# NZGA Winter Seminar 2021

## Fabian Hanik- Assistant Plant Manager

# Top Energy and Ngawha Generation company structure

# *Electricity Industry Structure*

**Trust Beneficiaries**

**Electricity Consumers**

Trust Deed

TOP ENERGY CONSUMER TRUST

*Sells power to consumer*

*Owns 100% shares*

Statement of Corporate Intent

**Electricity Retail Companies, e.g.**

- Contact Energy
- Trustpower
- Meridian Energy

(Currently 23 retailers)

*Distributes power on behalf of retail companies to consumers*

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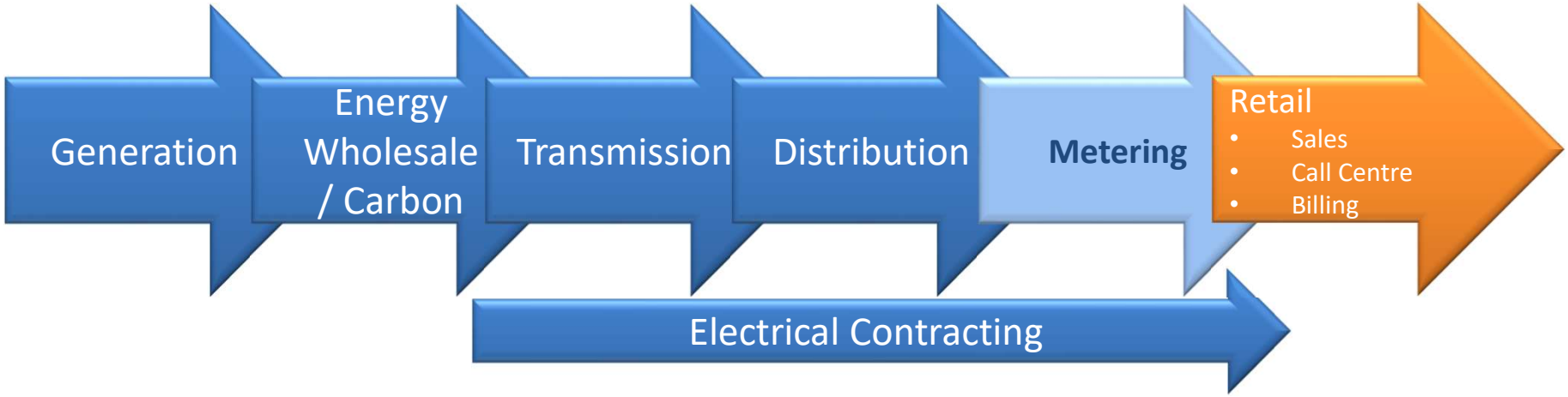
*Owns 100% shares*

