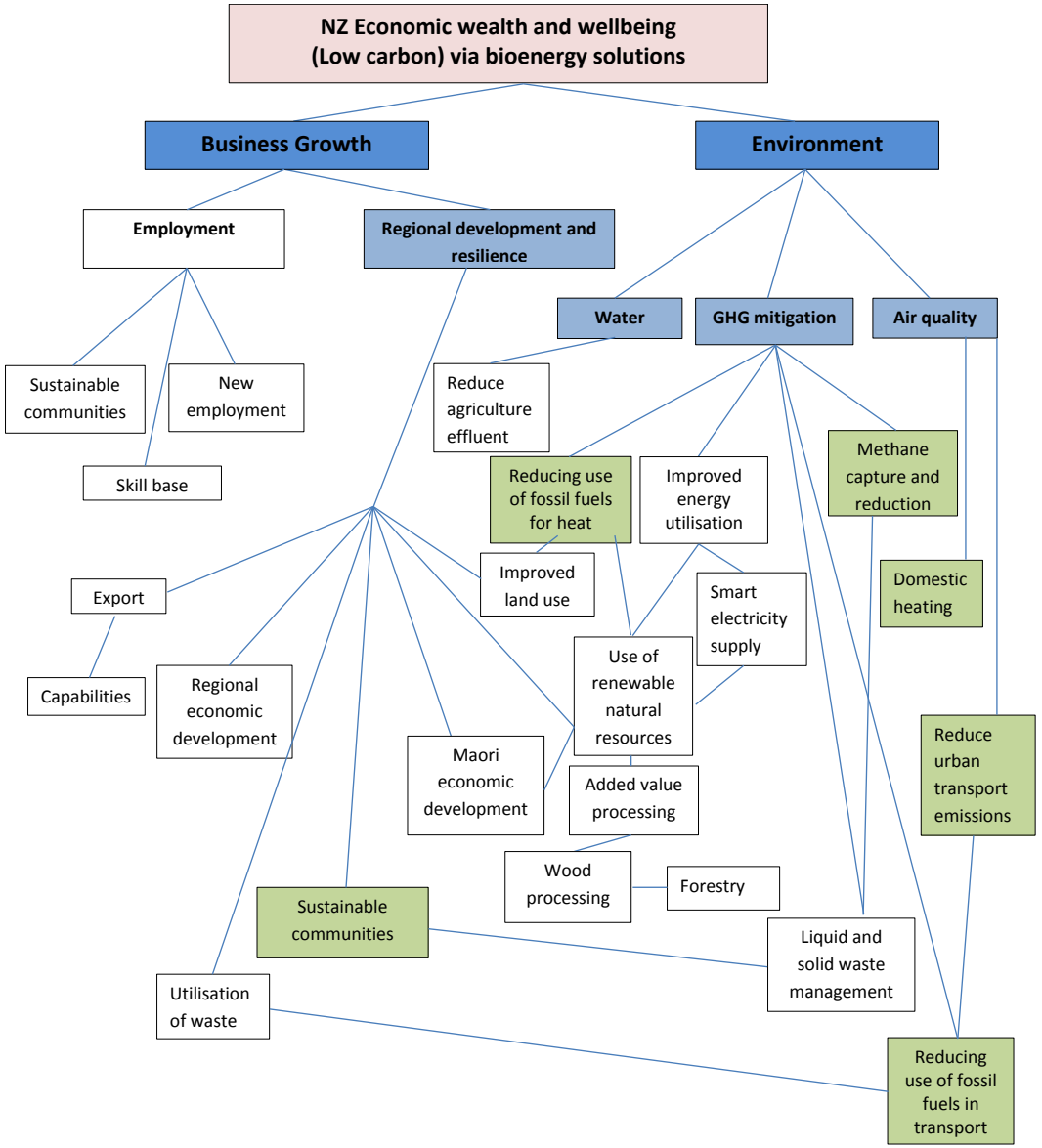
Primary Drivers for the Bioenergy and Biofuels Sector



