WOODY BIOMASS FOR BIOENERGY CAN SUPPORT DECARBONISATION

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Research findings are provisional and remain subject to EECA/Te Uru Rākau final review

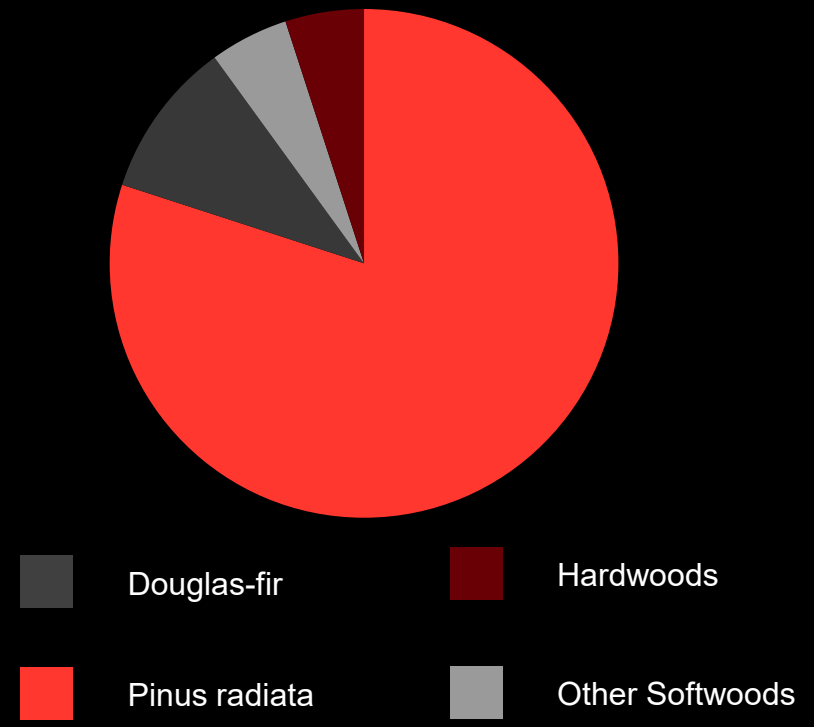
Why This Research Matters

- Plantation Timber Forests (PTF): (>90%, 28-year rotation)
- Short Rotation Forestry (SRF): (14-year rotation)

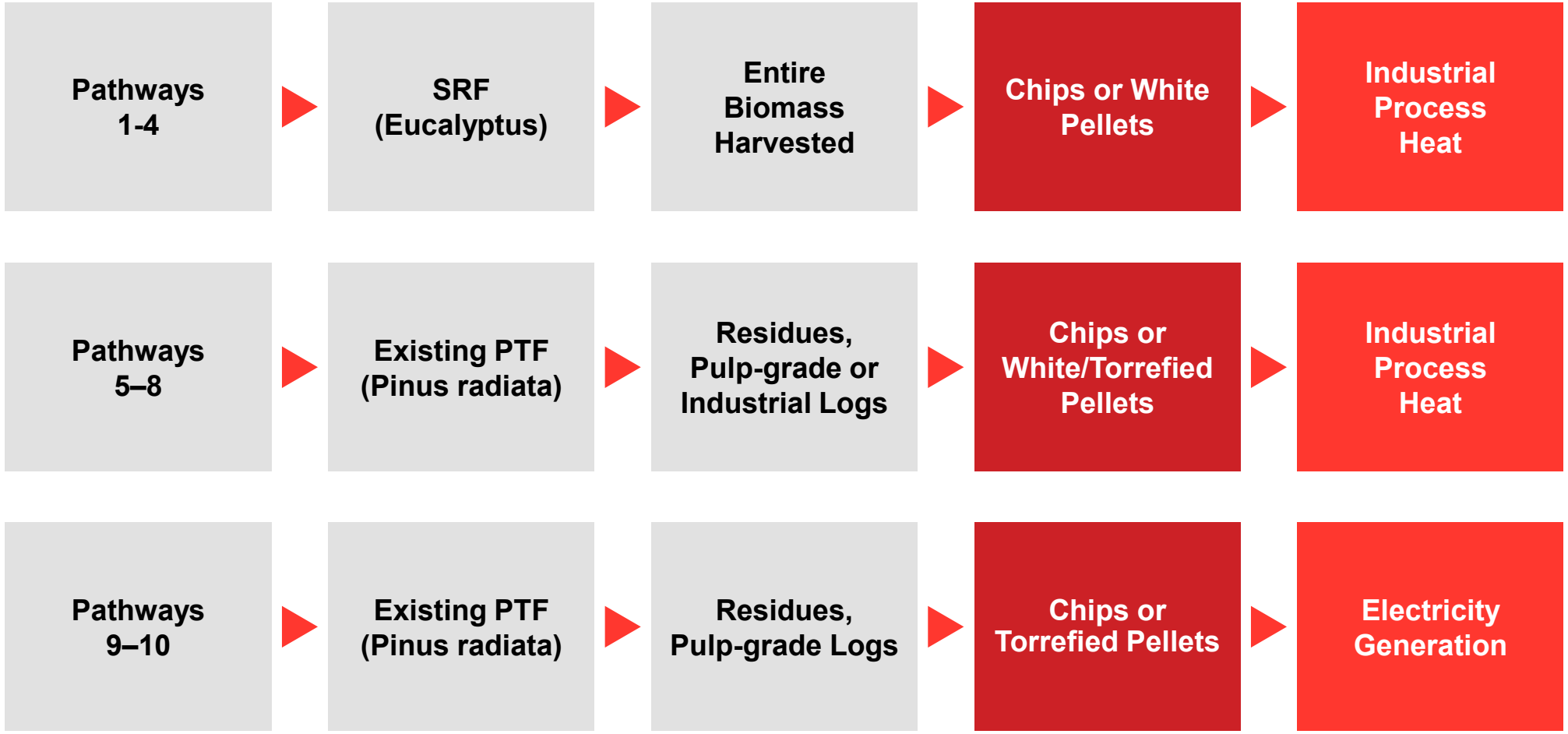
  Eucalyptus nitens in South Island and Eucalyptus fastigata in North Island

Plantation Species (ha)

Species Distribution (as of 1 April 2019)



What We Assessed



Robust, Transparent Methodology

- ISO 14044-compliant
- cradle-to-grave LCA
- 1 GJ heat (Pathways 1–8)
- 1 MWh electricity (Pathways 9–10; also reported per GJ for comparison)

Inputs
- Gravel
- Herbicide
- Fertiliser
- Seeding
- Equipment oils etc.
- Fuel
- Water
- Biological treatments
- Other consumables
- Nonchemical pest management material

