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The future of biogas in wastewater treatment

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Watercare

water NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa

water NEW ZEALAND CONFERENCE & EXPO
17–19 OCTOBER 2023
Tākina, Te Whanganui-a-Tara Wellington

Agenda

- Current biogas status and drivers for change
- Potential for biomethane in NZ
- Technologies
- Considerations needed for biomethane
- Future – where do we go from here

Rosedale WWTP

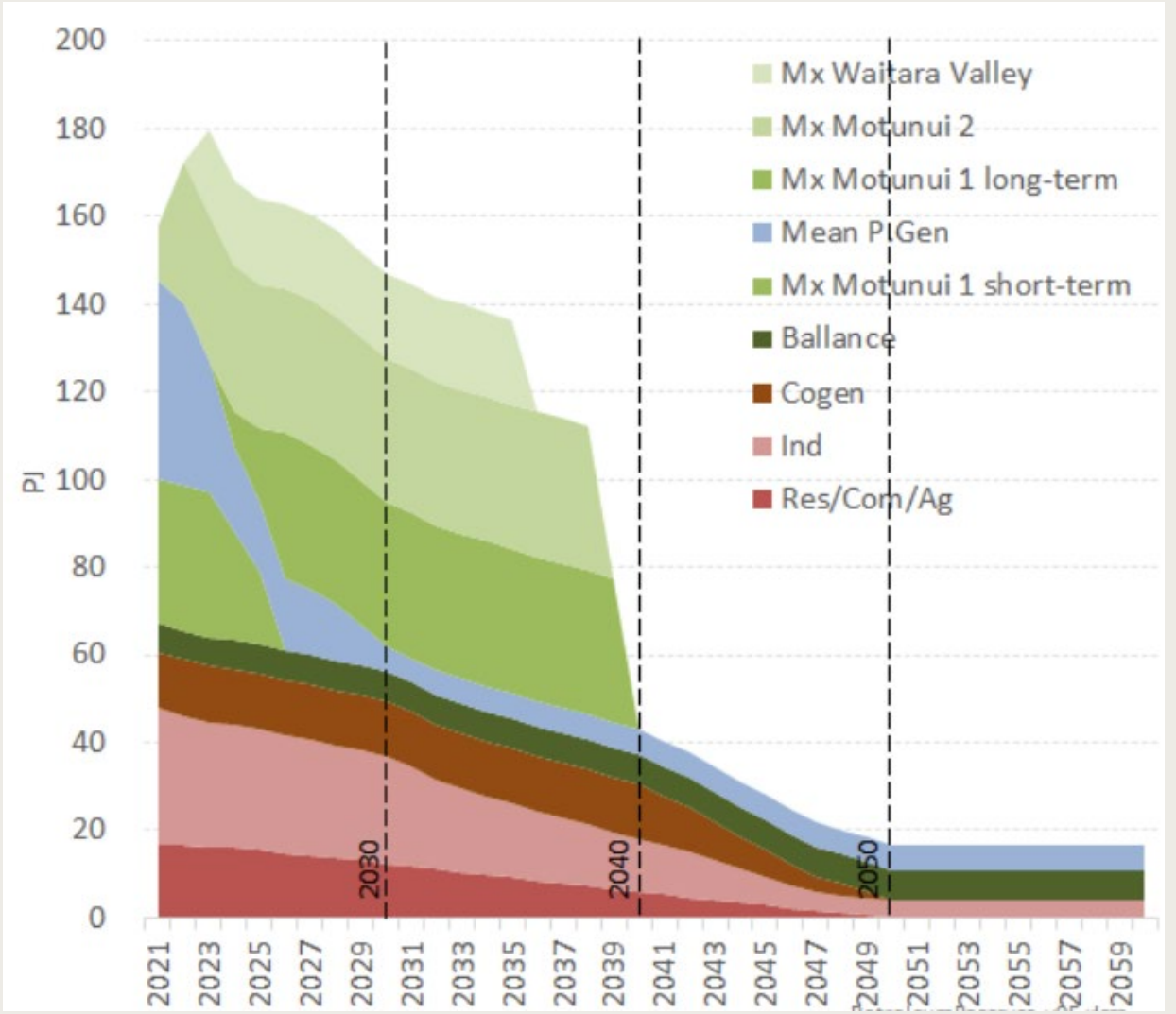
Current situation

- Currently in NZ bigas produced at:
  - ~15 WWTPs
  - 1 Food waste AD plant
  - Landfills, industrial and agricultural waste (eg dairy, pig manure)
