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A Comparison of Gender-based Employment Data from the New Zealand and Iceland Geothermal Sector

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ABSTRACT

The geothermal industry supports a diverse range of employment from skilled workers to higher professional degrees across a spectrum of disciplines. Through the phases of development i.e. exploration, construction, operations and maintenance, cascade projects, geothermal projects have significant positive direct and indirect impact on employment in the communities which they operate.

Geoscience, engineering, modelling, environmental scientists, policy, legal, business, technicians, mechanics, construction and many more specialist skills are required to deliver successful and sustainable geothermal projects. These are highly skilled and interesting roles.

Iceland and New Zealand are world leaders in high temperature geothermal electricity generation and direct use. This paper describes employment data from geothermal projects in both countries.

1. INTRODUCTION

Anecdotally, the international geothermal community is a diverse place to work. The vast locations where geothermal exists means a number of people from varying backgrounds and cultures enjoy working in our industry. Generally, women are significantly underrepresented in the geothermal sector at an international level.

This paper collates and compares data from major geothermal operators in New Zealand and Iceland to gain insights on the status of female participation in the two world-leader countries in geothermal exploration and development.

2. RENEWABLE ENERGY EMPLOYMENT TRENDS

Worldwide, the renewable energy sector employed 10.3 million people in 2017 (IRENA, 2018) and this number went up to 11 million people at the end of 2018 (IRENA, 2019). Many governments have prioritized renewable energy development primarily to reduce emissions and meet international climate goals and in pursuit of broader socio-economic benefits (IRENA, 2018). Figure 1A shows the global renewable energy employment between 2012-2017 and Figure 1B shows the renewable energy employment in 2017.

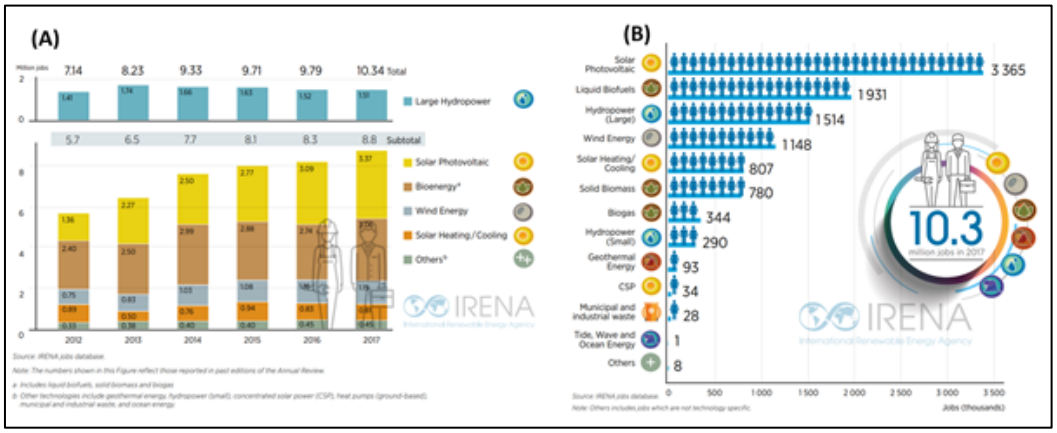

Figure 1: A) Global Renewable Energy Employment by technology between 2012 and 2017; B) Renewable Energy Employment by Technology in 2017 (IRENA, 2018).

3. GEOTHERMAL DEVELOPMENTS IN NEW ZEALAND AND ICELAND

Geothermal energy has long been recognized globally as a clean and reliable source of heat and electric power supply. This is constantly available, unlike wind or solar, making it an important source of low-carbon baseload power.

Most of New Zealand's installed geothermal capacity for electricity generation (~1010 MW) is in the Taupo Volcanic Zone (TVZ) (Figure 2), except for the Ngawha plant in the Northland (Blair et al., 2018). Geothermal sources contributed approximately 17% of the 2017 electricity generation (MBIE, 2018b), with 82% of the nation's electricity coming from renewable energy sources (MBIE, 2018b).