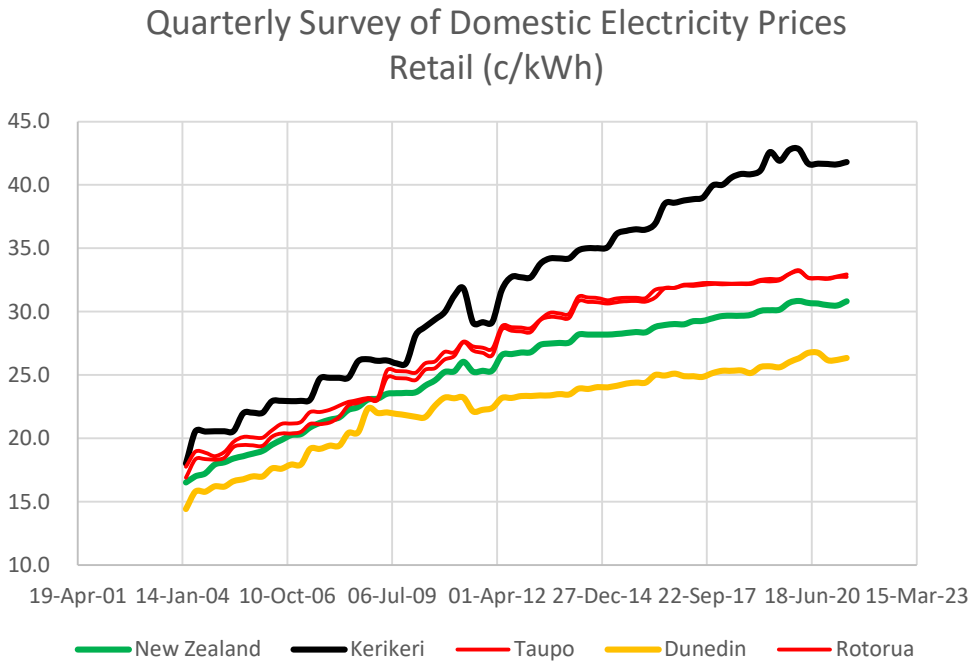
**Ngawha Generation**

# *Top Energy Value Chain Diversification: 2020*




Participate  Require Access to Data  Don't Participate

# *Highest Cost of Electricity and Lowest Income*

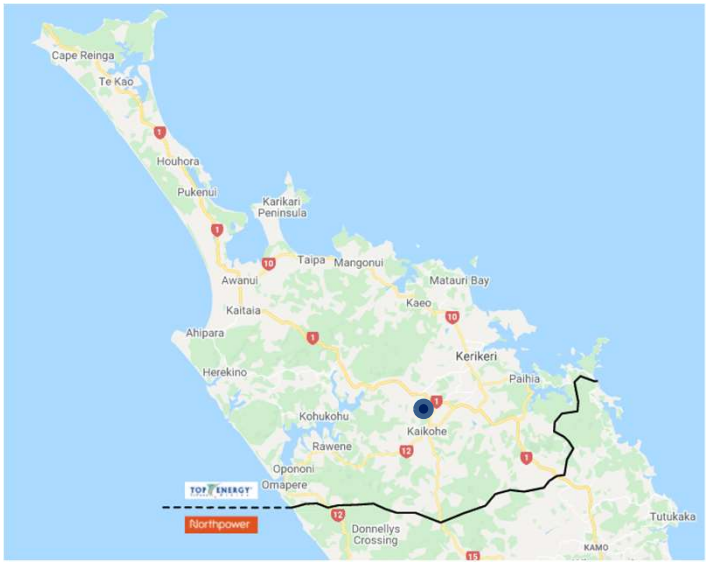



Source- MBIE; Quarterly Survey of Domestic Electricity Prices

| Regional council area | Average annual household income |
|---|---|
| Northland | $ 84,712 |
| Auckland | $ 128,138 |
| Waikato | $ 94,453 |
| Bay of Plenty | $ 95,143 |
| Gisborne / Hawke's Bay | $ 89,998 |
| Taranaki | $ 90,881 |
| Manawatū–Whanganui | $ 85,755 |
| Wellington | $ 124,449 |
| Tasman / Nelson / Marlborough / West Coast | $ 88,398 |
| Canterbury | $ 100,668 |
| Otago | $ 91,267 |
| Southland | $ 91,577 |
| Total | $ 107,196 |

Source- Household income and housing-cost statistics: Year ended June 2020-Table 4

# *Ngawha Geothermal Resource*




- Located 6kms from Kaikohe
- Area covers 25 $km^2$
- Government drilled 13 exploration wells in the 1980's and planned a 100MW station
- Field heat content 4,000PJ
- Originally thought to be sustainable at 25MW

# *Geothermal Field Characteristics*

- Low enthalpy @ 220$^{o}$C 15 bars
- Fluid dominated resource
- Caprock with limited surface features
- Reservoir hosted in Waipapa Greywacke between 500m and 1500m depth – Low porosity – Permeability due to fractures and faults
- High non condensable gas content, originally 22% of steam
- Chemical content toxic to vegetation


NG30
NG28
OEC4
NG04
NG31
NG33
NG32
NG18
NG12
OEC1
NG09
OEC3
NG16
NG27
NG11

# A Very Brief History of Ngawha Generation

# *Ngawha Geothermal Pilot Plant*

- 10 MW Pilot Plant Commissioned in 1998
- Generated 30% of Far North Electricity
- Initial investment of $25 million

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# *OEC3 Expansion Project*

The consents applied for included:

- Increase intake and discharge from 10,000 to 25,000 tonnes daily rate
- Additional re-injection up to 3,000 tonnes per day
- Monthly averaging offtake and discharge

# *Ngawha Geothermal*

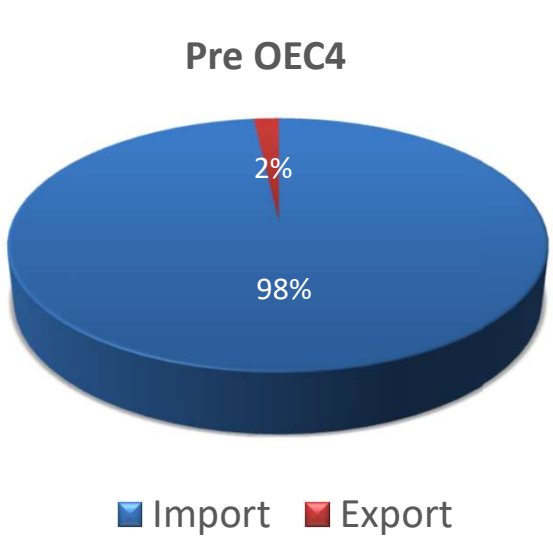
- Single Ormat unit 17MW gross Commissioned 2008
- Supply increased to 70% of Far North Consumption
- Embedded Network Connection