System Boundary

Land preparation
- Primary and secondary road networks
- Land preparation

Growing
- Planting
- Post planting
- Thinning
- Fertilising

Harvest and transport
- Felling
- Bundling
- Drying
- Storage
- Preprocessing on site
- Transport

Combustion
- Power plant running and maintenance

Processing
- Preprocessing
- Processing: pelletizing (white, torrefied), and wood chipping
- Cooling
- Screening
- Storage

End of life
- Wood decay
- Residue recycling
- Ash handling

Outputs
- Forest residues
- Emissions
- Products (Electricity / Industrial Process Heat)

Beyond Carbon

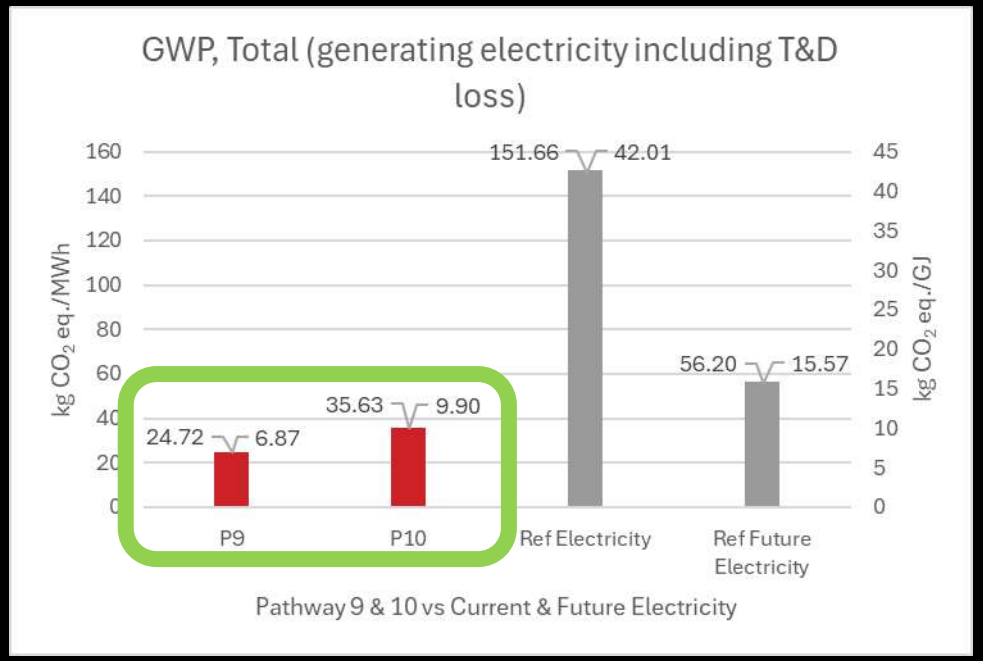
Climate change assessed using GWP-fossil, biogenic, and LULUC.

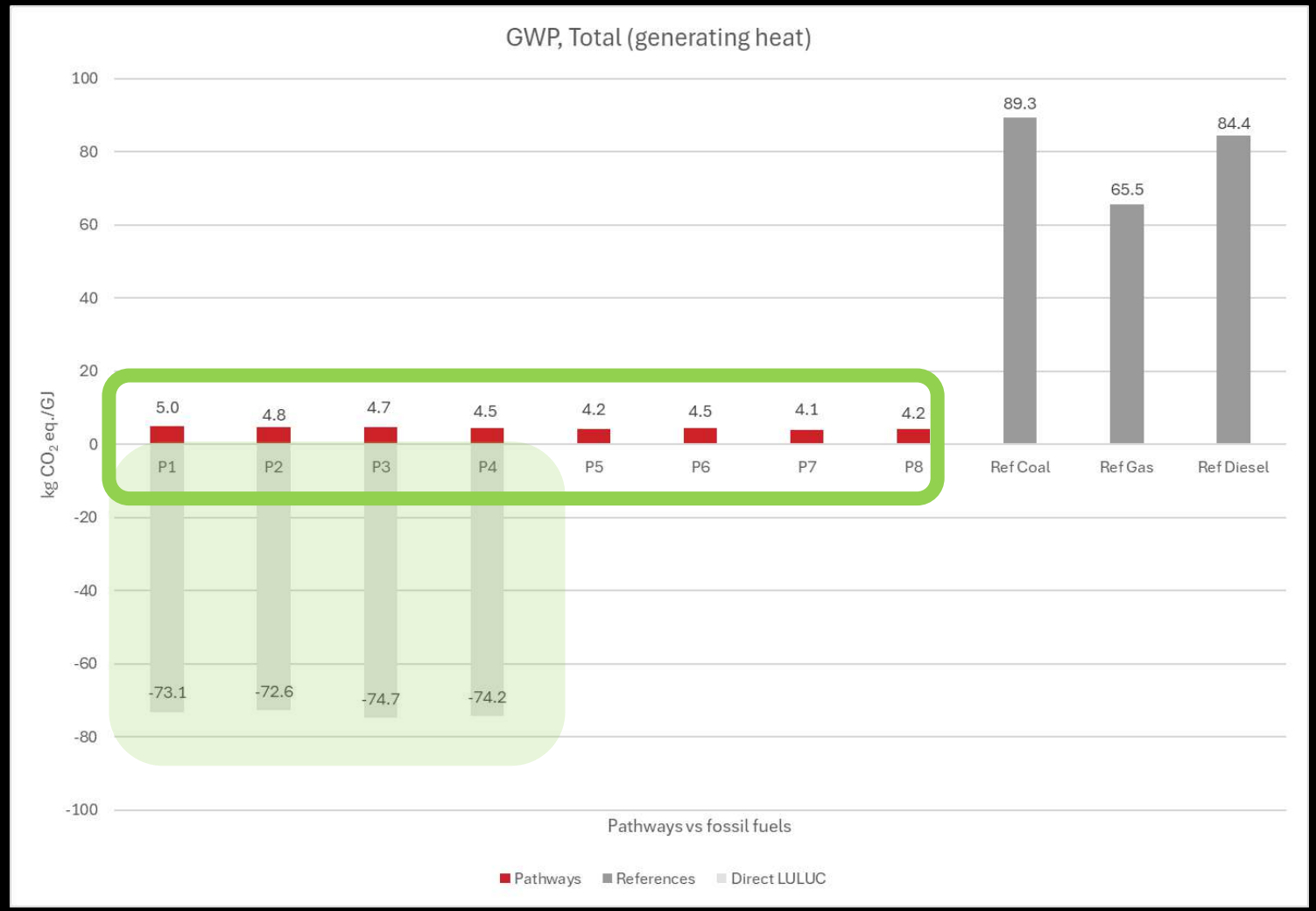
Additional indicators

EROEI included to confirm energy system viability.