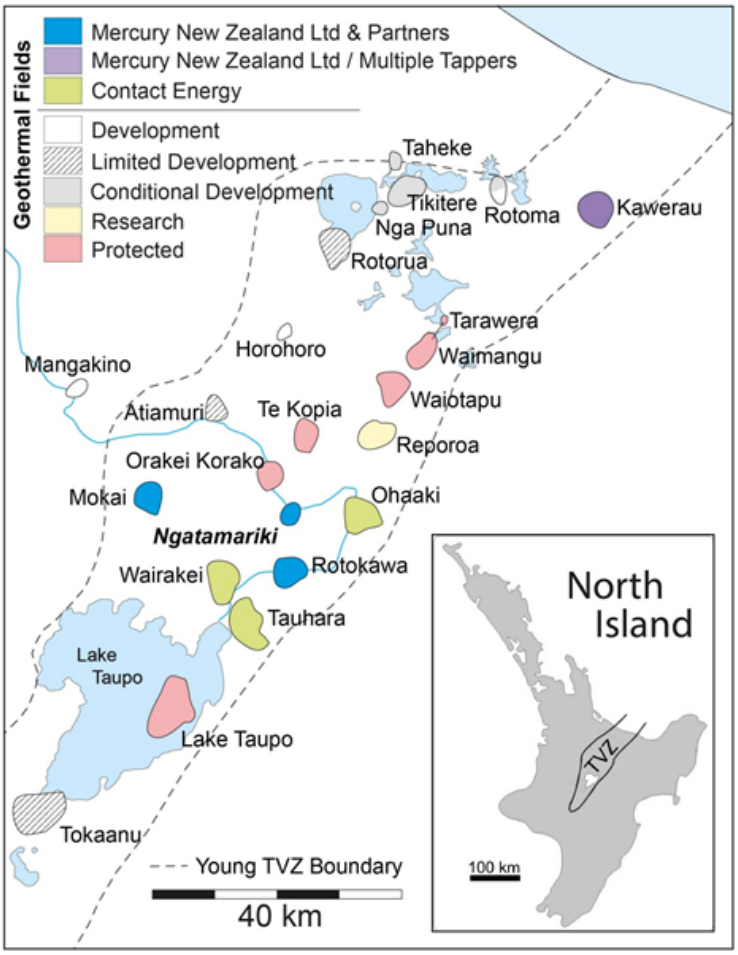

Figure 2: Location map showing TVZ high temperature geothermal systems. Insert shows TVZ (Hernandez, 2015) NB: Mighty River Power is now Mercury.

The first use of geothermal energy in New Zealand was by central North Island Māori, using hot pools for cooking, bathing, balneology, ritual/spiritual cleansing and burial, as well as geothermal muds for medicinal purposes and hot ground for cooking (Blair et al., 2018). They also provided the first guided tours of geothermal surfaces features. Climo et al. (2017) stated that Māori have welcomed visitors seeking a geothermal/volcanic experience for over 200 years now.

New Zealand saw a 73% growth in the amount of energy consumed from geothermal sources between 2010-2015 and this was mainly driven by an increase in the cost of gas supply which has resulted in geothermal being the lowest cost electricity generation available. (Bertani, 2015). However, since 2014, there has been a general hiatus in the construction of electricity generation projects (except for the 50-MW expansion in Ngawha and the 25-MW Eastland's Te Ahi O Maui project in Kawerau) due to flat electricity demand (Blair et al., 2018). This leads to a shift from exploration and growth to a focus on operation and maintenance.

90 years ago, in 1930, Reykjavik's geothermal district heating system began operations with only a few buildings connected. Since then geothermal energy utilization in Iceland has come a long way. Today it is used in a variety of ways from heating homes and swimming pools to direct use in industry and electricity production. In 2017, geothermal energy provided 27% of Iceland's electricity and 90% of the country's space heating supply. Installed electrical capacity is 707 MW (National Energy Authority, 2018).