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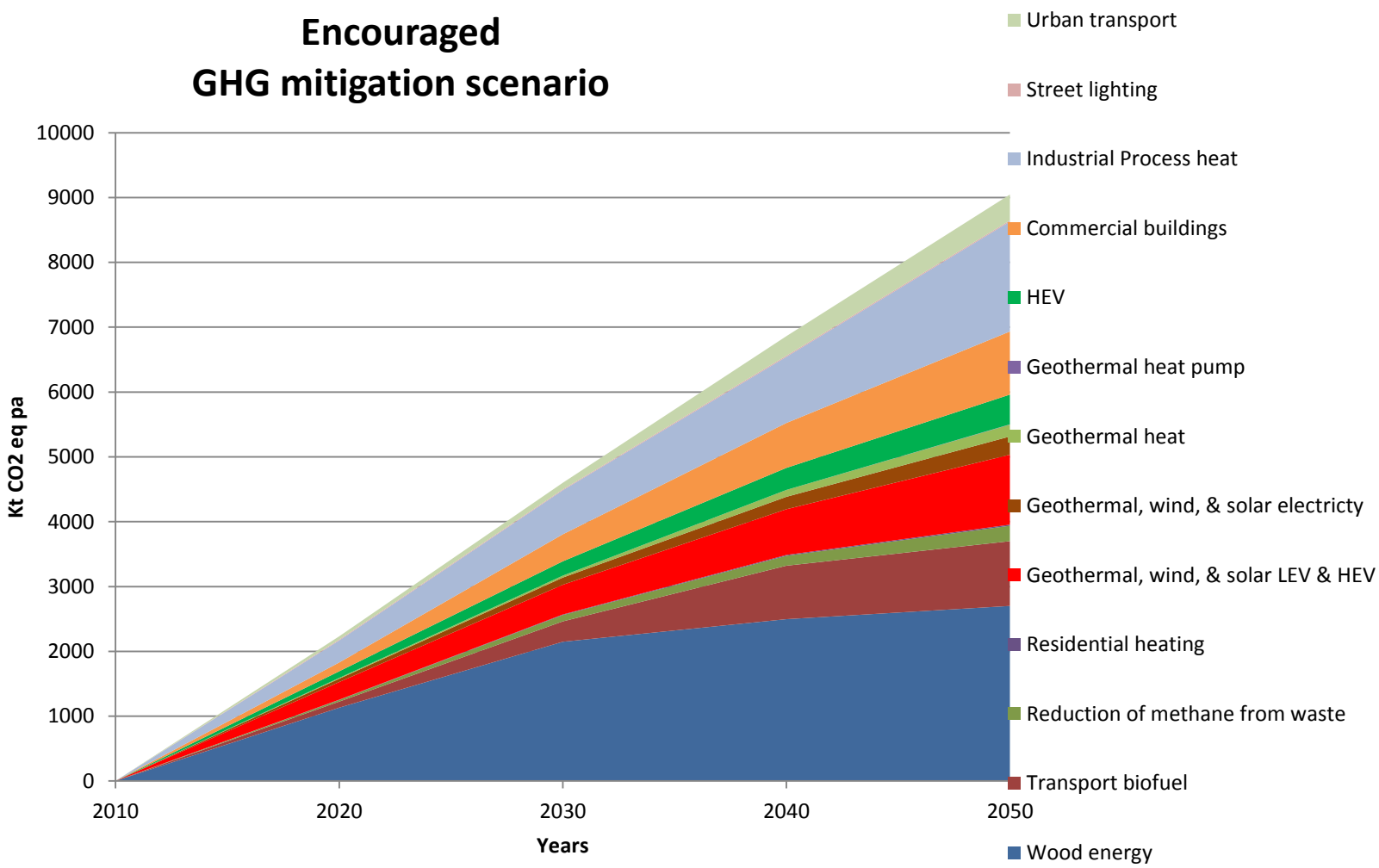
Six sector opportunity areas

- Bioenergy and biofuels touch on many areas
- Recommend focusing on six opportunity areas and doing these well – low hanging fruit
- Each is based on proven technologies
- A strong foundation for growth in each area
- Each area has complexities and challenges and will require
  - Identification of gaps and barriers
  - Identification and implementation of action plans for each area
  - Establishment and achievement of best practice standards
  - Establish monitoring and data collection so as to pursue agreed targets