Impact Category	Unit	Method
Climate change (total)	Kg CO_2-eq	IPCC AR6
Non-renewable energy use	MJ	EF 3.1
Land occupation	m^2-a crop-eq	ReCiPe 2016
Soil quality (land use)	-	EF 3.1
Acidification	Mol H^+-eq	EF 3.1
Eutrophication – freshwater	kg P-eq	EF 3.1
Eutrophication – marine	Kg N-eq	EF 3.1
Freshwater ecotoxicity	CTUe	EF 3.1
Particulate matter	Kg $PM_{2.5}$-eq	TRACI v2.1

GWP Comparison
Global Warming Potential

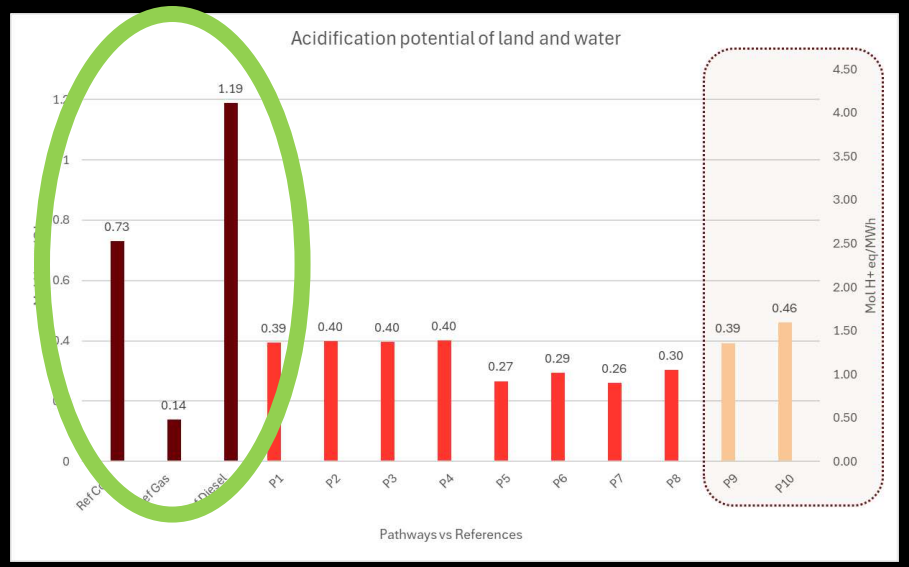


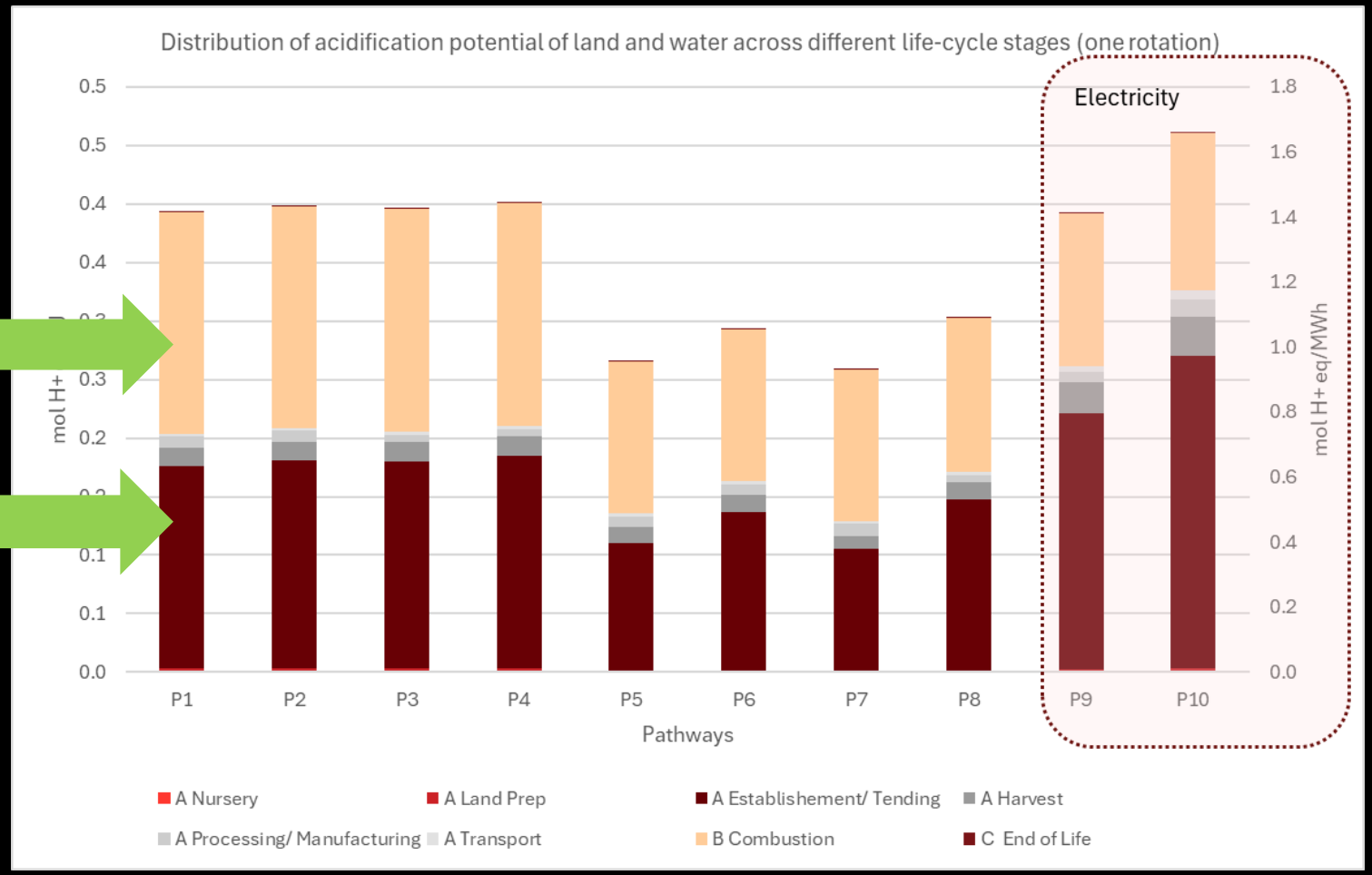


*Transmission and Distribution (T&D)