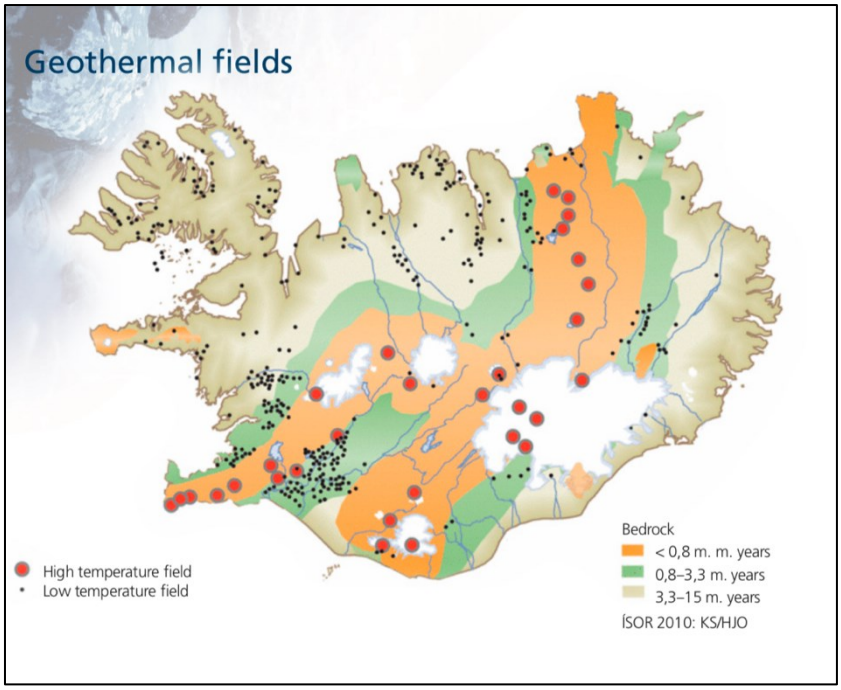

Figure 2: Geothermal fields in Iceland (National Energy Authority, 2018)

4. GEOTHERMAL EMPLOYMENT CASE STUDY: NEW ZEALAND V.S. ICELAND

Labor market estimates show that geothermal projects generally sustain slightly less than one permanent job per megawatt of installed capacity although these estimates vary between countries and the types of employment (ESMAP, 2018). The report also states that the Geothermal Energy Association (GEA) estimated that a 50-MW geothermal project would support 35-60 permanent jobs over a period of 30–50 years. In 2017, the International Renewable Energy Agency (IRENA) estimated around 93,000 jobs in geothermal energy globally (IRENA 2018).

Based on International Labour Office (ILO) data, women's rate of global labor-force participation in 2018 was 48% compared to 75% for men with women's global employment in industry on the decline (Figure 3) (ESMAP, 2018). A 2018 survey conducted by IRENA shows that women account for an average of 32% of renewable energy jobs (IRENA 2019).