Contribution to GHG emission reduction



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Symposium Summary - Domestic Reduction Opportunities 2030			
Symposium Scenarios	**Business as Usual**	**Encouraged Growth**	**Accelerated Growth**
Potential to Reduce Emissions (Mt CO_2-e)			
Renewable Electricity			
Geothermal/Wind/Solar supply	0.3	0.3	0.3
Commercial buildings	0.4	1.0	2.0
Street lighting	0.1	0.1	0.1
Heat			
Residential	0.1	0.1	0.1
Conversion coal to biomass	0.3	2.7	4.0
Geothermal	0.1	0.2	0.4
Industrial process heat	0.2	1.7	3.6
Transport			
Liquid biofuel	0.8	1.0	3.2
Light and heavy electric vehicles	0.8	1.1	3.7
Urban transport	0.2	0.4	0.8
Methane reduction from waste	0.1	0.2	0.5
Total Domestic Reductions above Baseline	**3 Mt**	**8Mt**	**17Mt**
Target reduction	**22.5Mt**	**22.5Mt**	**22.5Mt**
Balance of Internationally Traded Units or forestry	**14.4 Mt**	**14.5 Mt**	**31.2 Mt**
Cost of Units Acquired	@$15 to $25/t	@$25 to $50/t	@$50 to $100/t
$m per annum	**216 to 360m**	**362 to 725m**	**1560 to 3120m**
Avoided Unit costs			
$m per annum	**36 to 60m**	**243 to 285m**	**1035 to 2070m**

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Strengths of biomass energy

- Proven technologies
- Good demonstration plant
- Adequate biomass supply for short term
- Capability of growing more forestry for long term
- Minimal permitting requirements
- Some of the best solutions for reducing greenhouse gas emissions and meeting Paris targets
- Good availability of technical standards, best practice and training

Barriers to growth of biomass energy

- Coal and gas cheaper fuel for heat
- Wood fuel supply market emerging
- Perceived risk to investors of reliable consistent fuel supply
- No incentive to collect methane at waste water treatment plant
- Municipal and trade waste is landfilled and not seen as an opportunity to make energy
- Low population density
- Electricity produced cheaper from hydro, wind, geothermal and solar

Perceptions of bioenergy and biofuels

- Perceived as cottage industry
  - Individual parties selling in isolation
  - Limited collective promotion
  - Dominance of sellers focus on selling
  - Limited promotion to use trained/accredited people
- Quality of advice from advisers
  - Few consultants have real experience
  - Limited real data from demonstration facilities
- Limited collection of data and reporting of success
  - No annual reporting of metrics
- Wide mandate so difficult to project collective messages

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What gives confidence

- Buyers need to clearly specify what they want
  - Most markets are demand driven
- Sellers improving marketing of product
- Markets work well when there is open information
- Market perception
  - Need to show using proven conventional heat technologies
  - We are not selling our successes – a lot of plant is going in
  - We need to treat the market as existing
- Need to be able to provide market information
  - Trade is below the surface
  - Suppliers being prepared to provide sales information

Harvest and wood processing residues

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Direct heat from biomass

Market drivers	Categories	Fuel source	User	Target 2030	Focus
Direct Heat from biomass	(Domestic) Micro heat plant <0.1MWt	Purchase firewood and pellet fuel	Private	Xx installations	• Air quality regulations • Installation standards, consenting • Installer accreditation • Generic marketing
	(School scale) Very small 0.1-0.5MW	Purchase pellet fuel and chip	Government, schools and rest homes etc	xxPJ	• Link to Ministry of Education • Information on options • Conversion vs new
	Small heat plant 0.5-2MWt	Purchase biomass and pellet fuel	Government facilities	xxPJ	Work with Ministry of Health and l advisers
	(Commercial scale) Medium heat plant 2-10MWt	Own woodfuel	Wood processors	100% heat from biomass	Support owner/operators
		Purchase solid biofuel	Govt facilities	xxPJ	Work with Ministry of health, Corrections
			Food processing	xxPJ	Support owner/operators
			Horticulture	xxPJ	Promotion of applications in horticultural magazines
	(industrial scale) Large heat plant 10<	Own woodfuel	Wood processors	100% heat from biomass	Support owner/operators
		Purchase solid biofuel	Food processing	xxPJ	• Develop wood fuel supply market through focus on medium scale heat plant so that adequate availability of fuel • Support coal/wood fuel mix.