Soil & Land Use Effects

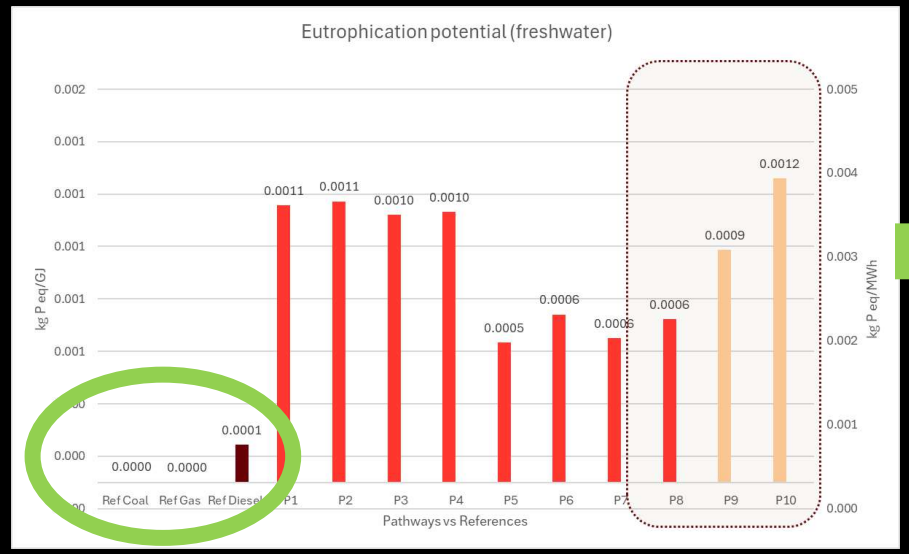
Acidification Potential of Land and Water

