



Evaluation of the potential of the Clare Basin, SW Ireland, for onshore carbon sequestration using electromagnetic geophysical methods

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Carbon capture, sequestration and long-term storage (CCS) is a critically important and intellectually and technologically challenging bridging technology for assisting humanity to migrate from its dependence on fossil fuels to green energy over the next half century. The IRECCSEM project (www.ireccsem.ie) is a Science Foundation Ireland Investigator Project to evaluate Ireland's potential for onshore carbon sequestration in saline aquifers by integrating new electromagnetic geophysical data with existing geophysical and geological data. The main goals of the project are to determine porosity and permeability values of the potential reservoir formation as well as to evaluate the integrity of the seal formation.

During the summer of 2014, a magnetotelluric (MT) survey was carried out in the Carboniferous Clare Basin (SW Ireland). Data from a total of 140 sites were acquired, including audio-magnetotelluric (AMT), broadband magnetotelluric (BBMT) and long period magnetotelluric (LMT) data. These new data added to existing MT data acquired at 32 sites during a feasibility pilot survey conducted in 2010. The nominal space between the 2014 sites was 0.6 km between AMT sites, 1.2 km between BBMT sites and 8 km between LMT sites.

The electrical resistivity distribution beneath the survey area was constrained using three different types of electromagnetic data: MT impedance tensor responses (Z), geomagnetic transfer functions (GTF) and inter-station horizontal magnetic transfer-functions (HMT). A newly-computed code based on the Generalized Archie's Law and available data from boreholes were used to relate the obtained geoelectrical model to rock properties (i.e. porosity and permeability). The results are compared to independent geological and geophysical data for superior interpretation.