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Wood energy in New Zealand

- Biomass supplying 14% of NZ energy
  - Potential to do much more
  - Well established conventional combustion technologies
  - Platform for future biofuel technologies and co-products
- Bioenergy Strategy
  - Achieving economic, employment and environmental benefits
- Unsubsidised markets
  - Non economic benefits often the main driver
  - Projects have to be financially robust
  - Well established and expanding use of wood energy
- In transition
  - A wood fuel market is evolving
  - Commencement of wood fuel sale by third parties

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Reducing use of fossil fuels for heat

- Proven technologies
- Established market for users with own fuel
- Emerging market for those without own fuel
- Approx 3.5MW_{th} being installed each year
  - Requires a lot of additional wood fuel each year
- Simple economics is difficult
  - Benefits often environmental eg reduced air emissions of existing plant
- Perceived high risk of availability of fuel
- Quality existing wood fuel suppliers in some regions
- No collaborative approach to growing the market.

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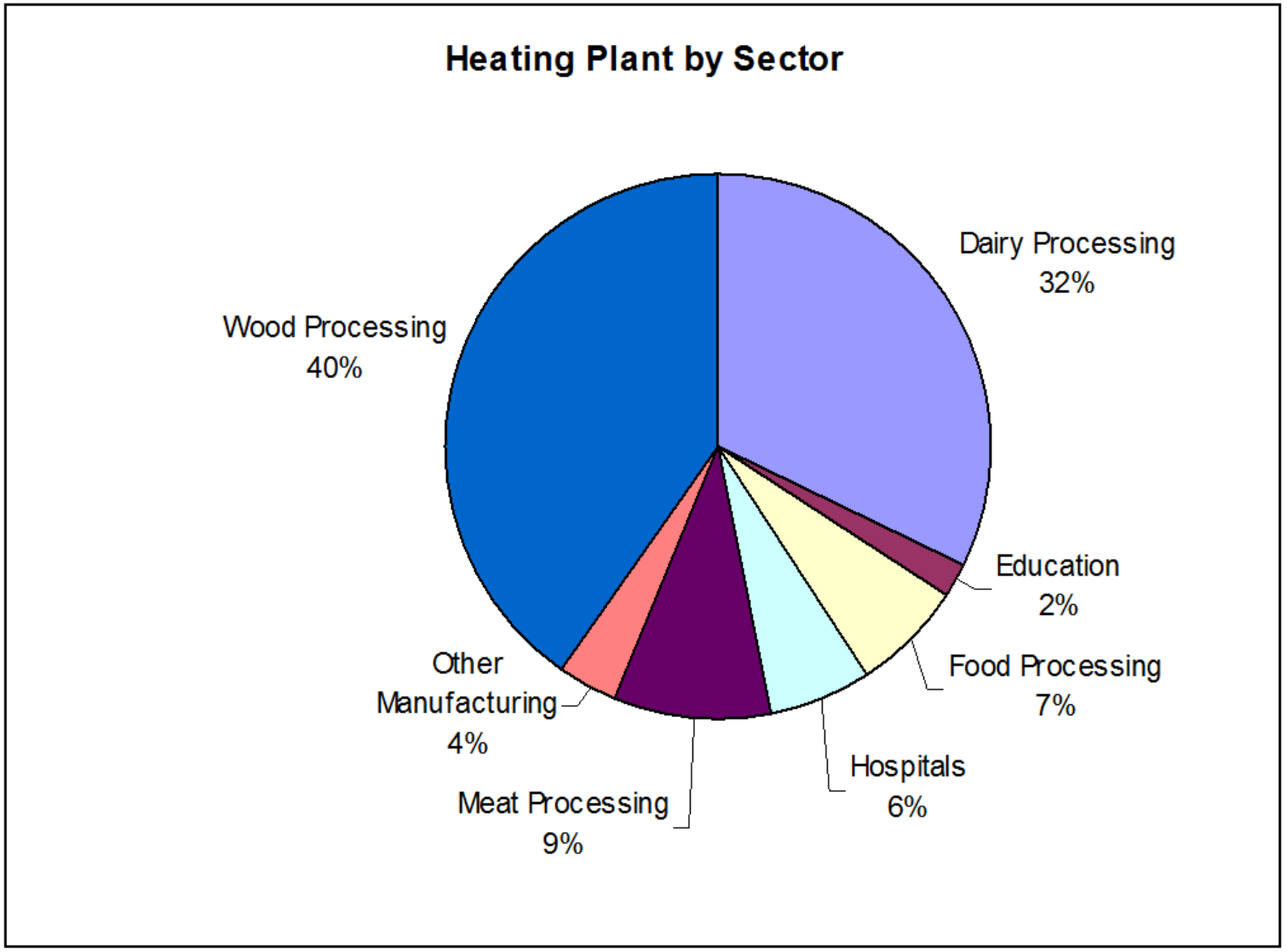
Market for wood energy