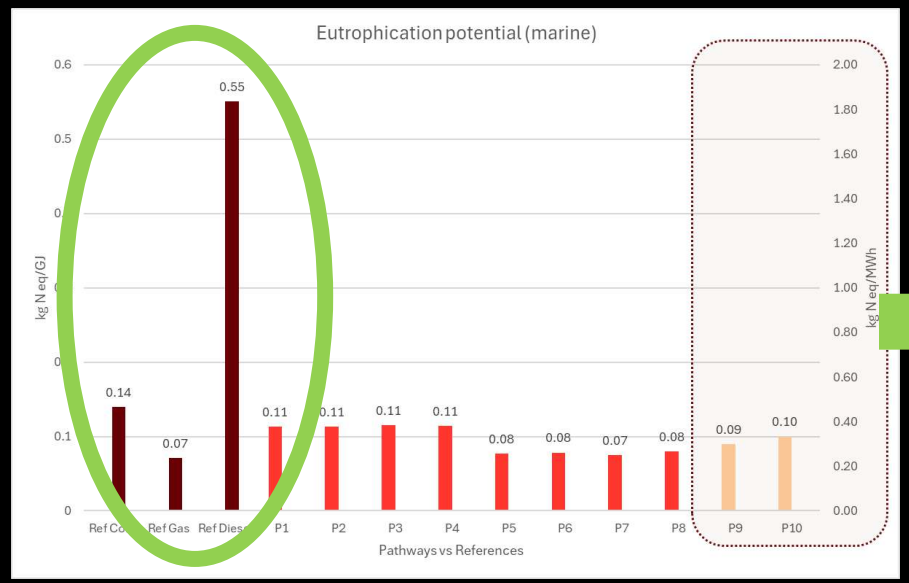


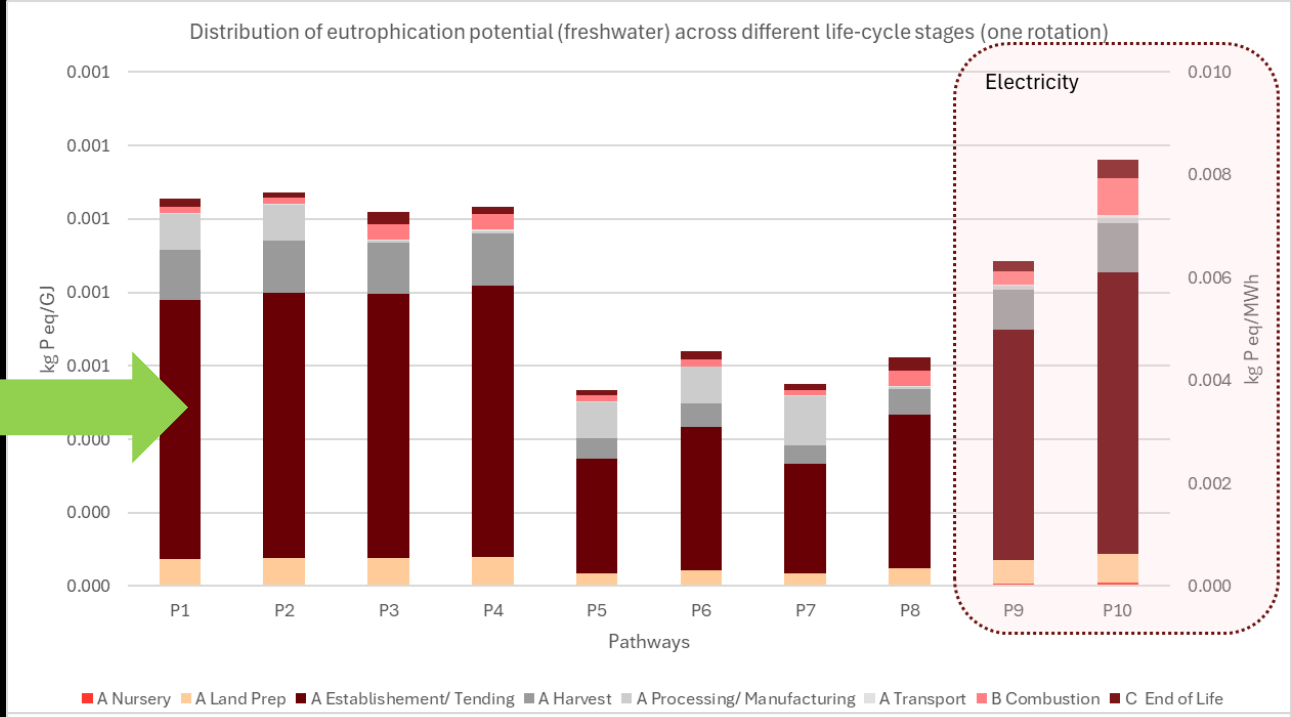


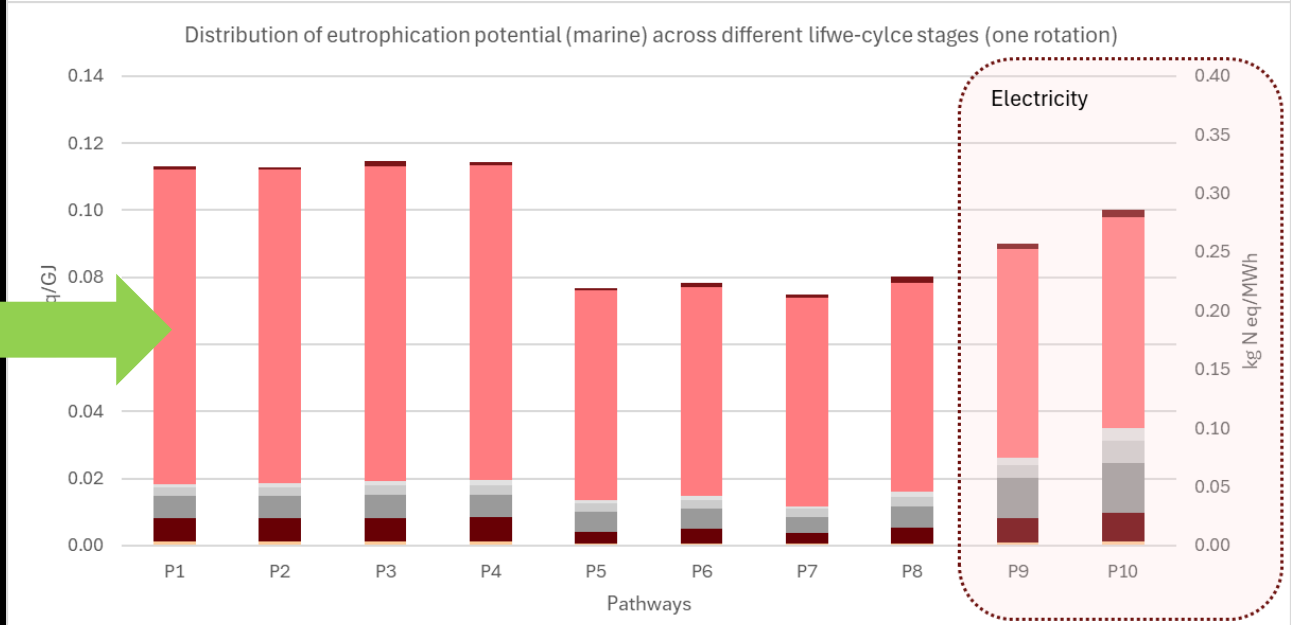
Eutrophication Potential (freshwater/marine)