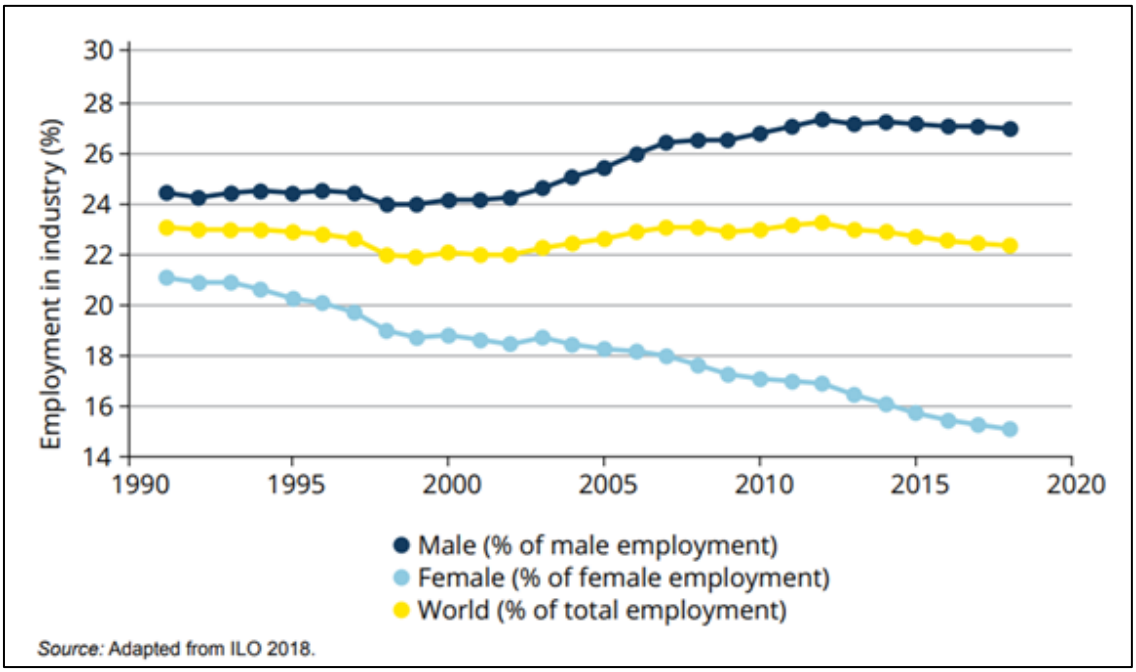

Figure 3: Trends in Geothermal Employment by Gender (ESMAP, 2018).

4.1 Women Employment in Geothermal in New Zealand vs. Iceland

Figure 4 shows a plot of the cumulative installed geothermal electricity generation capacity in New Zealand and the timing of the first female employed in selected disciplines. The figure highlights how male-dominated the industry. The first known female employed as a production technician was over 30 years since commissioning of the first geothermal plant in New Zealand.

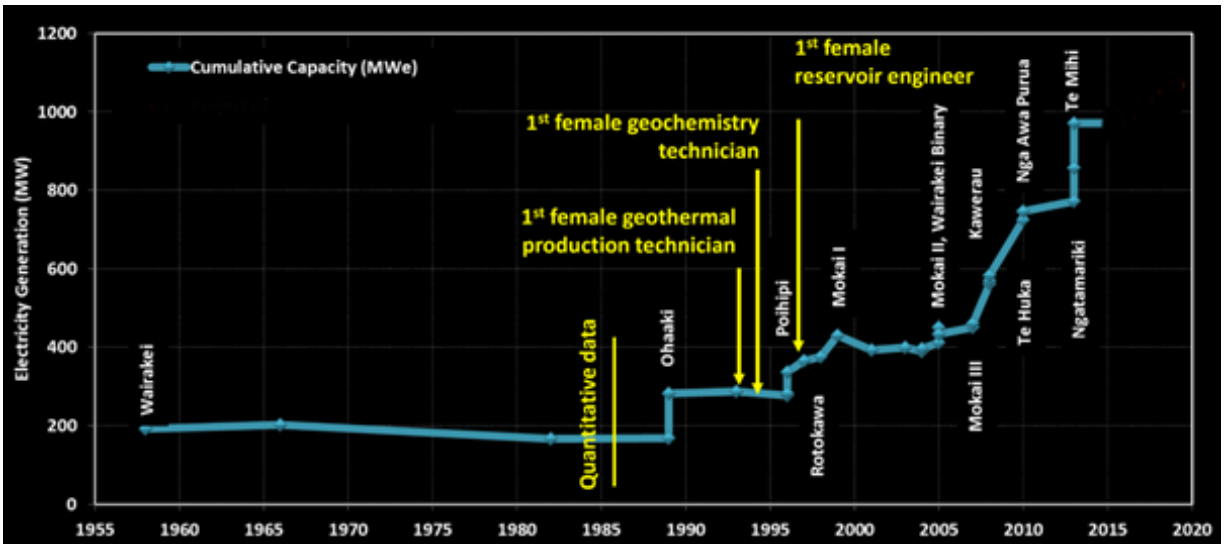

Figure 4: Installed Geothermal Electricity Generation Capacity, New Zealand (Newson, 2016).

For this study, several companies in the geothermal industries in Iceland and New Zealand have provided employment data for their geothermal sectors. These have included those focused on both electricity generation and direct use of geothermal. Companies participating include Ngati Tuwharetoa Geothermal Assets, Mercury and Contact from New Zealand and Orkuveita Reykjavíkur and HS Orka from Iceland.