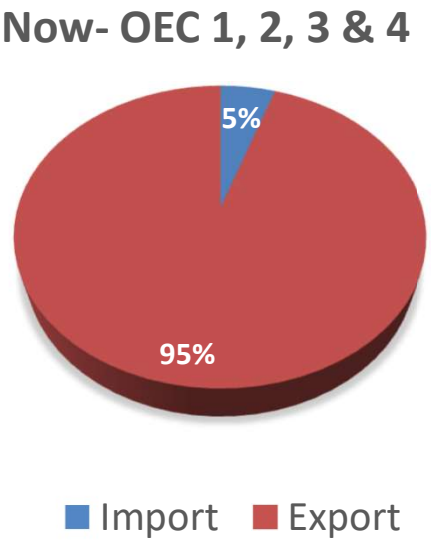
# OEC4 – 32MW Expansion

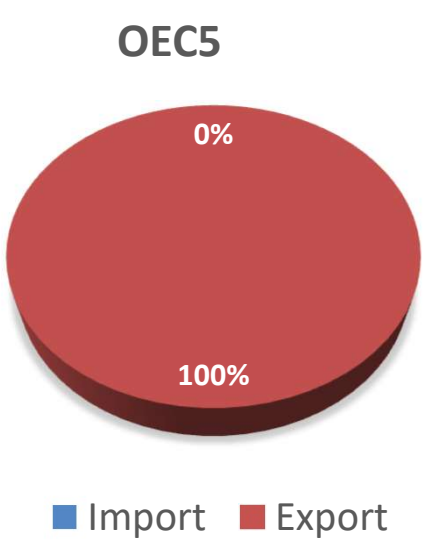
# *Consents Expansion – Reconsented & Expanded for OEC 4 & 5*

- Capacity to take and re-inject 18.6m tonnes of geothermal fluid per year
- Allowance to inject up to an additional 1.1m tonnes per year of water to maintain pressure
- Extensive monitoring and reporting requirements
- 3 years of field monitoring before OEC5 take allowed, field must respond as per the model

# *Electricity Self Sufficient Far North*




# *Key Project Metrics – Civil Works*

- Area of work – 36 hectares
- Cut material – 942,000 $m^3$ (a tower of soil on a rugby field 135m high)
- Moving average of 4,400 $m^3$ per day (over half a rugby field 1 m high)
- Metal course imported – 52,000 $m^3$ (rugby field 7.5m high)
- Roading – 3.8 km
- Water pipes - 5 km
- Ponds - 13
- Volume of stormwater ponds – 75,000 $m^3$ (30 Olympic swimming polls)

# OEC4 – Commissioning to now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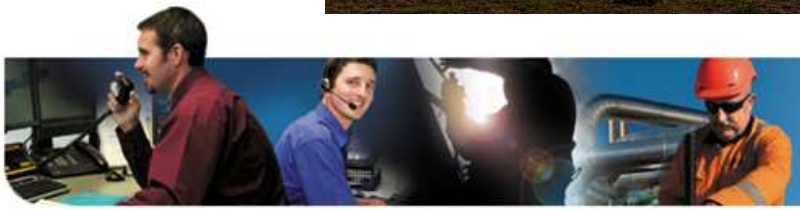

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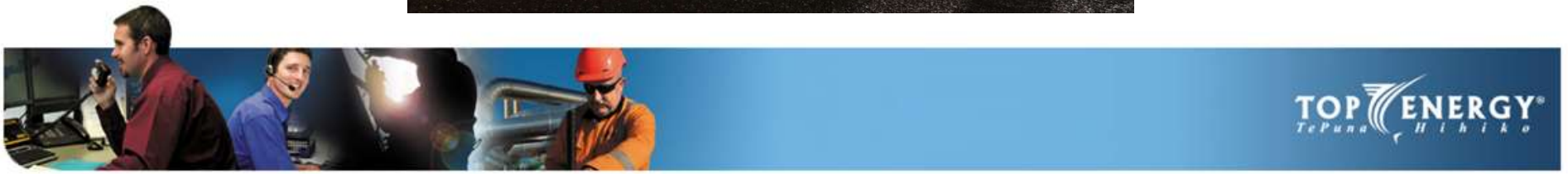
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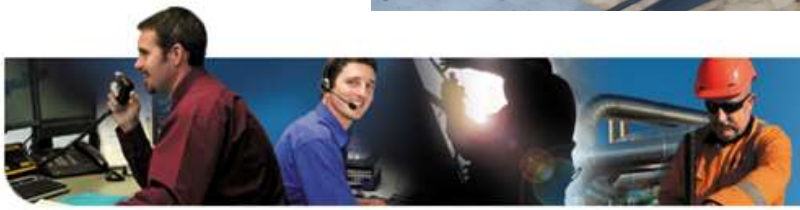
# Ngawha Generation-60*MW Net Export

*Cold northland winter night with the wind blowing in the right direction.