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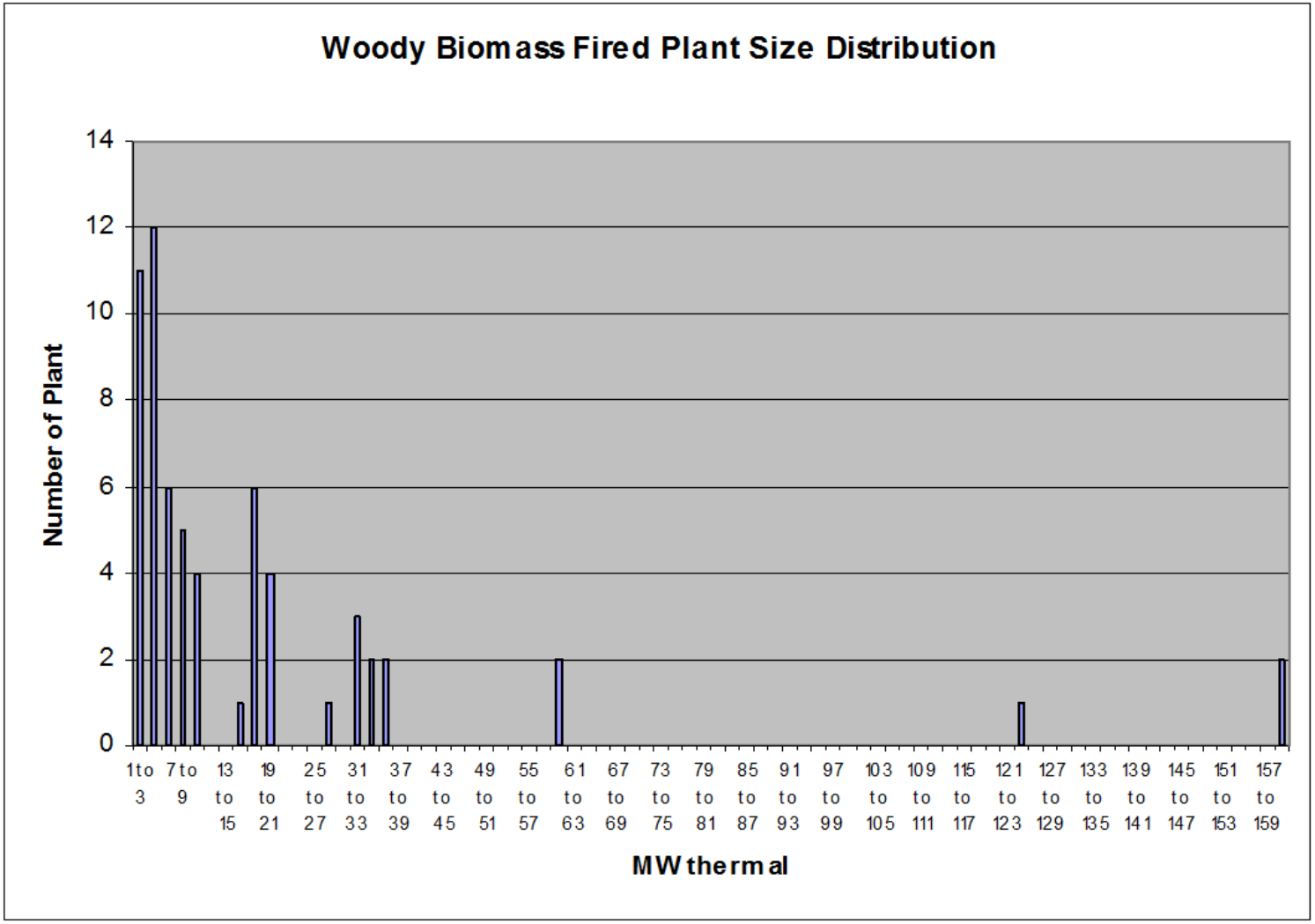
Size of heat plant



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Heat plant owners

- Business risk drives decisions
- Technology risk is manageable
- Often a lack of confidence in fuel supply

"We have to have security of supply for end to end sustainability, we need to be able to process that milk every day and we don't want to have a plant downtime due to an energy supply issue," Fonterra

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Customer perceptions – does this look like quality fuel?