- Biogas is flared to minimise methane emissions or used in CHP (cogen) engines
- European practice includes both biogas CHP and conversion to biomethane for grid injection and for vehicle fuel

Māngere WWTP

Drivers for change in NZ

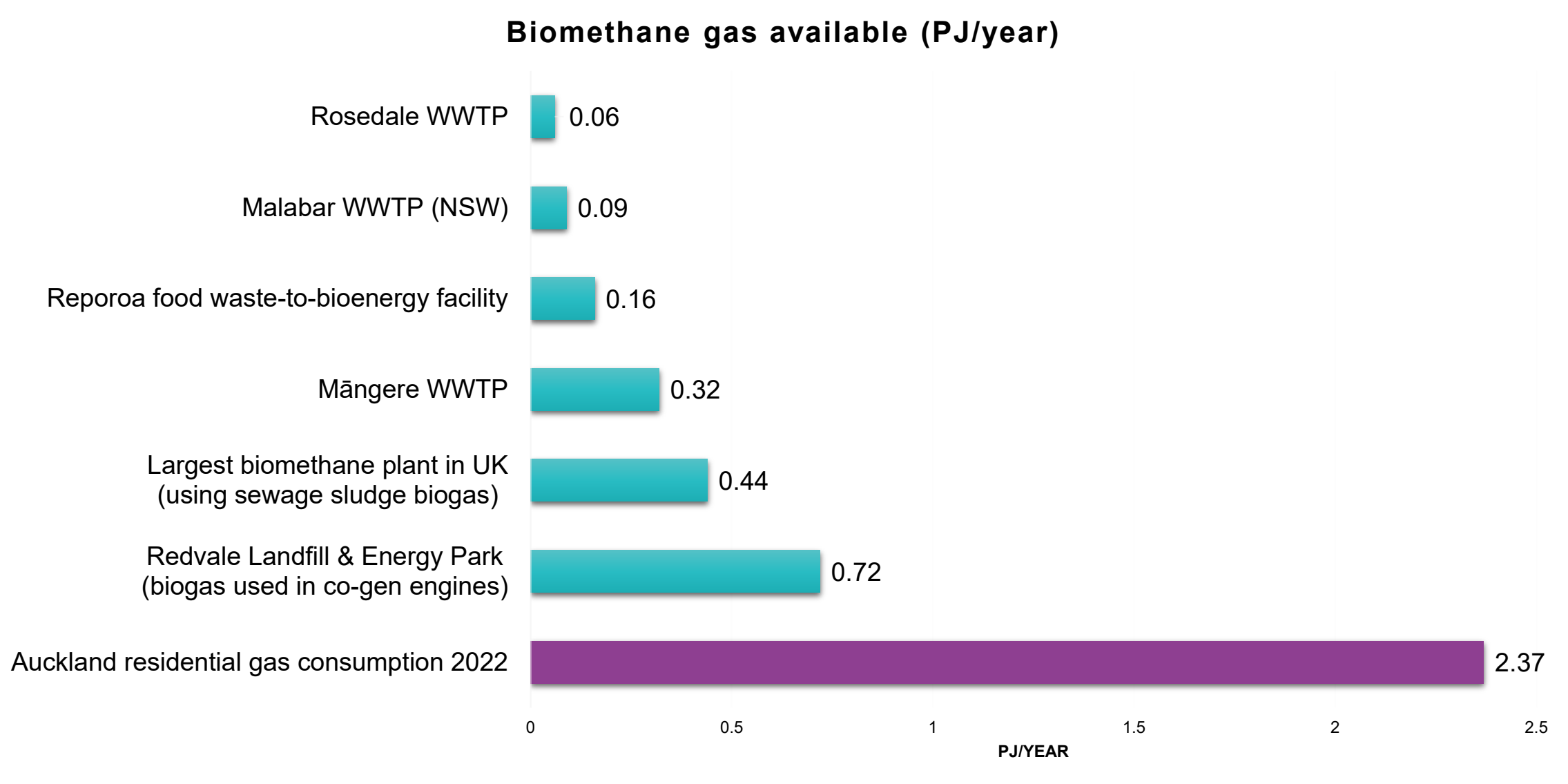
- Climate emergency
  - Power sector decarbonising rapidly
  - Focus moving to reducing and ‘decarbonising’ gas use
- Circular economy benefits - energy and other resource recovery
- Tied to the future of natural gas - Gas transition plan
- Source of biogenic CO_2 - for industrial uses and/or sequestration
- Revenue opportunities
- Maximising use of biogas and minimising flaring if biogas currently under utilised