kg phosphorus equivalents

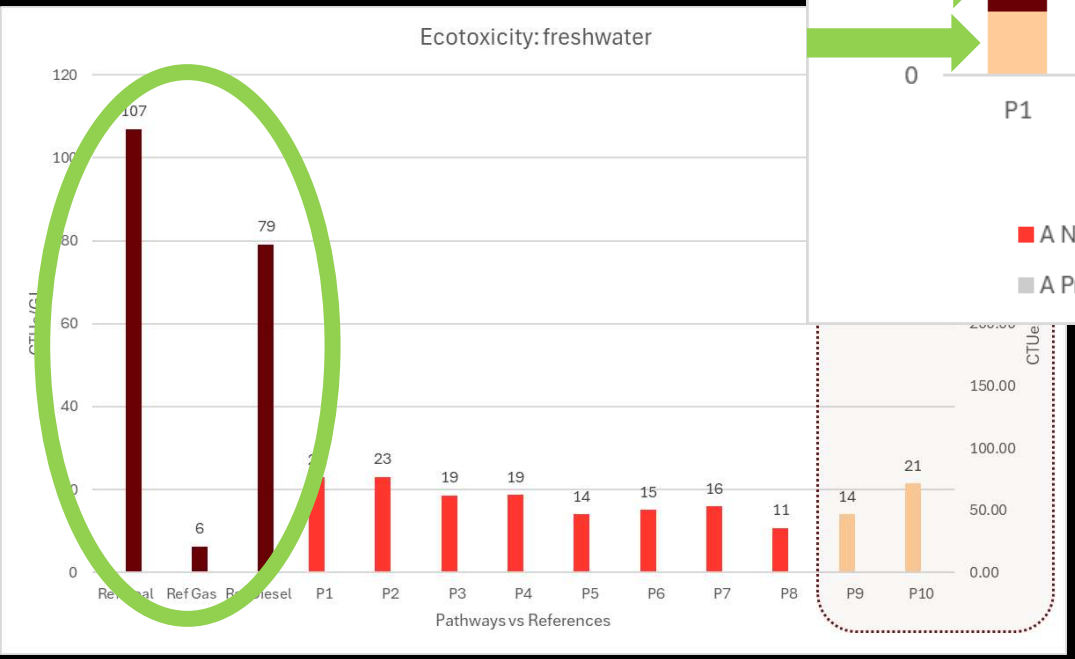


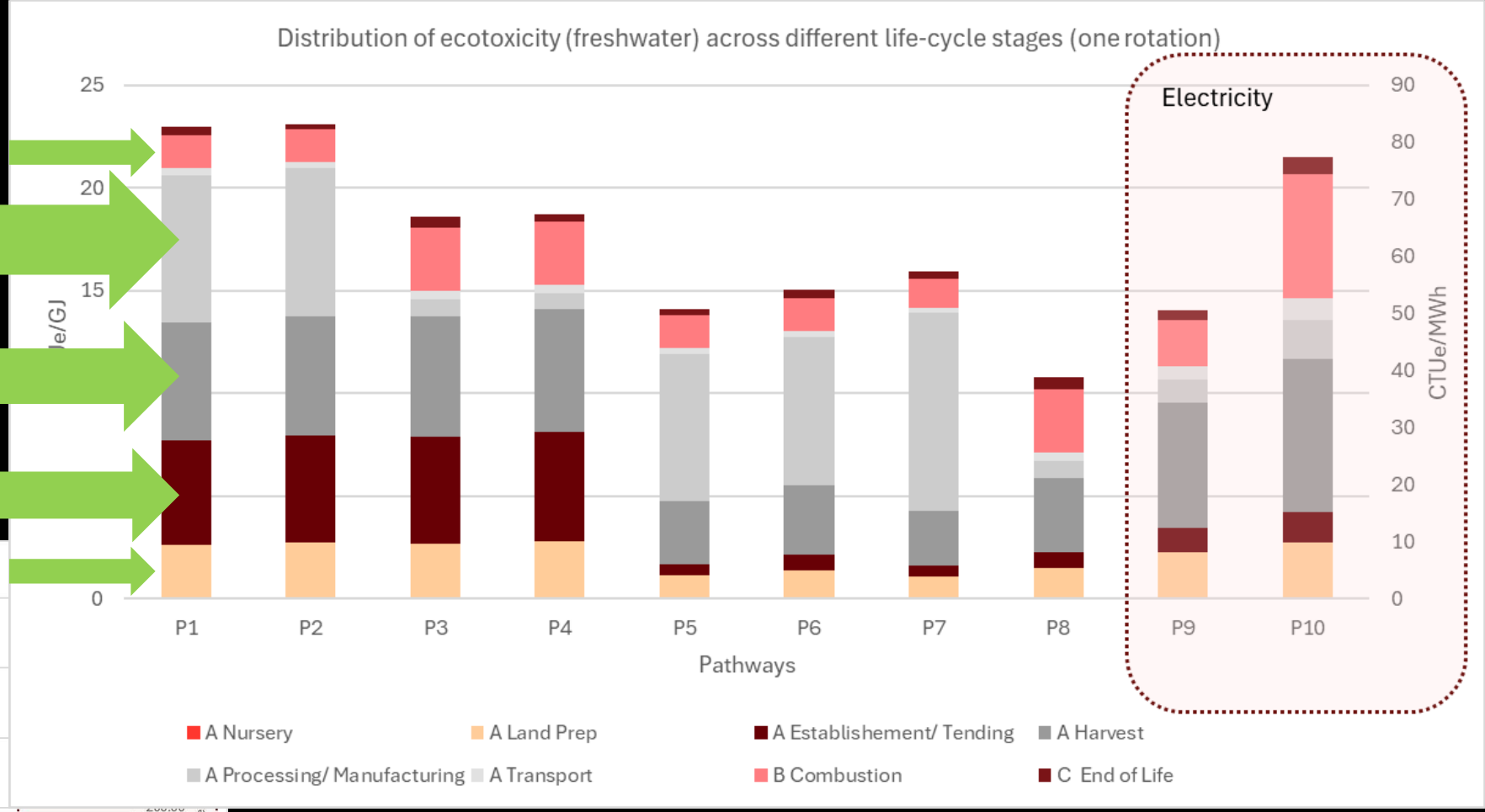






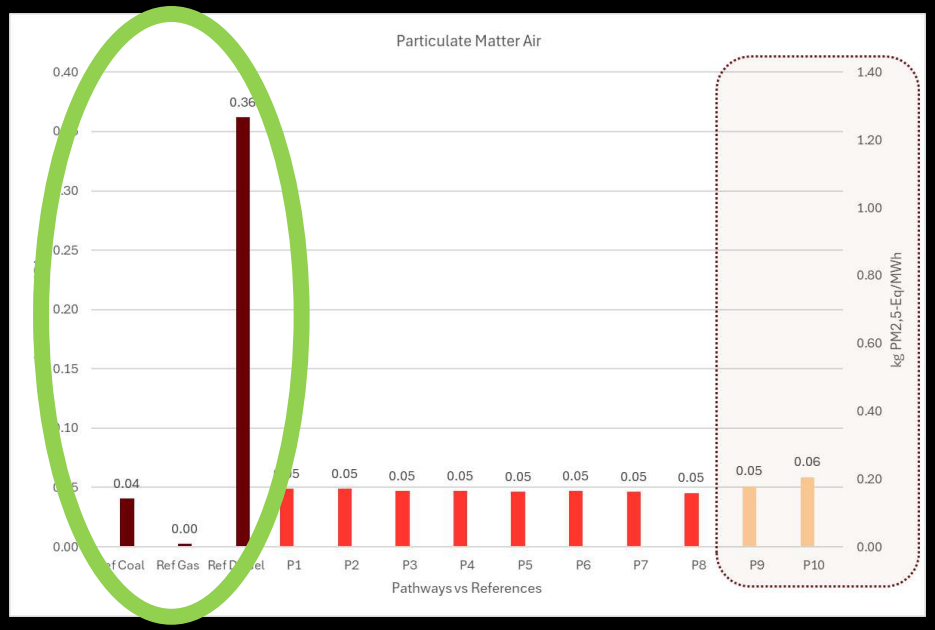
kg nitrogen equivalents

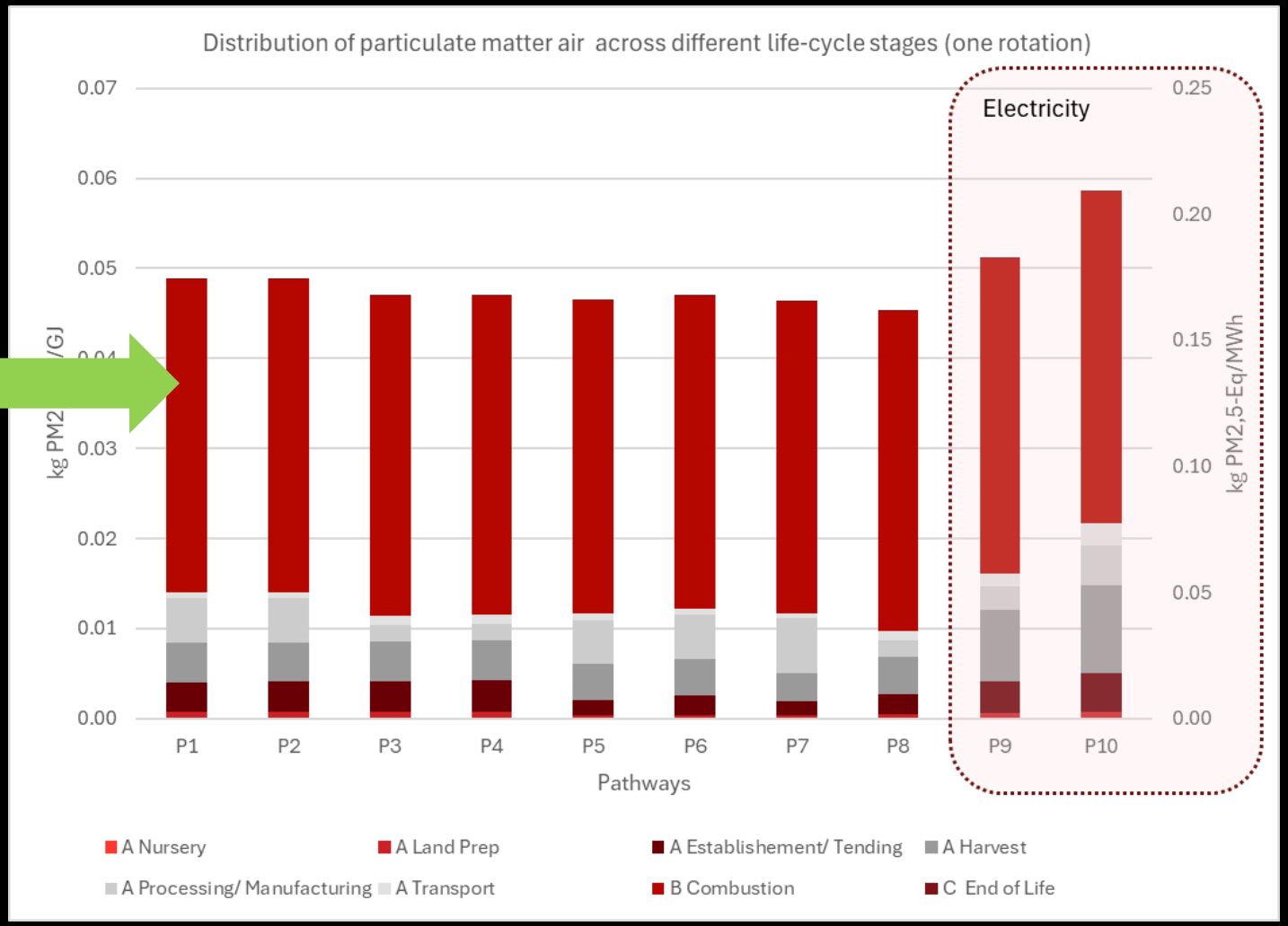




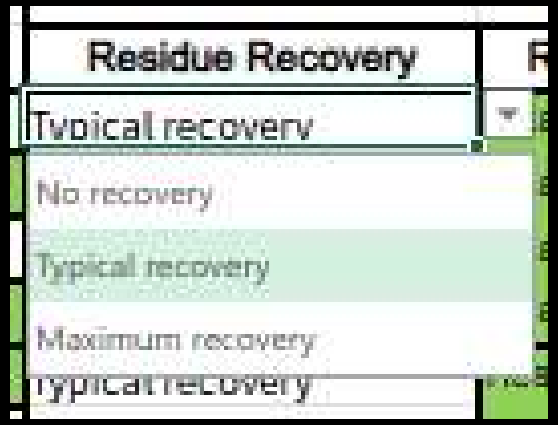
ECOTOXICITY: FRESHWATER

Air Quality ($PM_{2.5}$)





Dashboard and Sensitivity Analysis



Residue Recovery	Raw Material	Land Type	Planting	Fertiliser	Felling	Equipment	Storage	EOL Recovery Rate
Typical recovery	Total Biomass	Flat	No thinning	Typical	14 yrs	Typical	Biohub processing	Typical recovery
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Typical recovery	Total Biomass	Flat	No thinning	Typical	14 yrs	Typical	Biohub processing	Typical recovery