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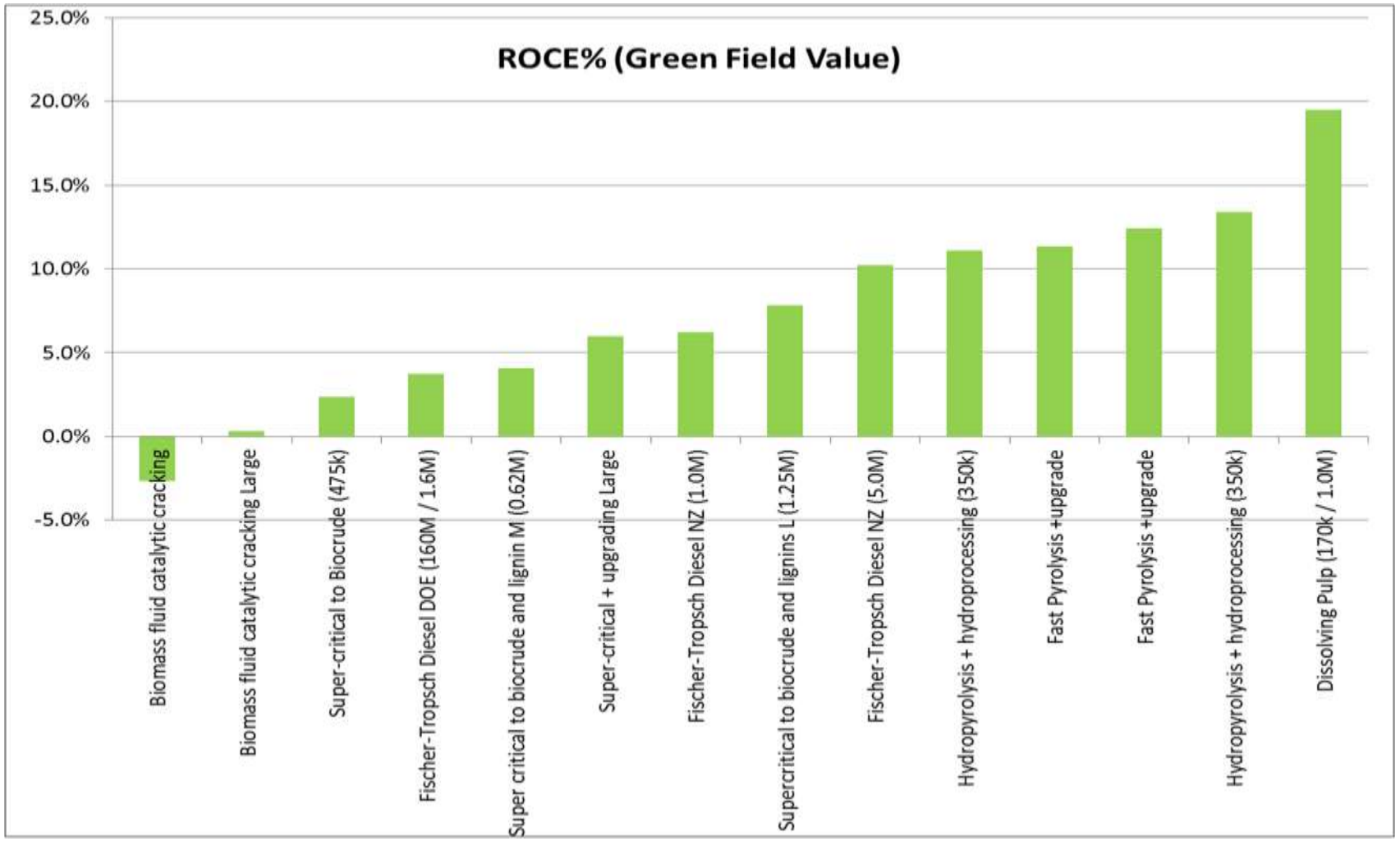
Wood fuel market issues

