#### "Fostering a sustainable future for Aotearoa New Zealand through geothermal"

# NZGA Strategic Project Update: CO<sub>2</sub> Reduction

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#### Aotearoa's Geothermal CO2 problem

- Geothermal in NZ is **renewable** and **low-carbon**.
- Like all energy sources there are emissions.
- The emissions across the full lifecycle of any electricity generation project are related to:
  - construction/materials.
  - released during operation or maintenance of the power stations.



#### CY2021 Emissions Intensity (lifecycle) of NZ geothermal power stations



Widths indicate relative plant size, heights are emissions intensity

Plant	CY2021 Lifecycle Emissions Intensity
Wairakei	29
Mokai	44
Poihipi	48
Te Mihi	49
GDL	55
Ngatamariki	55
NAP	61
Te Huka	62
TAOM	67
TOPP1	68
Rotokawa	82
KGL	102
Ohaaki	274
Ngawha	325
Median	62
Interquartile range (IQR)	50-79
MW-weighted average	73





New Zeoland Geothermal Associated

gC02e/kWh

#### Declining trend – operational emissions





## CO2 reinjection – part of the solution

This is one of the key initiatives to reduce CO<sub>2</sub> emissions from geothermal power stations.

Also sometimes called:

- CO<sub>2</sub> sequestration
- Carbon capture and storage (CCS)
- Non-condensable gas (NCG) reinjection





## CO2 reinjection – part of the solution

- In some types of geothermal power stations binary stations CO<sub>2</sub> reinjection occurs already.
- This is called "passive CO<sub>2</sub> reinjection" and occurs because not all the CO<sub>2</sub> comes out of the geothermal fluid.
- The amount of CO<sub>2</sub> passively reinjected ranges between binary stations, but can be up to 20%.
- "Active CO<sub>2</sub> reinjection" requires some plant modifications and presents some technical challenges.



#### NZGA Emissions Working Group



- The reduction of carbon emissions is a common cause across the industry, and there are shared technical and regulatory issues.
- Together the power station owners/operators can solve this challenge faster, for the benefit of everyone.
- For this purpose the NZGA Emissions Working Group was established in 2021.
- A framework for members to discuss, share and collaborate on issues associated with emissions from the use of geothermal energy, including: Knowledge/Mātauranga Maori, Risk and Engineering Solutions, Reinjection and Reservoir Management, Other Uses, Regulatory Matters, and Education.



### Updates from the Working Group

- Mercury, Contact, Ngāwhā Generation and Eastland Generation have committed to research and trials of CO<sub>2</sub> reinjection.
- This group of owners/operators represents 96% of the country's geothermal energy supply.
- Mercury's pilot trial at Ngatamariki:
  - Operational since October 2021.
  - First use of the technology in the Southern Hemisphere.
  - Reinjects one quarter of the station's emissions, from one of four units.
  - No adverse effects observed so far on plant/well performance.
  - To be increased in the future, and extended to other stations.



## Updates from the Working Group

- **Contact's** pilot trial at Te Huka:
  - Set to commence next month.
  - Aims to reinject all CO<sub>2</sub> from both units.
  - If successful will be the first carbon-zero power station in Aotearoa.
  - The next station will be Poihipi.
- Ngawha Generation's pilot trials:
  - OEC1 100% reinjection trial started earlier this year and has been operational since.
  - Offset around 3,200 tCO2e to date, equivalent to 600 cars off the road.
  - Aiming for 100% reinjection across the fleet with engineering design and procurement well underway.



### Updates from the Working Group

#### • Eastland Generation:

- Focus on TAOM plant (25 MWe) will transition to CO<sub>2</sub> reinjection during the next 24 months.
- GDL plant (9 MWe) will come next.
- Taheke project is still several years away.



#### **Member Companies**

#### **Corporate and Institutional Members**

The following companies have generously supported the N/GA.

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