

The Status of Geothermal Resource Development in Ireland

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ABSTRACT

Since 2003 the CSA Group Ltd. have carried out surveys of geothermal resources across the island of Ireland. Data were gathered and geothermal models developed, a GIS-linked geothermal database produced and a series of geothermal maps for different depths created. The status and utilisation of geothermal energy resources was reviewed and exploitation of geothermal resources was recommended. The studies on warm springs and ground-water temperature trends found that the warmest values are in the south and east. Ireland is well suited for ground source heat pumps utilization, due to its temperate climate and rainfall levels that ensure good conductivity and year round recharge.

Subsurface temperature data were compiled from 81 boreholes up to 2,500m deep. These reviews of the Republic of Ireland and Northern Ireland, indicate a regional increase in temperatures at 500m depth from 18°C in the south to 30°C in the north. At 1,000m depth from 20°C to 60°C. At 2,500m from 30°C to 95°C to the north. At 5km depth they vary from 60°C in the south to 150°C in the north. These results indicate significant geothermal resources with the potential for commercial development. The reports can be viewed at www.csa.ie.

1. INTRODUCTION

In Ireland in the last four years, shallow geothermal resources have seen a great increase in development. The result of the deep resource surveys has seen the interest in deep geothermal development become active.

2. RESOURCE ASSESSMENT

Surveys of geothermal resources across the island of Ireland, were carried out by the CSA Group Ltd. for Sustainable Energy Ireland, INTERREG and Action Renewables NI, with partners from Cork Institute of Technology, the Geological Survey of Ireland and the Geological Survey of Northern Ireland (Goodman, R. *et al.* 2004, 2005, Kelly, J. *et al.* 2005, O'Neill & Pasquali 2005, Jones *et al.* 2007). Thermal, geological, structural and hydrodynamic data were gathered and geothermal models created leading to the production of a GIS-linked geothermal database and the creation of a series of geothermal maps for different depths. The current status and utilisation of geothermal energy resources was reviewed and potential exploitation of the geothermal resource in Ireland was recommended in the context of International Best Practice.

The studies compiled data on warm springs and ground-water temperature trends and found that the warmest values are in the south and east. Ireland is particularly well suited

for the utilization of ground source heat pumps, due to its temperate climate and rainfall levels that ensure good conductivity and year round rain-fall recharge.

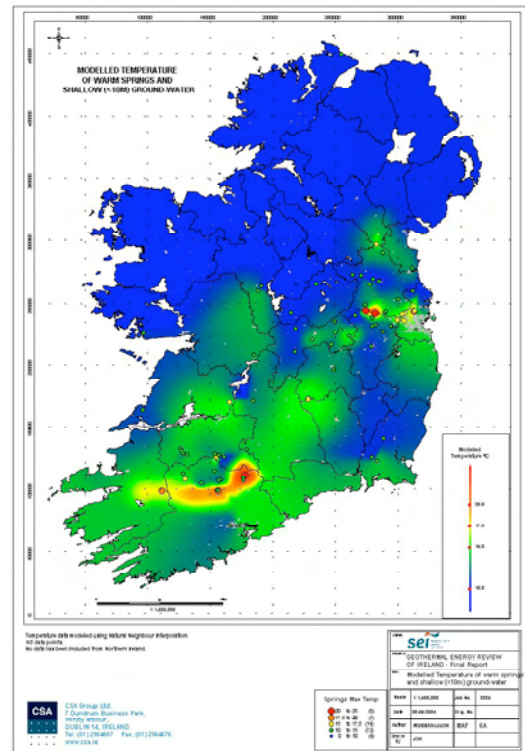


Figure 1: Two main areas of warm spring development are north Leinster (centre-east) and Mallow (south).

2. SHALLOW RESOURCES

As a result of recommendations in the Arsenal report on geothermal heat pump support (Boesworth 2004) and in the CSA report to SEI (Goodman 2004), grants for their encouragement were included in a measure to support various renewable energy installations announced by the government of the Republic of Ireland at the start of 2006. This followed on a similar 'Blue Skies' grants scheme announced for the North of Ireland. There has been a very large uptake in these grants leading to an extension to the amount of grant on offer. In the south of Ireland, this has led to the rise in the number of new installers. Training for these is provided by the equipment suppliers and also by the Centre for Renewable Energy at the Dundalk Institute of Technology, working across border with Action Renewables in Northern Ireland dealing. In the republic of Ireland an Accel funded project 'GT Skills', provides an in-company training scheme for, *inter alia*, installers, planners, geologists, engineers and architects. .