- Residues have not been a traded commodity
  - Beyond wood processors
  - Perceived as a waste stream rather than as valuable product
  - Because perceived as waste purchasers want to buy at low price
- Trading of wood residues is fledgling
  - Supply chain is emerging
  - Contracts are poorly developed
- An under developed market
  - Concern demand for wood fuel will push up the price of chip for engineered wood products eg MDF
  - Perception that sources of wood residues are limited

Future products from wood



Source Woodscape – www.scion.com

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Energy from waste

- Largely landfill and solid and waste water treatment
- Opportunities for rural waste – animal agricultural and food
- Proven technologies
- Appropriate for small or large applications
- Uses – heat , vehicle fuel, electricity

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Methane reduction by waste to energy

Market drivers	Categories	Fuel source	User	Target 2030	Focus
Obtaining value from waste and methane removal using waste to energy technologies	Waste to heat and electricity from solid waste	Landfill Own fuel/purchase	Municipal and trade waste	2.56PJ	• Generic promotion to get waste owners engaged • Find high value uses of the biogas produced
	Heat and electricity from liquid waste	WWTP	Municipal and trade waste	1.77 PJ	Assist facilities to be 100% using the methane produced to reduce operating costs
	Heat and electricity from Food processing and agricultural waste	Food processing residues Dairy Piggeries	Food processing and agricultural	0.75PJ	Develop off-the shelf guides

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Methane capture and reduction

- Councils significant contributors to GHG via emissions from waste
- Improvements to existing sewage facilities
  - Supplementary feedstock from trade waste
  - Very cost effective
  - Can reduce facility operating costs
- Landfills very inefficient converters of waste to biogas
  - Designed enclosed waste to energy facilities remove 100% methane
- Methane perceives to be too small
  - Methane 23 times more contributor to GHG than CO_2
  - Advocacy required to bring to the attention of Councils

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Improvements in air quality

- Many urban areas have air pollution problems
- Replacing old polluting coal boilers with wood fuel
- Domestic wood pellet heating
- Enforcing firewood quality standards
- Replace diesel engines in urban areas with biofuels
- Councils not seeking solutions
- We have to prepare material for them
- Requires a plan of action and facts to support advocacy.

Transport biofuel

Biodiesel from tallow

Bioethanol and biodiesel produced from:

- Dairy processing residues (whey)
- Used cooking oil
- Canola
- Tallow

Biogas from:

- Landfill gas,
- Waste water treatment plant

Landfill gas collection

Future advanced liquid biofuel production from:

- Lignocellulosic material
- Municipal waste

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Low emissions and low carbon transport

Market drivers	Categories	Fuel source	User	Target 2030	Focus
Low emissions and low carbon transport	Liquid biofuels	Lignocellulosics Trans esterified vegetable oils(Biodiesel)	Fleet operators		
			retail		Assist producers/retailers expand their existing markets
			Marine and rail		Pilot use of biocrude in marine and rail applications
			Aviation		Wait and see
	Gaseous biofuel	Biogas	Point source operations	0.2PJ	Pilot use of biogas as a vehicle fuel.

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Reduce fossil fuel use in transport

- EV will have a big impact
- EV will not be the solution for all applications
  - Long haul
  - Large vehicles
- Trade off will be new EV fleet vs production of biofuel for existing vehicles
- Marine and rail can easily use biocrude fuels
  - Requires limited infrastructure
  - Point source fuelling
  - Includes improved emissions to air
- Biofuels already being supplied by Gull and Z Energy

Sustainable communities

- Assisting communities use bioenergy solutions
- Different for each community
  - Requires involvement of local sector practitioners
  - Many communities have the aspiration but not the knowledge
- Sharing and working collectively

Generic sector needs

- Monitoring and reporting
  - Lack of data on what is actually happening in the sector.
  - Expand database of target opportunities in each category
  - Establish mechanisms for collection of data on bioenergy use
  - Annual reporting of progress in each category
- Expand use of BANZ Quality programme
  - Accredited fuel suppliers
  - Registered advisers
  - Standards
  - Training
- Develop advocacy plan for each category
  - Target facility owners
  - Decision makers
  - Prepare information pack for each category

Generic sector needs

- Collaboration
  - Other multi market and multi product sector associations
  - Member collaboration for joint projects
- Information dissemination
  - Web portals
  - Workshops and webinars

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