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Supporting the Uptake of Direct-Use Geothermal Energy in the Agri-Food Sector of Northern Ireland

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INTRODUCTION

Agriculture is a major emitter of Greenhouse Gases in Northern Ireland, responsible for 31% in 2023 (NISRA, 2025), providing a challenge for complying with the Climate Change Act (Northern Ireland) 2021.

The Agriculture and Food Processing Sectors employ a number of heat intensive processes ranging from 20°C for aquaculture to temperatures in excess of 100°C for evaporation, distillation and sterilisation (Figure 1)(IRENA, 2019; Lindal, 1973; Van Nguyen et al., 2015).

Globally, geothermal energy is used within Agri-Food, with contributions across to horticulture, dairy, poultry and alcohol production (Lund and Toth, 2021), in countries including the USA, New Zealand, Kenya and the Netherlands (Lund and Toth, 2021). These sectors contribute highly to the Northern Ireland Economy (Hamilton, 2025), yet Geothermal Energy is all but absent in Northern Ireland (Figure 2.2) and across the wider UK and Ireland.

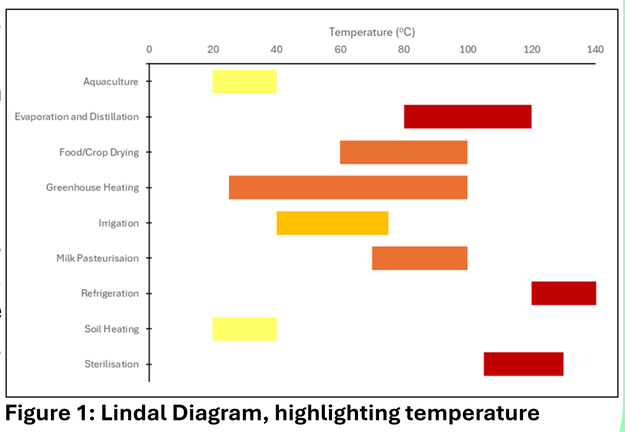


Figure 1: Lindal Diagram, highlighting temperature requirements for geothermal utilisation for Agri-Food applications, after Lindal (1973), Van Nguyen et al., (2015) & IRENA (2019).