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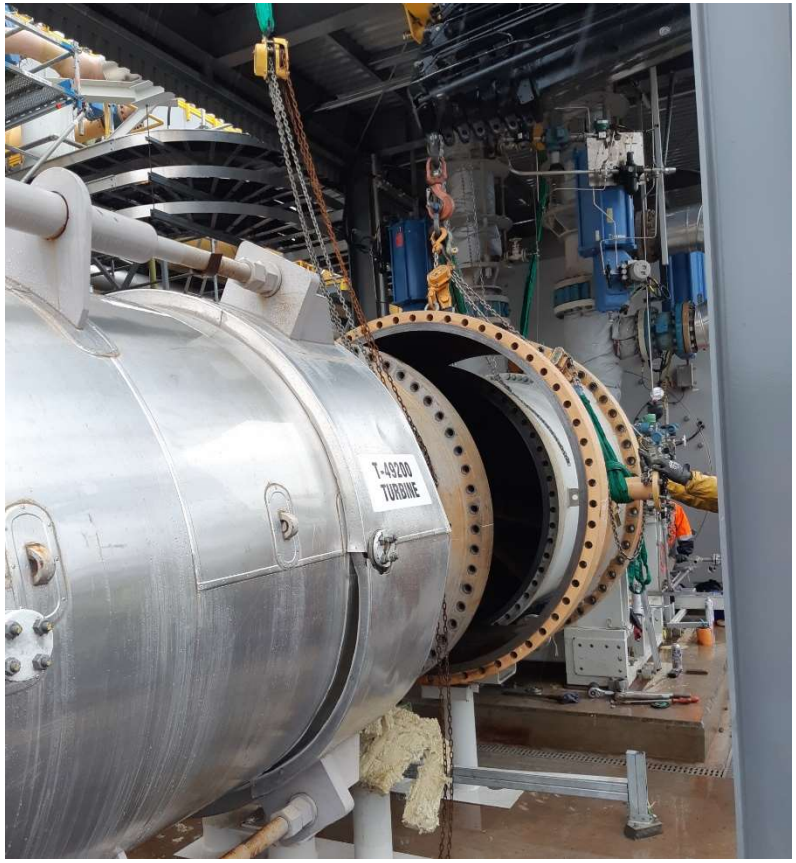


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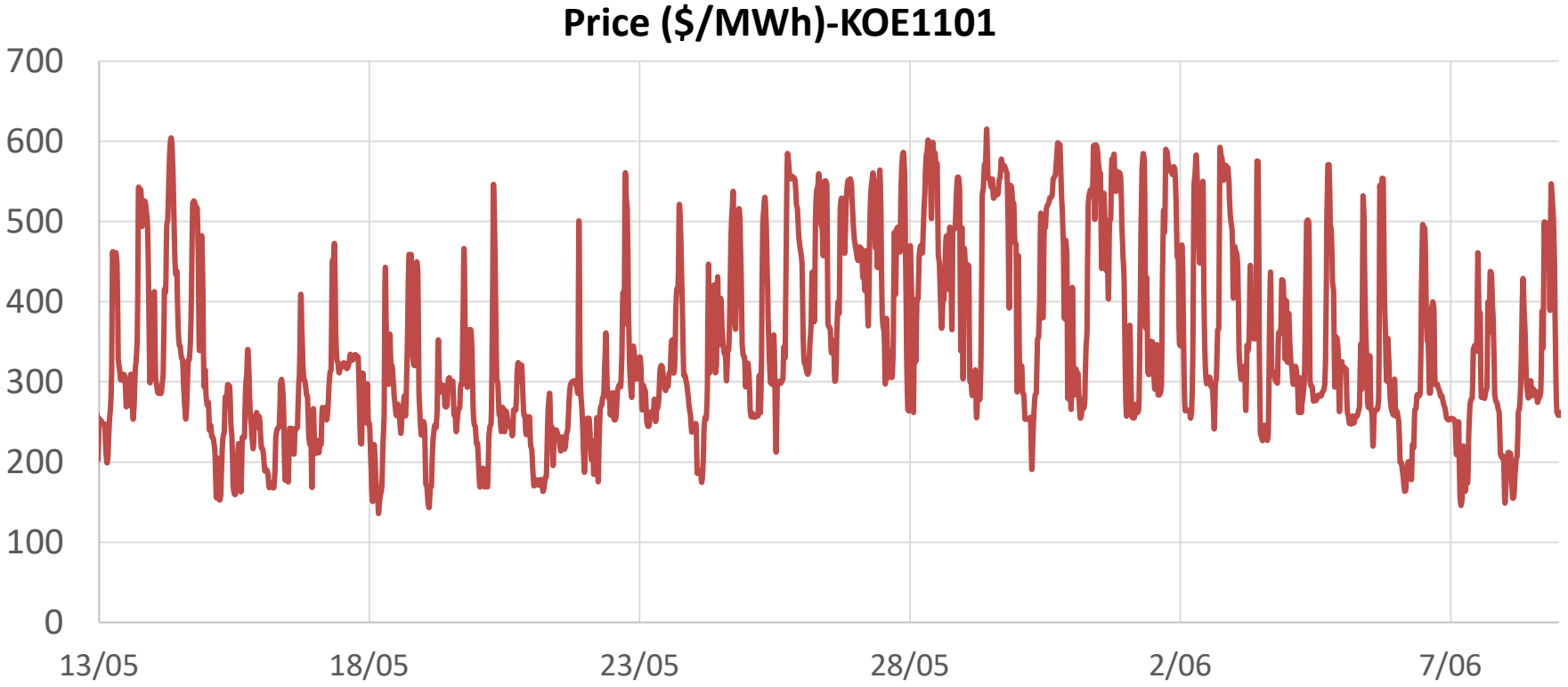
Price ($/MWh)-KOE1101
700
600
500
400
300
200
100
0
13/05
18/05
23/05
28/05
2/06
7/06


