Projects funded under SEAI RD&D programme

Since 2019

As part of the SEAI-GSI co-funding partnership, three projects were funded in the area of geothermal energy research in Ireland**.**

ThermoWell Project

Deep Standing Column Wells (DSCW) represent a promising technology to support the uptake of deep geothermal energy solutions in Ireland compared to traditional deep geothermal and large-scale ground source heat technologies. The high capital expenditure and associated risk of unknown subsurface conditions that have stunted the growth of a geothermal industry in Ireland to date could be offset by the use of high thermal capacity DSCWs. The ThermoWell project will test and demonstrate the viability of this technology by drilling a DSCW at a site at Hotwell House, Enfield, Co. Meath, where several previous geological investigations have taken place. The completed DSCW will be subject to a state-of-the-art monitoring and testing programme which will include amongst others, thermal response testing and fibre optic distributed temperature sensing. All the data collected as part of the ThermoWell project will feed into a geological and hydrogeological assessment of the finished well. A final report outlining the totality of works undertaken will be produced. This report will give a breakdown of the thermal capacity and cost of a DSCW when compared with traditional deep geothermal exploration and shallow geothermal technologies. The ThermoWell project aims to demonstrate how suitable and applicable DSCWs are to Irish geological conditions and showcase an alternative way to utilise subsurface heat resources.

Total Project Cost: €269,548
Funding Agency: SEAI; Geological Survey Ireland (GSI)
Year Funded: 2019
Lead Organisation: Gavin and Doherty Geosolutions Ltd. (GDG)
Partner Organisation(s): Geo Drilling solutions; GeoServ
James McAteer | Lead Researcher(s)

Shallowtherm project

The ShallowTHERM project will test a methodology, previously applied in Italy, to estimate the underground heat-exchange potential for shallow geothermal installations, in particular, vertical closed loop collectors. The ShallowTHERM project aims to build upon previous SEAI supported projects under the Irish Ground Thermal Properties (IGTP – RDD/00045 & RDD/00109). The proposed methodology for ShallowTHERM focuses on the use of the DCCAE/GSI Tellus airborne electromagnetic dataset linked with geographical information systems (GIS) based maps of Irish geology and the current Irish Ground Thermal Properties (IGTP) database. The project will test, and optimise for application in Ireland, a method of mapping litho-electrical units (Santilano et al., 2015, 2016). The project will apply this methodology to map litho-electrical units through association with the IGPT database and selective additional laboratory measurement. This methodological approach and the derived data, will allow thermal conductivity to be more accurately determined over significantly wider areas of bedrock coverage in Ireland (as opposed to the currently available single point measurements in the IGTP database). The available thermal conductivity data will allow for direct input into the ground source vertical closed loop collector suitability maps recently published by GSI and improve the understanding and potential for deployment of Ground Source Heat Pump (GSHP) systems.

Total Project Cost: €61,584
Funding Agency: SEAI; Geological Survey Ireland (GSI)
Year Funded: 2019
Lead Organisation: GeoServ Solutions
Collaborators: Geothermal Association of Ireland
Riccardo Pasquali | Lead Researcher(s)

DIG project; De-risking Ireland's Geothermal Energy Potential

Potential deep (greater than 400m) geothermal resources in low- to medium-temperature settings remain poorly understood and largely untapped in Europe. The DIG project will explore the potential for low-enthalpy geothermal energy on the island of Ireland by means of integrating multi-disciplinary, multi-scale geophysical, geological and geochemical data analysis and interpretation. Building on tested and validated methods and the rich and diverse datasets from previous and on-going successful Irish research projects (ISLE-MT, IRETHERM, G.O.THERM.3D, SWEMDI, Ireland Array, Tellus), DIG aims to (i) determine the regional geothermal gradient with uncertainty estimates across Ireland using new and existing geophysical (surface heat flow, active and passive seismics, magnetotellurics,

magnetic and gravity anomalies) and geochemical-petrophysical datasets (radiogenic heat production and thermal conductivity), (ii) investigate the thermo-chemical crustal structure and secondary fracture porosity in Devonian/Carboniferous siliciclastic and carbonate lithologies within and adjacent to the Munster Basin, southern Ireland, using wide-angle seismic, gravity and geochemical datasets, (iii) identify and assess the available low-enthalpy geothermal resources at reservoir scale in the Munster Basin, i.e., Mallow warm spring case study, by joint interpretation of electromagnetic and passive seismic methods complemented by a structural geology and new hydrochemistry programme to characterise deep reservoir water composition in order to identify convective pathways and mixing zones using environmental tracers, and (iv) design and implement communication, dissemination and exploitation of the project results to a range of stakeholders (industry, agencies, public) together with the Geothermal Association of Ireland, Geological Survey Ireland (GSI), Irish Centre for Research in Applied Geosciences (iCRAG) and SEAI.