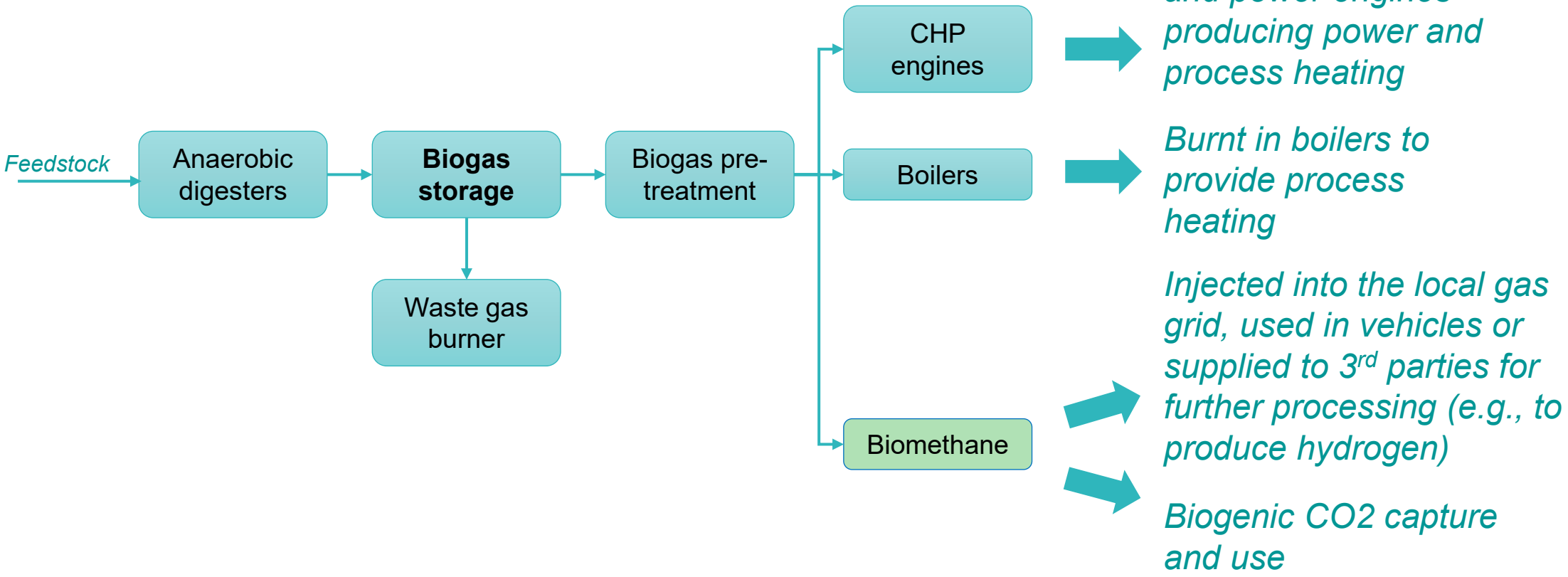
Central demand + Central supply projection out to 2060