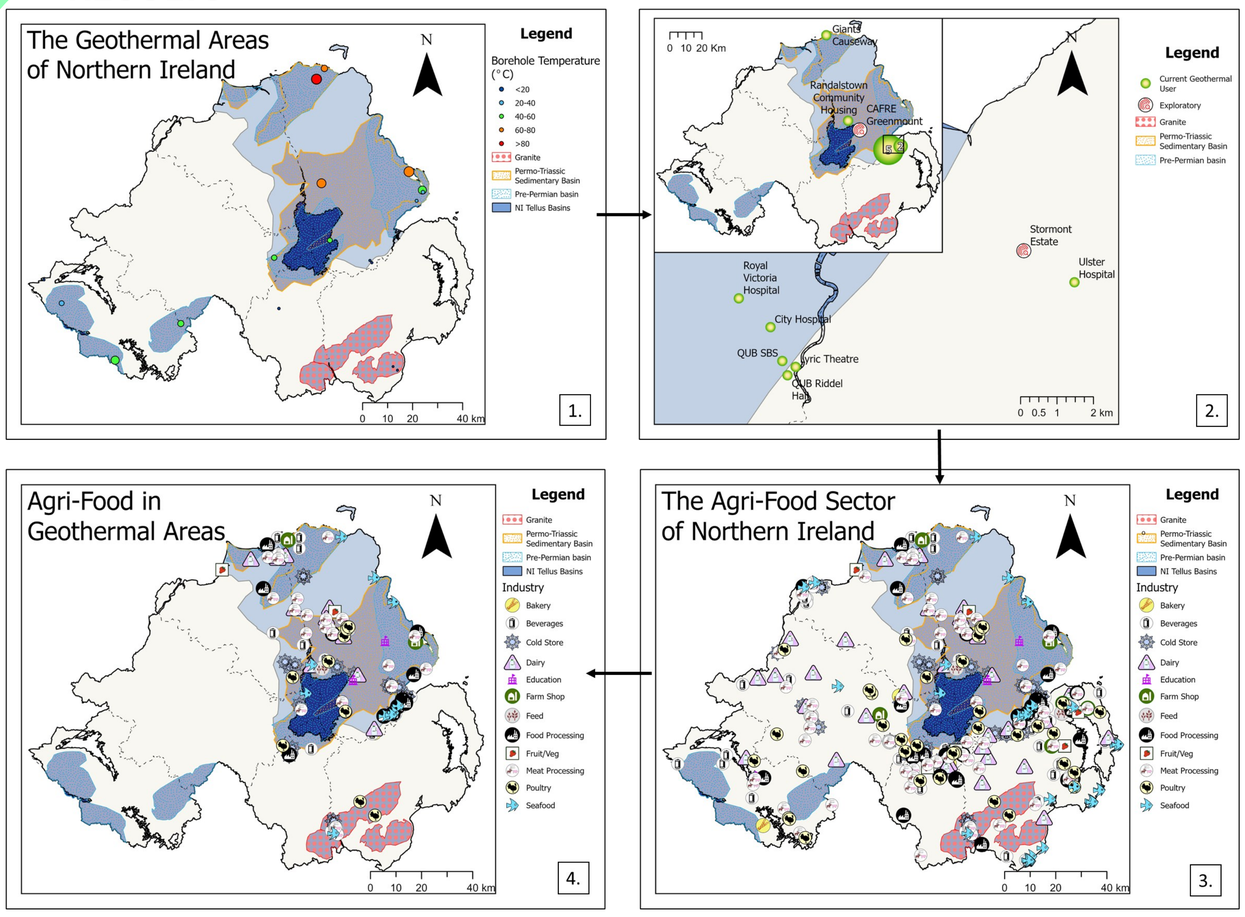
AIMS

1. Identify regions in Northern Ireland where geothermal resources and heat intensive Agri-food sites coexist.
2. Identify specific sites across key Agri-Food sectors in Northern Ireland with a high suitability for geothermal.

METHODS

1. Using the available scientific literature, potential geothermal resources and any current users of geothermal energy within Northern Ireland were identified.
2. Online resources including foodcompanies.org.uk and the Foods Standards Agency, were used to identify agri-food sites. The currency of identified sites was verified via their websites/ social medias and Companies House. Coordinates for each of these sites were ascertained using Google Earth.
3. Once data for 367 sites was collated this was imported into a GIS for analysis, with sites sorted by industry, and plotted against geothermal resources.
4. Sites were then subjected to a Multi Criteria Analysis (MCA) to rank the suitability of each site for geothermal exploitation, this analysis considered several factors including the maximum temperature used at the site, to the scale of the business and any prior renewable energy use.
5. Based on the MCA sites were designated as having High/Medium/Low potential for geothermal exploitation this was again analysed in a GIS.