Total Project Cost: €775,606
Funding Agency: SEAI; Geological Survey Ireland (GSI)
Year Funded: 2019
Lead Organisation: Dublin Institute for Advanced Studies (DIAS)
Partner Organisation(s): University College Dublin (UCD)
Collaborators: University College Dublin (UCD); Earth Science Institute of the Slovak Academy of Sciences; University of Vienna; University of Sydney; Geophysical Consultant, The Geothermal Association of Ireland, UCC
Brian M. O'Reilly & Duygu Kiyan| Lead Researcher(s)

GEONORM: Geothermal Energy and Optimal Renewable Mix at UCD

The GEONORM project will showcase the impact of geothermal energy in decarbonising a district heating network as part of a broader renewable energy mix. The project focusses on the existing District Heating System at University College Dublin Belfield Campus (UCD-DHS), which currently combines a CHP (combined-heat-and-power system) and gas boilers, supplemented by biomass and solar energy sources. The project capitalises on the ideal geological setting of UCD Campus, which is located within the most promising geothermal basin in Ireland and is adjacent to the principal Blackrock-Newcastle fault. Geological and geophysical analysis will de-risk the geothermal resource potential, by investigating the subsurface structural and stratigraphic architecture and the 3D distribution of petrophysical and geothermal properties. Basin modelling and simulations will provide predictions of the energy production capacity of a conceptual geothermal system (CGS), for a variety of scenarios, including single-well and doublets, open and closed-loops, for a range of reservoir depths (1km-3km) and state-of-the-art geothermal energy extraction technologies. GEONORM will quantify the potential of the CGS to partially replace existing gas boilers to further decarbonize the UCD-DHS. Optimal Renewable Energy Mix modelling and long-term techno-economic assessment will finally be performed including all UCD-DHS energy

sources (natural gas, biomass, solar and CGS). The project results will inform future development of UCD's DHS infrastructure and transitioning towards sustainable energy goals and decarbonisation of heat energy. A set of generalised tools and guidelines will be provided which can accelerate the development of future public and private DHS developments.

Total Project Cost: €348,837
Funding Agency: SEAI; Geological Survey Ireland (GSI)
Year Funded: 2021
Lead Organisation: Gavin and Doherty Geosolutions Ltd. (GDG)
Partner Organisation(s): Irish Centre for Research in Applied Geoscience (iCRAG); UCD Energy Institute (EI); Dublin Institute of Advanced Studies (DIAS); Causeway Geothermal (CG)
James McAteer| Lead Researcher(s)

HYSS: Hydrogen Salt Storage Assessment

HYSS is a feasibility study to assess the potential for excess wind energy to be stored as Hydrogen gas in manmade subsurface salt caverns directly below or adjacent to offshore wind farm locations around Ireland.

The project will utilise the team's regional geological knowledge to define offshore areas (to a water depth of 500m) where geological salt formations may be present. Existing oil & gas industry datasets will be interrogated to delineate the extent, thickness, and depth of burial of these geological salt formations.

Phase 1 (WP2) of the project will focus on the Kish Bank Basin offshore Dublin where exploration wells encountered salt formations. State of the art "PreStack Depth Migration" reprocessing of 130km of existing 2D seismic data was completed in 2012 and is freely available to the project. This data will be integrated with other seismic datasets to delineate potential cavern storage size and distribution, to evaluate the maximum Hydrogen storage potential of the Kish Bank Basin. Finally the potential salt cavern storage sites will be integrated with existing surface datasets, including INFOMAR, seabed cores, traffic routes and environmental considerations, to assess potential surface constraints for salt cavern infrastructure. A common risk segment map of surface and subsurface risks will be produced which will effectively delineate high graded areas.

Phase 2 (WP 3- 6) will utilise the same workflow to assess other locations offshore Ireland, specifically the Celtic Sea Basins to the south, Irish Sea Basins to the east and basins on the Atlantic Margin to the west.

The HYSS project will also review the potential of CCS within salt as well as the potential of future repurposing of existing oil & gas infrastructure for Hydrogen storage, such as the

Corrib Gas Field where salt formations are known to exist above and below the producing gas reservoir.

Total Project Cost: €430,280
Funding Agency: SEAI; Geological Survey Ireland (GSI)
Year Funded: 2021
Lead Organisation: SLR Environmental Consulting (Ireland) Limited
Partner Organisation(s): Illmatic Energy
Keith Byrne | Lead Researcher(s)

GeoStorIE project

Ireland's offshore sedimentary basins are of substantial interest for geological storage to decarbonise the energy system and provide seasonal energy storage. This study aims to map the extent, depth and nature of Ireland's offshore geostorage complexes, and characterise reservoir and seal heterogeneity that may impact safe long-term geological storage. This project will build on legacy exploration data including seismic, well data, and core, and recent research into the offshore basins by the Irish Research Centre of Applied Geosciences (iCRAG), integrated with the recent Standard Stratigraphic Framework of Offshore Ireland (DECC, 2021). Geostorage complexes will be characterised through new interpreted maps of structure, depth, thickness, reservoir properties (porosity, permeability, heterogeneity, reservoir quality), reservoir conditions, containment risk and storage capacity. We aim to collect new data in areas with data gaps for reservoir quality and reactivity, heterogeneity, and implement a hyperspectral scanning programme to characterise key storage intervals. A risk assessment for the storage complexes will address leakage potential due to faulting, facies variations and well penetrations. Storage potential fairway maps integrating the different parameters will be created considering the most up to date safe geological storage protocols. Resulting maps will be compatible with GIS viewers. This project will provide the first database with a compilation of all offshore data relevant to geological surface storage (H2, CO2) and allow industry, government and interested stakeholders to interrogate and spatially plan for potential future offshore developments for the energy transition.

Total Project Cost: €748,500
Funding Agency: SEAI; Geological Survey Ireland (GSI)
Year Funded: 2024
Lead Organisation: UCD
Kara English | Lead Researcher(s)