Source: Concept Consulting - Gas supply and demand projections (24 March 2022)

Project scale



Biogas use options



Options explored by Watercare – for Māngere and Rosedale

Option	Primary biogas use	Process heat source - Primary and backup	% biogas available for biomethane	Net emissions (tCO_2e/y) Māngere/ Rosedale
1	**All biogas used in existing CHP engines -** replaced at end of life	Primary: Biogas CHP engines Backup: Biogas fuelled boilers	0%	- 5,870 / - 1,470
2	**All biogas converted to biomethane** – assuming sufficient demand for biomethane at all times	Primary and backup: Biogas fuelled boilers (duty/standby)	65% to 70%	- 20,750 / - 5,100
3	**Combination of CHP engines and biomethane options** – to provide flexibility for seasonal variations in biomethane demand	Primary: CHP and/or boilers Assist/standby: Boilers CHP / boilers sized to take biogas that cannot be exported as biomethane. Biomethane plant sized to meet max grid demand	40 to 50%	- 15,560 / - 4,860

Biogas upgrading in detail

Biogas for biomethane production

Biogas Pre-treatment (drying, carbon filters)

Biogas compressors

Biogas upgrading

CO_2 stream discharge

Carbon dioxide used in industry or sequestered

Other biomethane uses
- Export to 3rd party
- Use as vehicle fuel (CBG/LBG)
- Convert to hydrogen

Grid entry unit (GEU) (monitoring, odorant)

Gas network

Network isolating valve (NIV)

Reject biomethane

Biomethane Reject Gas Burner

Pre-treatment

BUU kiosk

GEU kiosk

Membrane cartridges within BUU kiosk

NIV kiosk

Biogas potential in the NZ context

CHP

Beneficially using biogas for electricity production has a decarbonisation impact (and minimises flaring) – displaces **some** CO2

Maximises resiliency of the site from loss of grid

Well understood and current NZ best practice for 100k+ plants (better than flaring / boiler)

Best commercial outcomes for large sites

Biomethane to Grid

Deliver **4x** the carbon emissions reduction of CHP alone – **(Indirectly and outside of the boundary)**

Needs to have a large throughput (PE 1M+) and grid to accept it

Currently poor commercial drivers

Is generally seen as culturally acceptable to burn for cooking

Flare

Biogas potential in the NZ context

Hybrid solutions (CHP + BUU)

Allow for seasonal/weekly variation in demand

Maximises flexibility while maintain resiliency

Product CO2 (via liquefaction)

Currently has attractive commercial value

As biogenic may have cultural prohibitions if used directly in food production

Carbon saving attribution would be added value

Would avoid dependence on imported CO2 and minimise fossil CO2

CHP engine

MCA

Key factors

- Commercial impacts and benefits
- Total Carbon savings
- Environmental and social impact
- Flexibility / Scalability / Constructability
- Ability to recognize emissions reduction
- Te Ao Māori outcomes
- Technology readiness
- HSE – (eg Major Hazard Facility)
- Marginal abatement cost of emissions reduction

Te Ao Māori considerations

The wānanga felt that although this project is about best use of gas, it is valuable to keep the connection to water in the narrative and links to removing paru from water, as this adds a lot of mana and integrity.

The wānanga has found that the use of gas that is produced through the process of treating human excrement, in the production of food (such as carbonated drinks) is not culturally accepted in Te Ao Māori whereas it is fine to use it for heating or where it will go to flame.

For it to be free of restrictions it must first be combusted. In this respect biomethane would be acceptable because it would be combusted. Use of carbon dioxide in food production, including water treatment, on the other hand, would be considered tapu. The use of carbon dioxide in industry for processes other than food production, however, would likely be acceptable.

Considerations for biomethane

Hard to do alone/for a water company
Attribution requires more work so recognition can be clear
Should focus on hard to abate industries and they should collaborate/lead/be involved.
Requires regional strategy to ensure there is economy of scale. Māngere is borderline and is the largest WWTP in the country.
Could require incentive as large capital cost and some uncertainty on future price

From here

Thank you,

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