Typical recovery	Residue	Flat	Typical	Typical	28 yrs	Typical	Biohub processing	Typical recovery
Typical recovery	Pulp & Residue	Flat	Typical	Typical	28 yrs	Typical	Biohub processing	Typical recovery
Typical recovery	Pulp & Residue	Flat	Typical	Typical	28 yrs	Typical	Biohub processing	Typical recovery
No recovery	Industrial log	Flat	Typical	Typical	28 yrs	Typical	Biohub processing	Typical recovery
Typical recovery	Pulp & Residue	Flat	Typical	Typical	28 yrs	Typical	Biohub processing	Typical recovery
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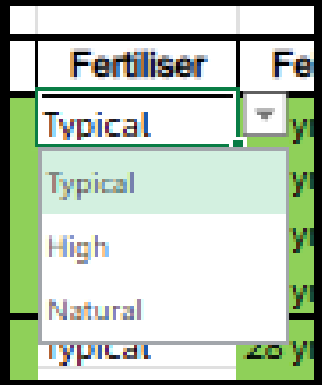
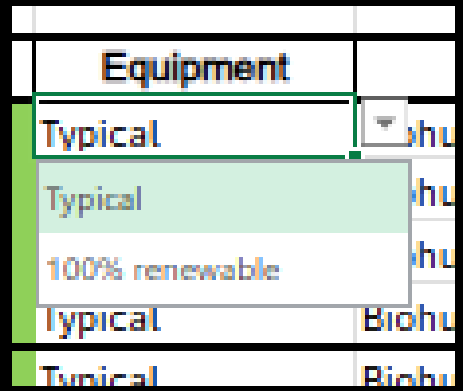
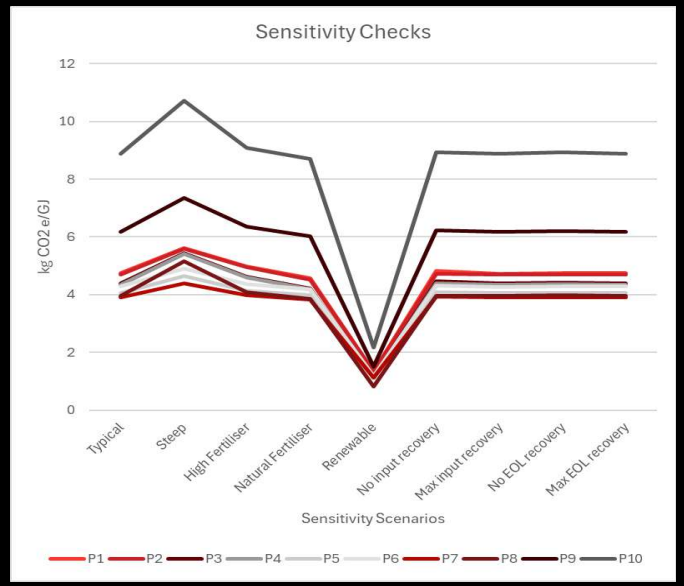