Figure 5 shows a comparison of female participation in the geothermal sector in New Zealand vs Iceland based on the employment data obtained from major geothermal power operators in the two countries. The reservoir category includes groups whose focus is 'below ground' including geologists, geochemists, geophysicists, reservoir engineers, reservoir modellers, and drilling engineers. The operations category refers to groups working mainly on 'above ground' equipment including process engineers, production engineers, production teams, maintenance teams, shut/outages teams. The support category includes the finance group, health and safety, and environmental teams.

Female employment in the operations group scored the least (at 8% and 10%, respectively) for both New Zealand and Iceland. In the reservoir category, women make up 30% for New Zealand and 39% for Iceland. For the support category, New Zealand has 28% women while Iceland has 62% women. Overall, female employment in geothermal is at 14% for New Zealand and 23% for Iceland and these numbers are relatively lower than the average 32% for the renewable energy sector (IRENA, 2018).

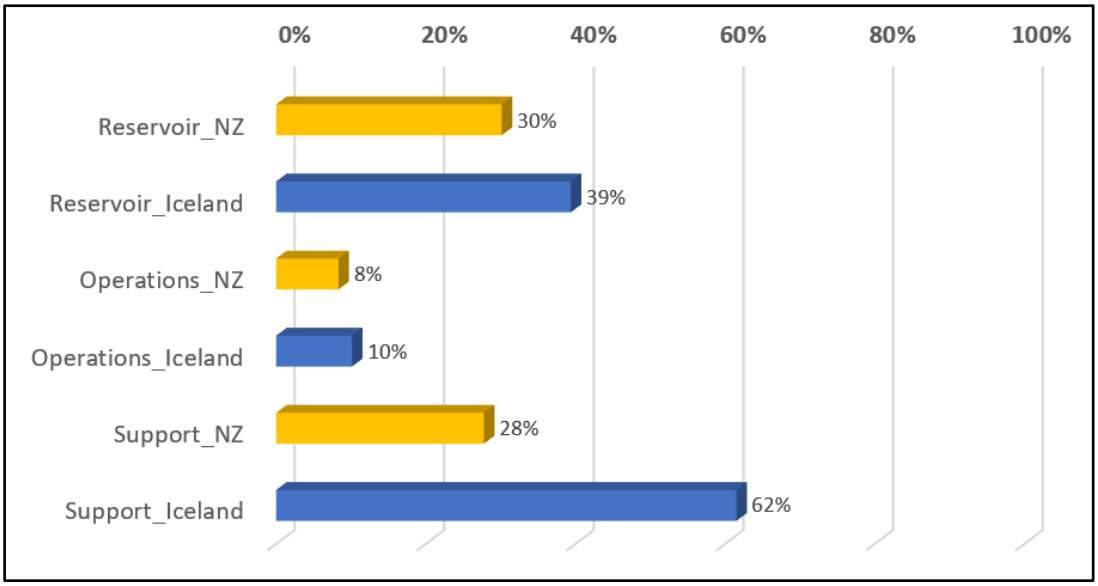

Figure 5: Percentage of Women in the Geothermal Power Sector - NZ vs Iceland.

Figure 6 shows the percentage of women in administrative positions with New Zealand having 53% women and Iceland at 27%, respectively. These positions have been historically mostly held by females in all sectors and it is encouraging to see close to or even less than 50% women in these positions in the companies assessed in New Zealand and Iceland.