RESULTS



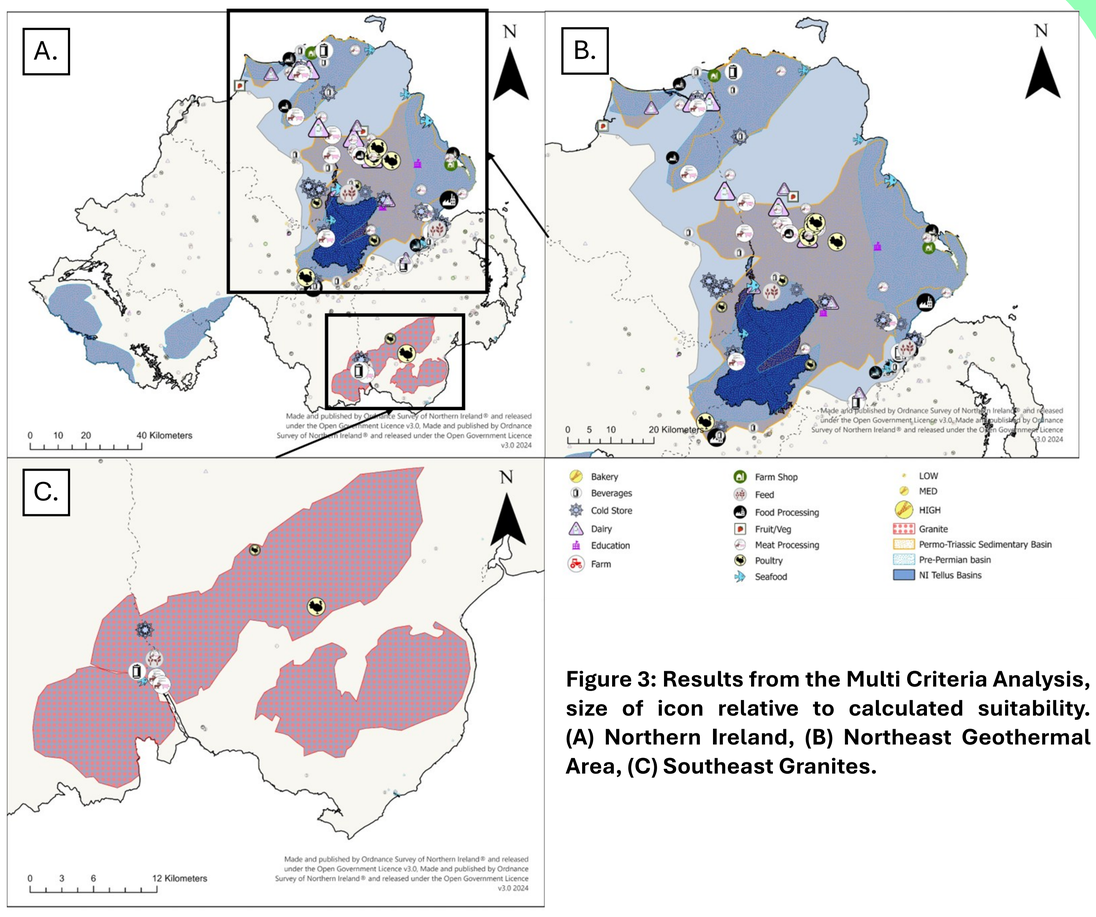


Figure 3: Results from the Multi Criteria Analysis, size of icon relative to calculated suitability. (A) Northern Ireland, (B) Northeast Geothermal Area, (C) Southeast Granites.

Figure 2.1: The Key Geothermal Areas for DUGE in Northern Ireland, Permo-Triassic sandstones in the North (Rathlin, Larne, Lough Neagh and Foyle Basins), Carboniferous sandstones in the Southwest, and the Mourne Mountain granites (British Geological Survey, 2024; Busby, 2014; Busby & Terrington, 2017; English et al, 2024; Pasquali et al, 2010; Raine & Reay, 2021)

Figure 2.2: Current users of geothermal energy, exclusively for space heating, using Ground Source Heat Pumps and shallow resources.

Figure 2.3: Agri-food sites in Northern Ireland, sector is diverse ranging from seafood through livestock and arable farming to food and drink processing.

Figure 2.4: Agri-food sites within the Geothermal areas, 92% of the identified sites are located within the (Antrim Plateau).

DISCUSSION

Open and closed loop shallow geothermal systems used in conjunction with Ground Source Heat Pumps (GSHP) can provide low grade heat across the entirety of Northern Ireland (Raine and Reay, 2021). For greater temperature needs such as those in Agri-Food higher temperature resources are required, these are found in Hot Sedimentary Aquifers in the Northeast and Southwest and radiogenic Granites in the Southeast (Figure 2.1)(Raine and Reay 2021).

Of the 367 identified agri-food sites 130 sites were found to cohabit within areas with the necessary geology (Figures 2.3. & 2.4). These sites are not evenly distributed with 92% of within the Northeast area, 8% in the Mourne Mountains and 0% in the Southwest. Meat processing has the highest identified sites (29), ahead of Drink production (23) and Dairy and Poultry (12 each), these sectors are amongst the greatest contributors to the Northern Irish economy (Hamilton, 2025).

The MCA (Figure 3) revealed 50 sites were calculated to have a high suitability for geothermal use. The distribution by sector shows a similar pattern to the overall number of sites, with Meat processing (13) ahead of Poultry (7), Dairy (5) and Drink Production (4).

CONCLUSION

Geothermal energy is underutilised in the UK and Northern Ireland. Within Northern Ireland there are three main foci for deep geothermal exploitation for DUGE, the Hot Sedimentary Aquifers in the Northeast and Southwest, and the radiogenic Granites of the Southeast.

Agri-food is a major land user in Northern Ireland with a diverse number of thriving sectors across the entirety of the country. There is substantial cohabitation of agri-food applications and geothermal resources in Northern Ireland, primarily in the Northeast.

The Multi Criteria Analysis showed that 50 of the 367 identified sites met the criteria for a high suitability for Direct Use Geothermal exploitation, spread across a number of sectors with varying heat requirements.

NEXT STEPS

1. Utilising identified case studies with high suitability based on the MCA, identify site/ organisation specific opportunities and challenges for the uptake of geothermal energy.
2. Aim to better understand the reservations of the NI Agri-food sector surrounding geothermal energy and the reasoning behind the lack of uptake to date.

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