In the south of Ireland a new warm water source of 23°C was discovered at Glanworth near Mitchelstown. This has led to a new project to investigate the source of the warm water and to identify areas suitable for exploitation. This is being studied by Breacan Mooney of WYG under Dr. Alistair Allen of University College Cork. They will look at position & orientation of deep faults providing migration paths for warm water from depth. New projects to exploit the large resource of urban heat island warmed waters in the deep gravels beneath the city in Cork include:

- The conversion of the old Cork City water works on the banks of the River Lee, using the water as a heat source to heat the new LifeTime Lab in the converted buildings.
- Cork City Council offices with a shallow geothermal borehole
- University College Cork IT building using a shallow geothermal borehole for cooling and also for heating

Also the Musgraves factory project installed a field of 12 shallow closed loop boreholes to heat their building sited on Old Red Sandstone.

The huge uptake in the installation of shallow geothermal heat pumps in the last four years was initially with horizontal systems, but recently there has been increase in the use of shallow boreholes (<150m), both closed-loop and sometimes open-loop. Present estimates of heat pump installations in the south of Ireland amount to an Installed Capacity of at least 16MW.

3. DEEP RESOURCES

The 2004 CSA study: ‘Geothermal Energy Exploitation In Ireland – Review of the Current Status and Proposals for Optimising Future Utilisation’ for SEI (Goodman *et al.* 2004), led to the completion of an all Ireland study reported in the ‘Geothermal Energy Review of Northern Ireland’ report to INTERREG (Kelly *et al.* 2005). This was followed in 2005 to an ‘Assessment of the Shallow Geothermal Potential of Northern Ireland’ report to Action Renewables (Goodman *et al.* 2005).

In the deep studies, subsurface temperature data were compiled from 42 existing, open boreholes up to 810m deep (#01-541-03, Co. Galway). Data from 39 previously monitored mineral and oil exploration holes up to 2,500m deep (Drumkeeran (No. 1), Co Leitrim) were also included. These reviews of the Republic of Ireland and Northern Ireland, indicate a regional increase in temperatures at 500m depth from 18°C in the south to 25°C in the midlands to 30°C in the north. At 1,000m depth from 20°C to 40°C to 60°C. At 2,500m from 30°C to 65°C to 95°C to the north. At 5km depth they vary from 60°C in the south to 100°C in the midlands to 150°C in the north. These results indicate significant geothermal resources with the potential for commercial development. The reports can be viewed at www.csa.ie.

Further work on ‘Deep Geothermal Site Characterisation’ in a 2005 CSA report on six sites around Ireland for SEI (O’Neill & Pasquali 2005), was followed by a ‘Feasibility Study & Market Research for the Development of a Deep Geothermal Borehole on the University College Dublin Campus’ by Conodate for SEI (Jones *et al.* 2007).