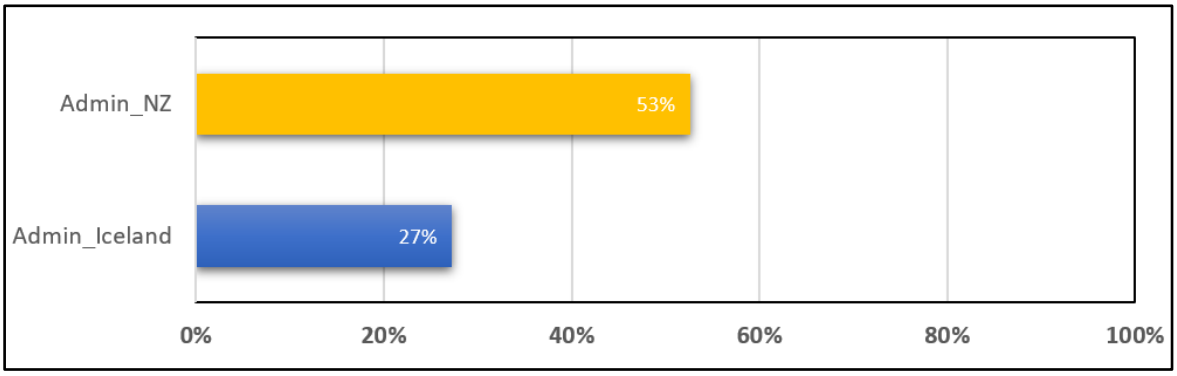

Figure 6: Percentage of Women in Admin Positions in Geothermal – NZ vs Iceland

4.2 Women in Management in Geothermal- New Zealand vs. Iceland

Figure 7 highlights the percentages of women in management positions in the geothermal power sector in New Zealand vs Iceland. Iceland shows a significant lead in terms of the percentage of women in management positions in the reservoir group, i.e. 81% in Iceland vs 8% in New Zealand. Similarly, in the operations group, Iceland has a higher percent of women in management positions at 25% compared to 11% for New Zealand.

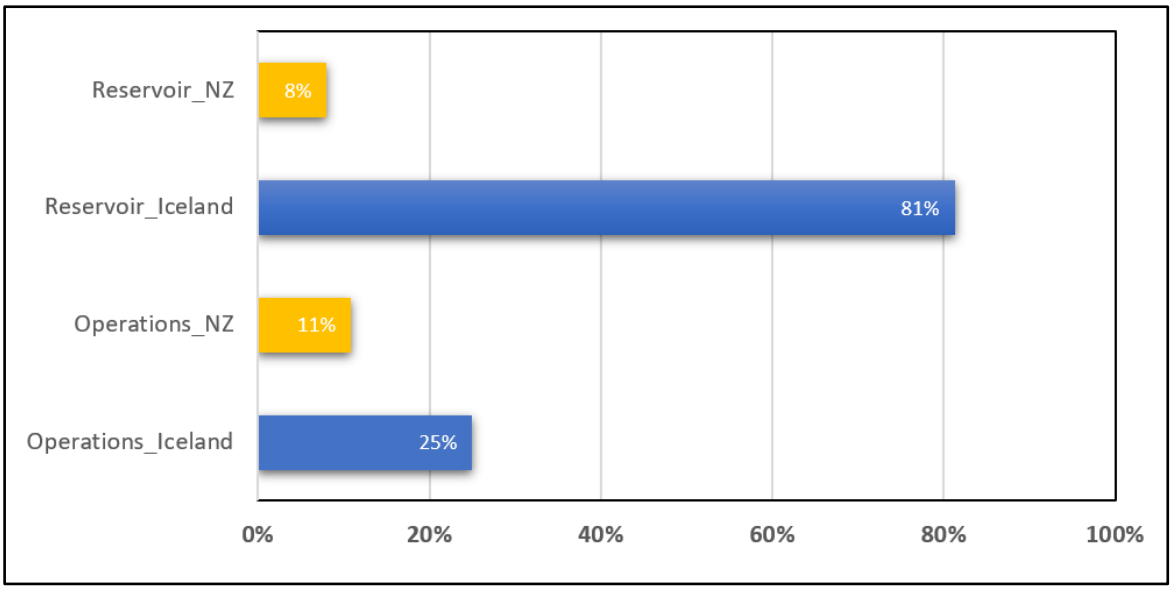

Figure 7: Percentage of Women in Management Positions in Geothermal – NZ vs Iceland

5. CONCLUSIONS

Both New Zealand and Iceland are world-leaders in geothermal exploration and development. Comparison of gender-based employment data between New Zealand and Iceland show that overall female participation in the geothermal power industry is at around 20-25%. The percentages of women in management positions vary widely across the three categories assessed.

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