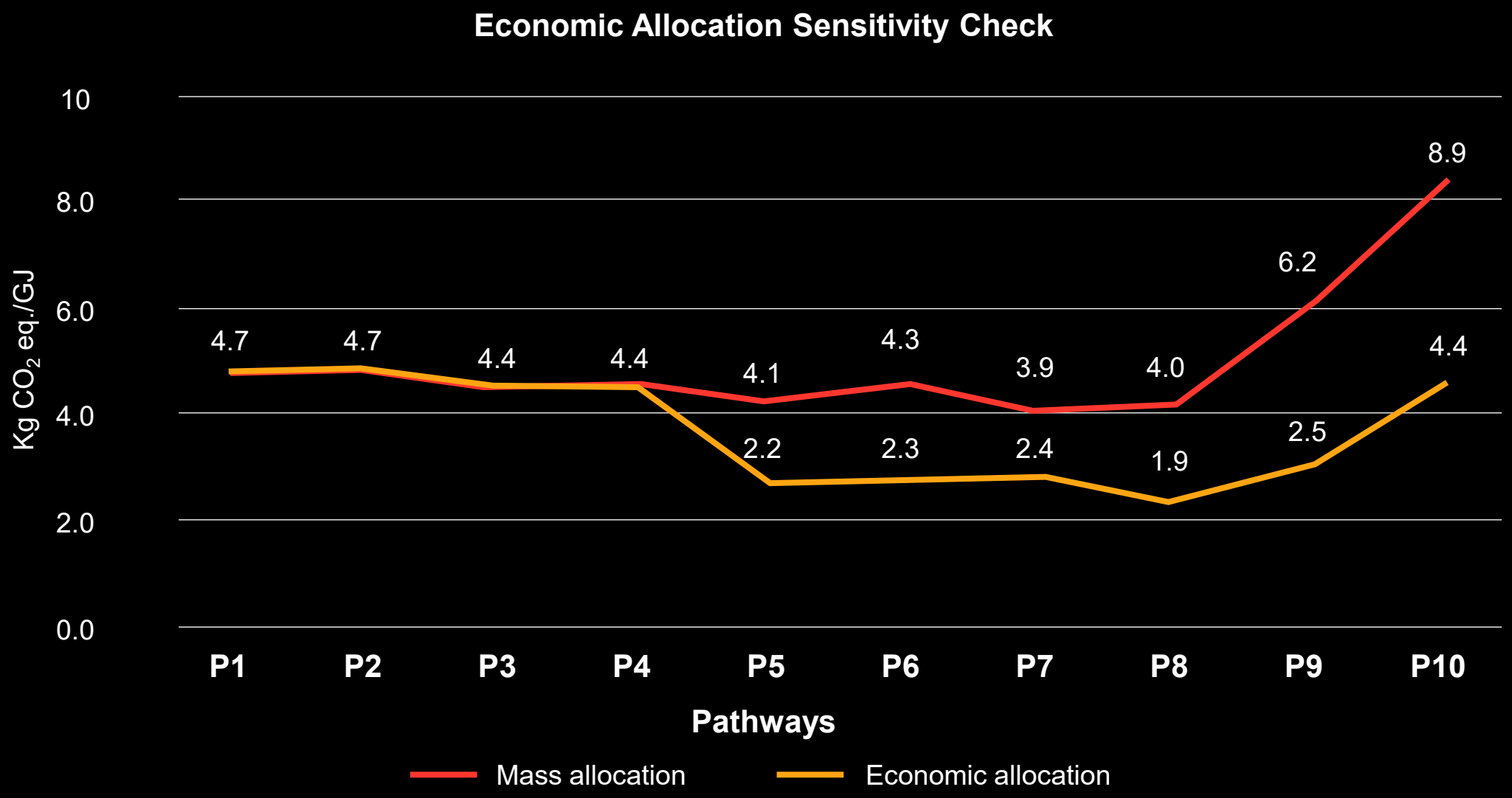


5% to 10 %

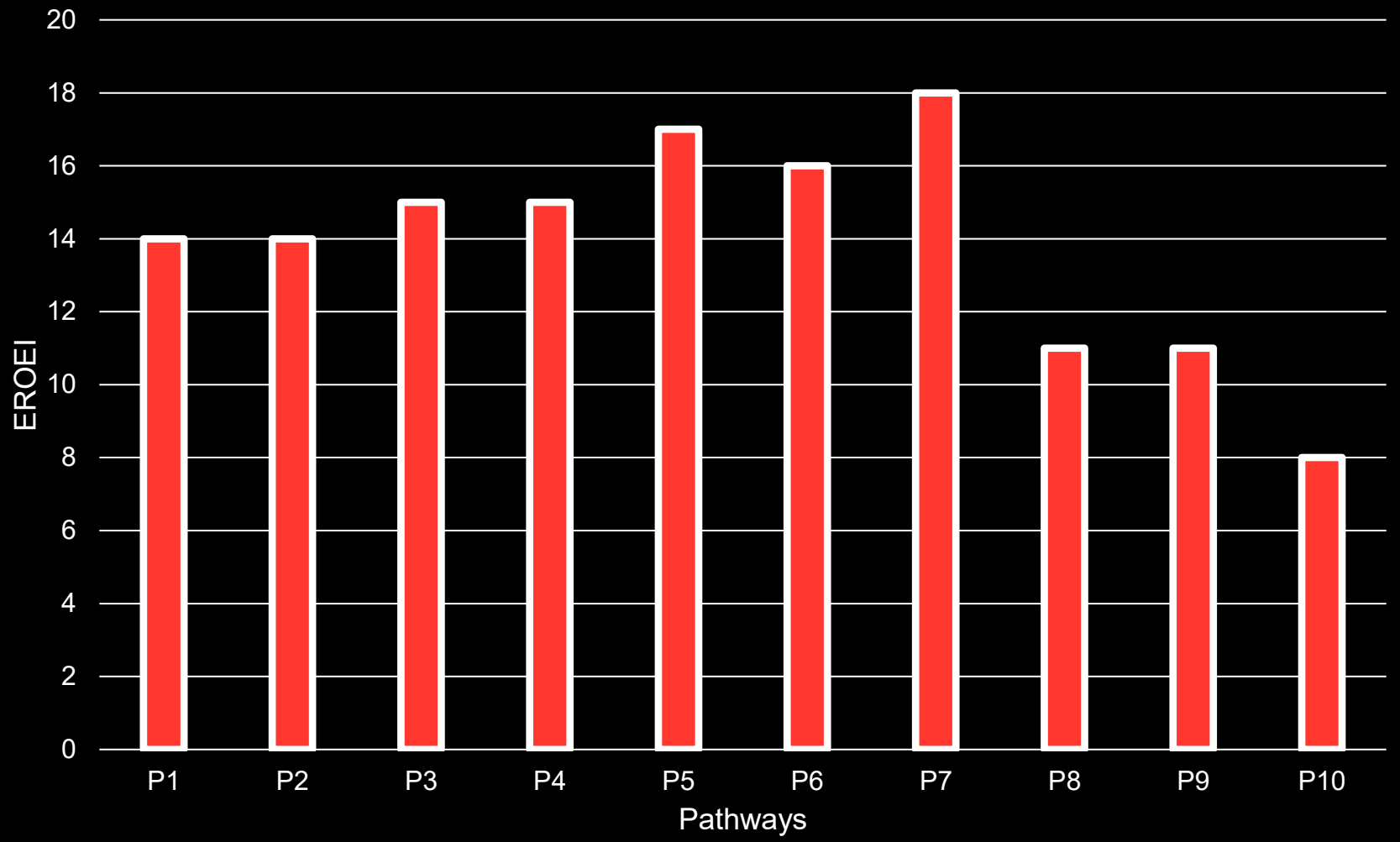
10% to 30 %



Economic Allocation and Sensitivity Check



Energy Return on Energy Invested (EROEI)



Key Messages & Implications for New Zealand

Best overall pathways for on-going performance:

PTF pellets for industrial heat (P5–P7).

SRF offers strong soil and land-use benefits, but carbon benefits are front-loaded.

Biomass could be prioritised for industrial heat

To maximise benefits:

- Electrify harvesting and processing
- Minimise transport distances
- Manage fertiliser carefully
- Use advanced combustion controls


THANK YOU