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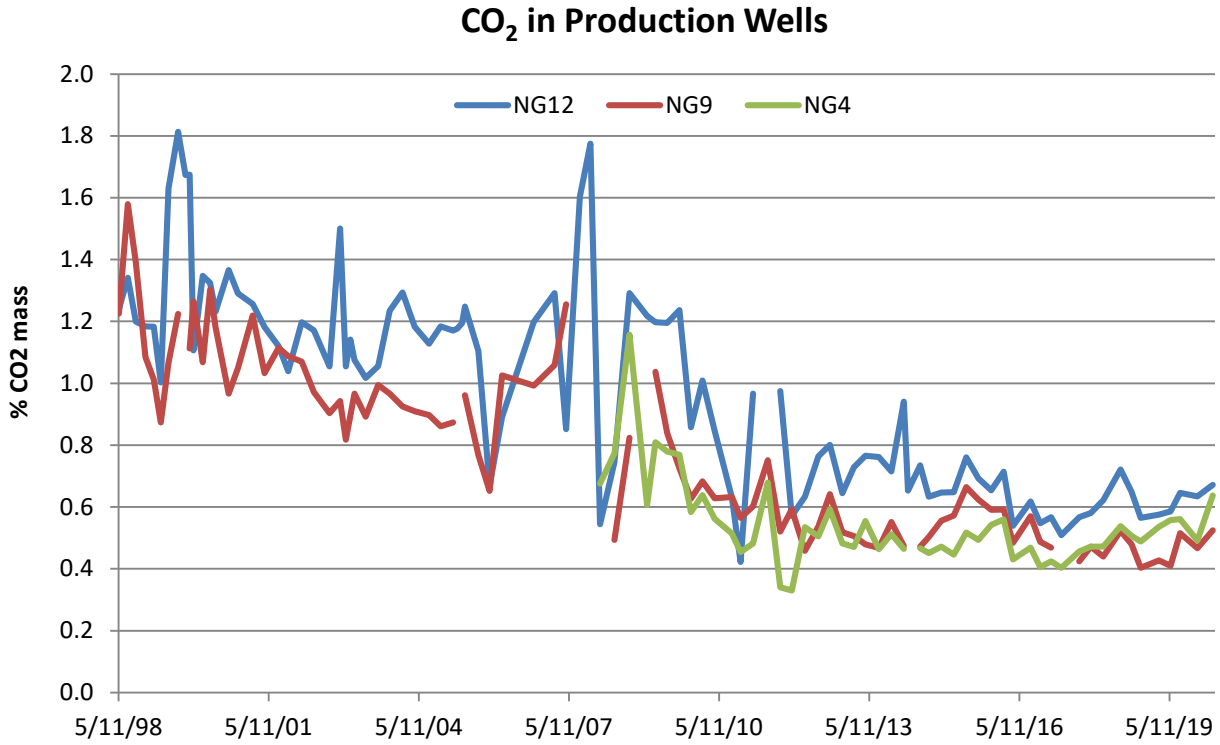
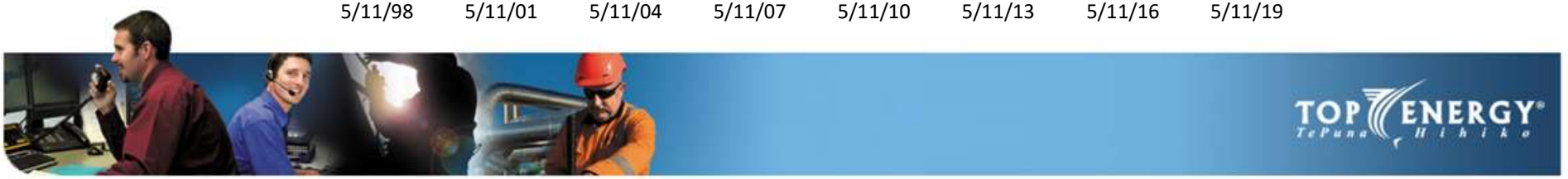
# NCG