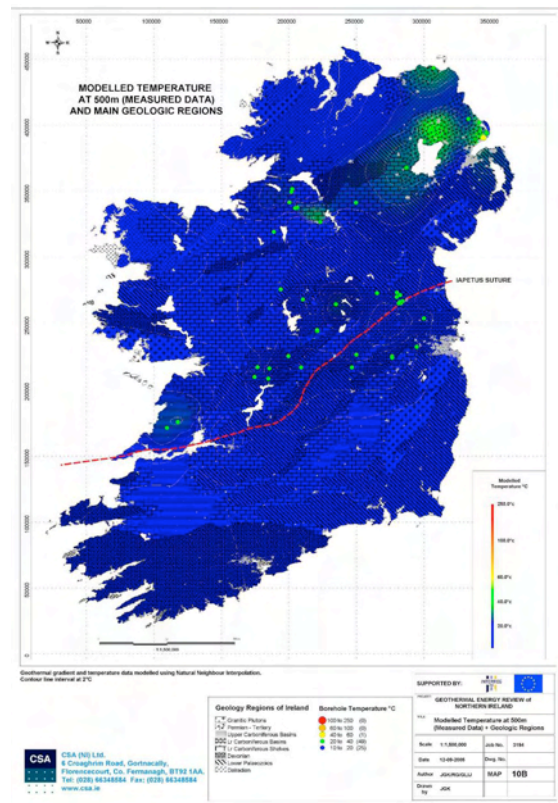


Figure 2: 500m

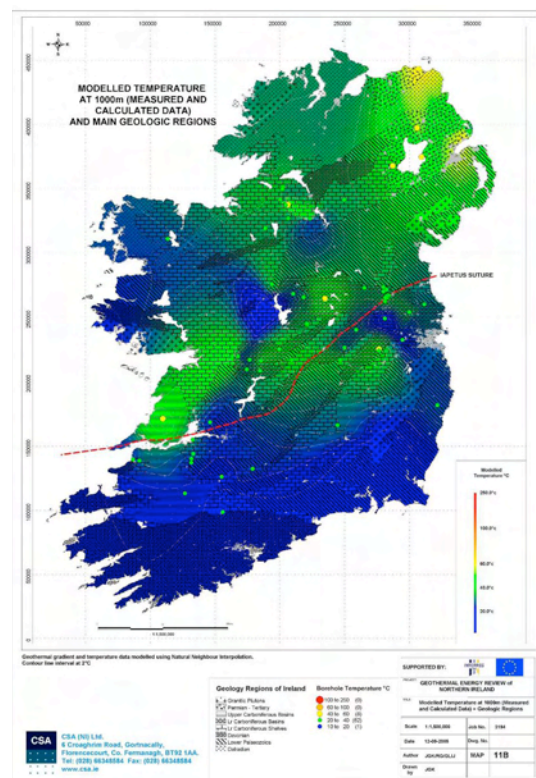


Figure 3: 1,000m

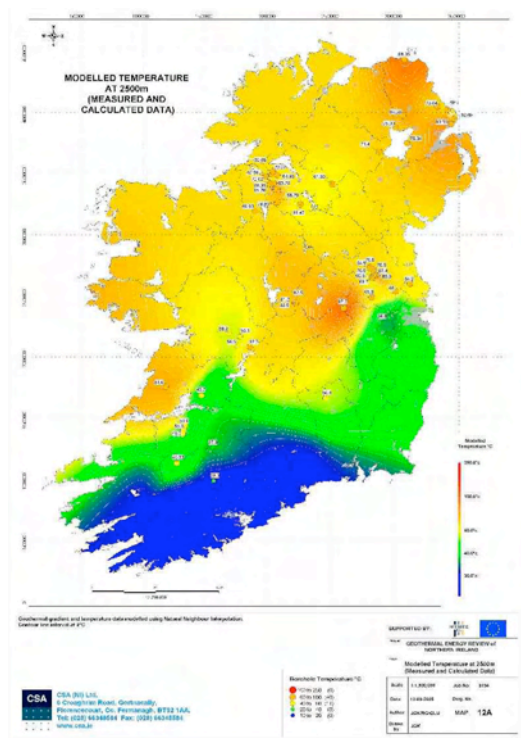


Figure 4: 2.5km

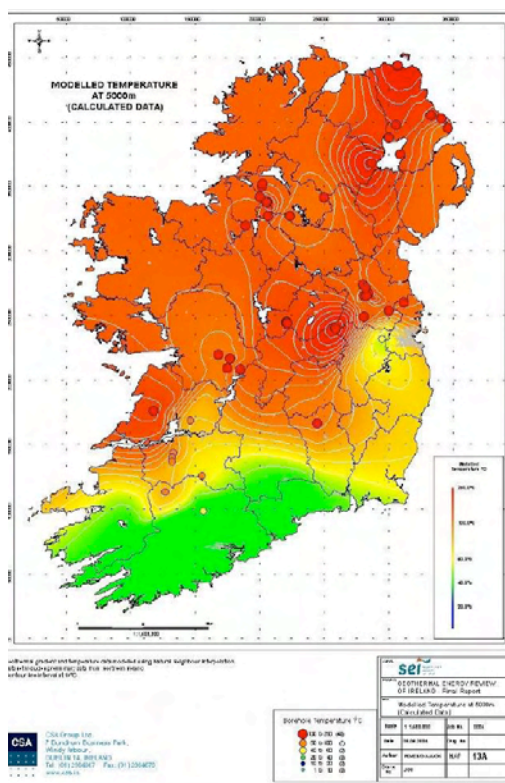


Figure 5: 5km

Figures 2-5: See a consistent trend of warmer areas to the north-east and cooler in the south at these depths

4. EUROPEAN CONTEXT - EGEN INVOLVEMENT

Following the inclusion of data from Ireland in the K4RES-H Altener study by EGEN, The CSA Group leads another Altener study on the development of framework regulations for geothermal heat in a project named GTR-H. Partners include EGEN and organizations from Holland, Germany, France, Poland, Hungary, Northern Ireland/UK and Ireland.

5. ACKNOWLEDGEMENTS

We would like to thank the following for their contributions to the projects: Viv Byrne, Conan Daly, Gildas Antin, Eric Fournier.

6. CONCLUSIONS

Ireland is particularly well suited for the utilization of ground source heat pumps. The deep results indicate significant geothermal resources with the potential for commercial development. The reports can be viewed at www.csa.ie.

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