# $CO_2$ Content


CO2 in Production Wells
NG12
NG9
NG4
% CO2 mass
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
5/11/98
5/11/01
5/11/04
5/11/07
5/11/10
5/11/13
5/11/16
5/11/19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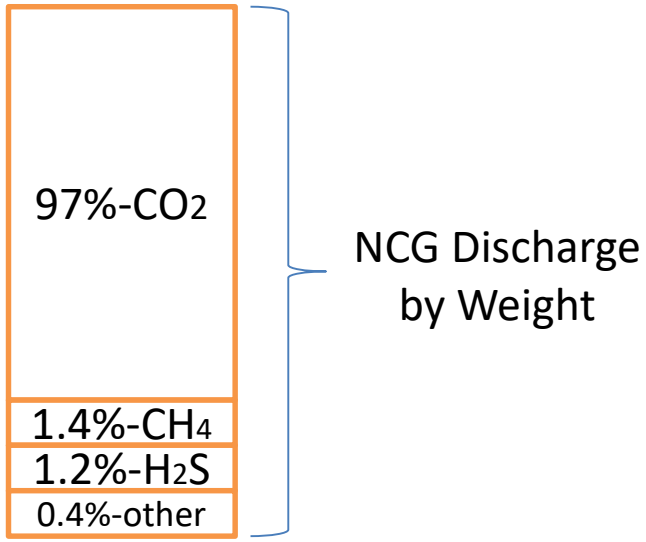
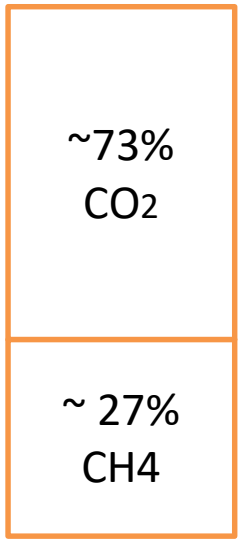
# *Methane Content vs Carbon Tax*

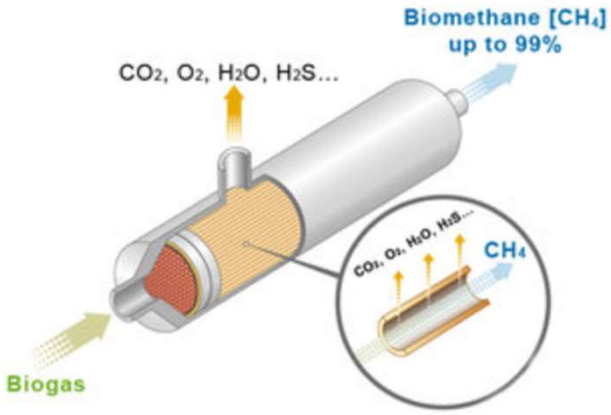



NCG Discharge by Weight




NCG Discharge Tax paid

# *Turning a negative into an opportunity*



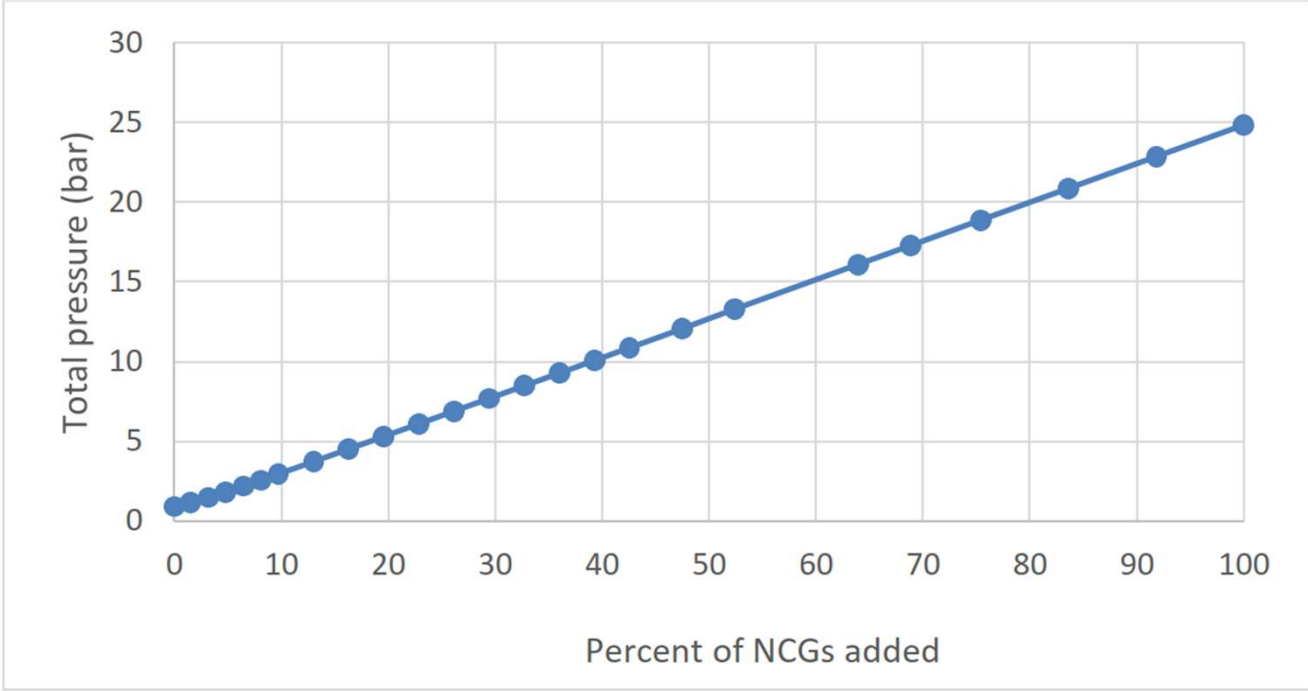

stuff ☰ | the press

**Hanmer Springs Pools granted mining permit to convert methane gas to electricity**

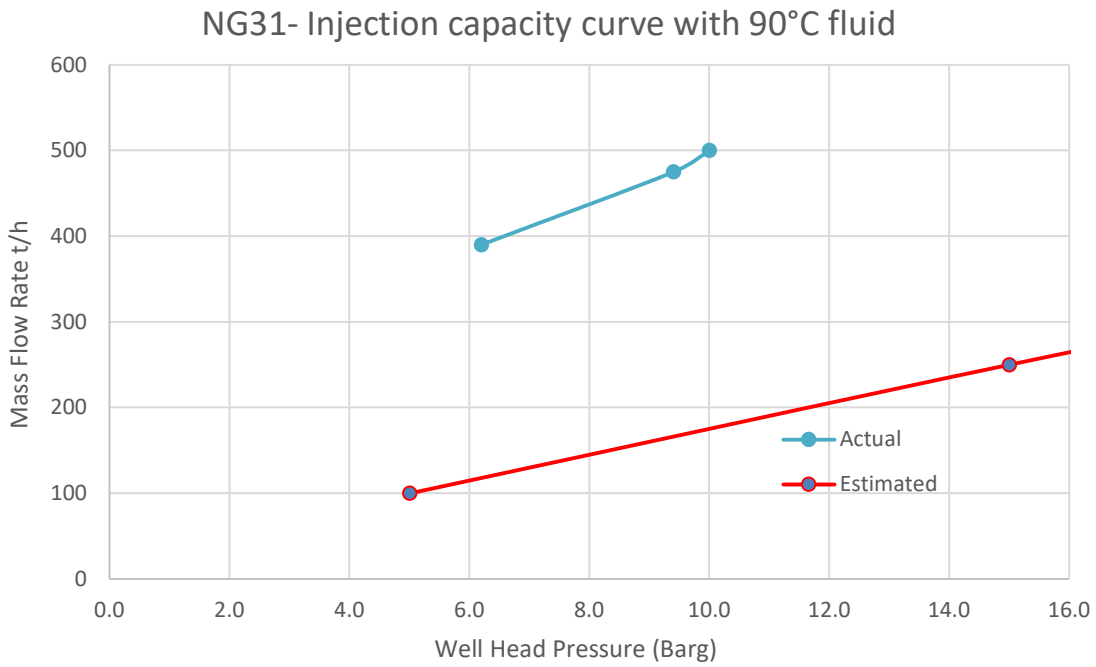
Emma Dangerfield · 14:55, Oct 23 2018

- ~0.5 MW Gross Electrical Energy
- ~$1M reduction in Tax/ year (at $35/T)
- Just a ~~few~~ lot of technical challenges to overcome.
- Many other options NGL are looking into

# *Injection of NCG under pressure*




* Model by Kevin Brown


NG31- Injection capacity curve with 90°C fluid
Mass Flow Rate t/h
600
500
400
300
200
100
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Well Head Pressure (Barg)
Actual
Estimated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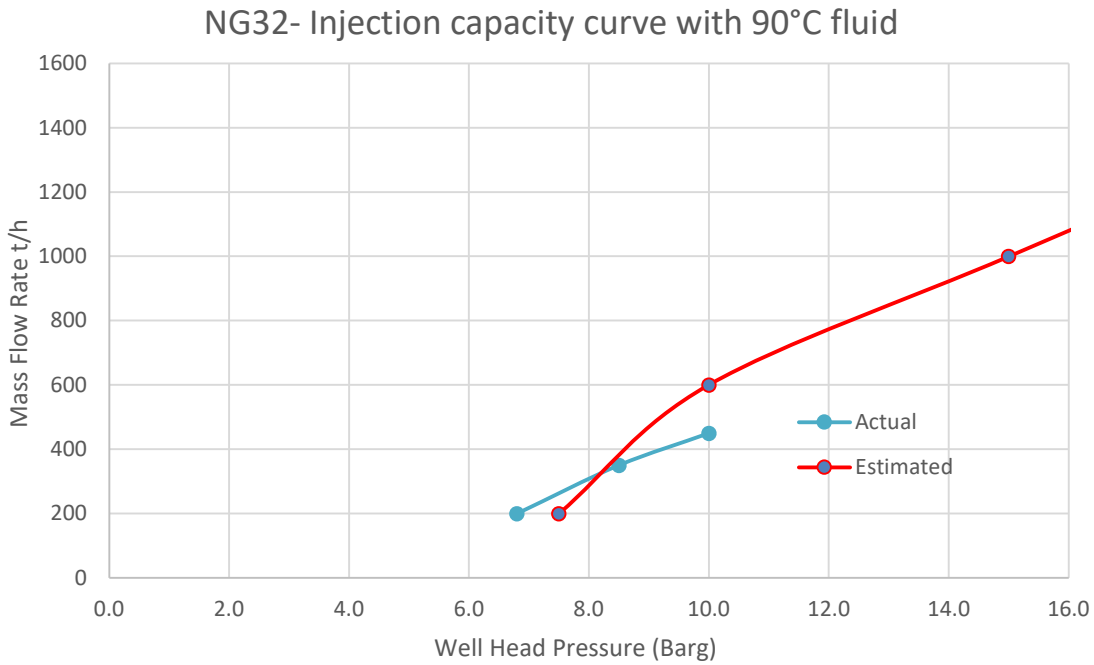
NG32- Injection capacity curve with 90°C fluid
Mass Flow Rate t/h
1600
1400
1200
1000
800
600
400
200
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Well Head Pressure (Barg)
Actual
Estimated


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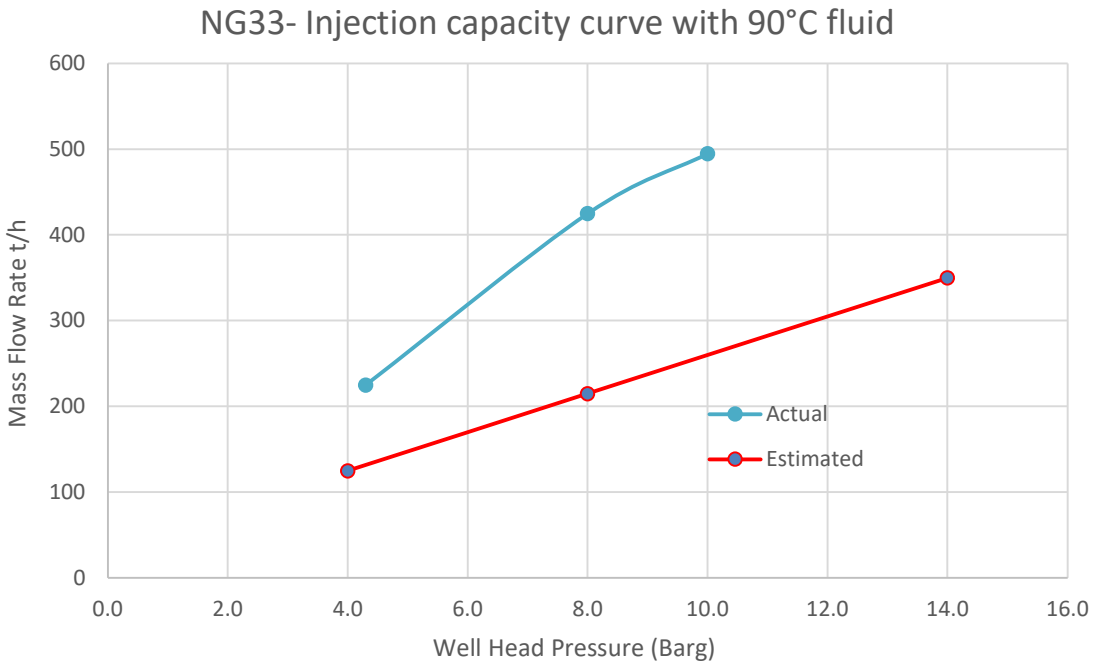
NG33- Injection capacity curve with 90°C fluid
Mass Flow Rate t/h
600
500
400
300
200
100
0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Well Head Pressure (Barg)
Actual
Estimated


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## *Ongoing observations and work*

- Monitor NCG discharge from production wells
- Monitor calcite ppm and scaling
- Check suspected increase in stibnite scaling
- Review II/ skin damage of injection wells.
- NCG Tee install during October shut


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