

Lessons Learnt Report #1

2021/ARP009 Ground Source Systems Pty Ltd
Yanderra Shallow Geothermal Solar System



Contents

1.	Project Details	3
2.	Executive Summary.....	4
3.	Project Overview and Progress.....	5
4.	Key Learnings	6

1. Project Details

Project Title	Ground Source Systems Yanderra Shallow Geothermal-Solar Systems Demonstration
Recipient Name	Ground Source Systems Pty Ltd (ABN 82 164 680 424)
Project Participants	The University of Melbourne (ABN 84 002 705 224) Fourth Element Energy Pty Ltd (ABN 41 644 610 926)
Primary Contact Name	Brad Donovan
Contact Email	brad@groundsourcesystems.com.au
Reporting Period	Nov 2021 - June 2022
Submission Date	10 August 2022

This Project received funding from ARENA as part of ARENA's Advancing Renewables Program.

The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.

2. Executive Summary

Ground Source Systems Pty Ltd is developing a hybrid geothermal system for heating and cooling a commercial poultry breeding facility in Yanderra, NSW to demonstrate its effectiveness and its financial & environmental benefits to the rural industries. The hybrid geothermal system comprises a ground-source heat pump (GSHP) system in part fed by a solar PV, and with gas back-up. A GSHP system is being installed to replace in full or in part LPG (Liquefied Petroleum Gas) as a fuel for heating and evaporative cooling for a single poultry shed. The typical mid-sized poultry operation at the Yanderra demonstration site is expected to provide an important case study to drive uptake across the sector.

Contracts were signed between November 2021 and February 2022, with the geothermal-solar system expected to be operational by November 2022. The system is currently in construction phase. This lessons learnt report focuses on the lessons gained through the design, contracting and construction phases of this project. Specific technical lessons learnt on this project will be shared in future reports.

The lessons learnt explored in this report focus on four key learnings:

- There is a lack of market maturity for shallow geothermal projects in the agriculture sector. Particularly, there is limited depth of ground source heat pump designers and providers in Australia able to demonstrate a comprehensive understanding of the specific needs of the poultry industry.
- There is a variety of ways farmers operate the broiler facilities, impacting on thermal load demand to satisfy.
- A good site characterisation is required as well as good site management, often needing with quick decisions to be made during ground loop installation (e.g., dealing with floaters / big boulders/ rocks on site) and challenging weather conditions.
- Commercial operation of the poultry sheds continues, and installation of the new systems must be planned around this schedule. Therefore, careful planning is required.

3. Project Overview and Progress

The overall purpose of the project is to demonstrate a hybrid geothermal system for heating and cooling a commercial poultry breeding facility in Yanderra, NSW. The hybrid geothermal system comprises a ground-source heat pump (GSHP) system in part fed by a solar PV, and with gas back-up. A GSHP system will be installed to replace in full or in part LPG (Liquefied Petroleum Gas) as a fuel for heating and evaporative cooling for a single poultry shed. The typical mid-sized poultry operation at the Yanderra demonstration site is expected to provide an important case study to drive uptake across the sector.

During this reporting period, a revised ground loop design for the project was completed on site. To speed up installation and while waiting for civil works to commence, particularly excavation and trenching, ground loop in a slinky configuration were pre-manufacturing (Figure 2). The loops were then placed on site, and pressure tested for quality assurance and quality control. Figure 1 shows the loops just before backfilling, placed next to the demonstration shed.

The construction of hybrid ground source heat pump plant is underway with header piping end completed and extended to plant location. Fan coils and switchboard installation is also underway, with the installation of heated water lines to feed the fan coils in the chicken shed completed. As part of the switchboard install, the power supply conduit was run in the shed. Fan coils themselves will be mounted inside the shed and connected to these line ends and wired once delivered on site. This latter part of works is most likely to occur in the next batch of birds (i.e., next reporting period), this is as scheduled and agreed with the farm management team as the shed continues its normal commercial operation while this project's works are underway.

Press release has also been planned and drafted. Members of an Industry Reference Panel has been identified, representing various stakeholders for initial feedback and suggestions in commercialisation strategies.



Figure 2. Horizontal slinky loop pre-manufacturing



Figure 3. Ground loop placement before backfilling

4. Key Learnings

4.1 Lesson learnt No. 1: Lack of market maturity for shallow geothermal projects in the agriculture sector

Category: Commercial

Objective: Improving understanding of market needs and supply chains

Detail:

There is a lack of market maturity for shallow geothermal projects in the agriculture sector. Particularly, there is limited depth of ground source heat pump designers and providers in Australia able to demonstrate a comprehensive understanding of the specific needs of the poultry industry.

Earthworks as a service may need better integration in the rural settings and access to supply of earthworks is constrained by large infrastructure and construction booming in nearby.

Implications for future projects:

Ground Source Systems expects this situation will change over time as new, and more mature, GSHP suppliers in the chain enter the Australian market and expertise develops for suppliers. Future projects will be able to leverage the learnings and market developments that this project has enabled.

4.2 Lesson learnt No. 2: Complexity in determining thermal load demand to satisfy

Category: Technical

Objective: Improving understanding of sizing of systems

Detail:

Ground Source System's experience with other poultry farms and the one here at Yanderra NSW shows that there is not one-size-fit-all. This is because there is a variety of ways farmers operate the broiler facilities, impacting on thermal load demand to satisfy.

Implications for future projects:

While there is no one-size-fit-all solution to the sizing required for space heating and cooling of the broiler facilities, it may be possible to identify the most common practice across farms and regions in the future as the market grows and the industry gain experience and/or though targeted installations across the country.

4.3 Lesson learnt No. 3: Changing ground and weather conditions requires quick decision making on site

Category: Technical and Commercial

Objective: Improving site characterisation and excavation/drilling for installation of ground loops

Detail:

There are significant costs implications to changing ground conditions. A good site characterisation is required prior to start of design and installation of a GSHP of substantial size (e.g., 100 kW). During the construction this system, we encountered these changes and needed to deal with rock floaters, big boulders and rocks on site and quickly adjust placement of the ground loops. Removal of large boulders and floaters would have been too costly. Delays to the construction program adds to costs.

Implications for future projects:

It is advisable to not underestimate the need for good site characterisation and good site management skills, with fluid communications with geothermal designers to make quick adjustments to suit the site conditions. This will avoid cost overrun and having civil work gear idle on site, which is costly.

4.4 Lesson learnt No. 4: Complexity in planning installation works around continuing commercial operations of retrofitting poultry sheds

Category: Commercial

Objective: Improving of planning and costing of work in sheds

Detail:

During retrofitting of the poultry sheds it is hard for farmers to stop or delay their commercial operations, in the case of Yanderra and most other similar farms, often farmers do not have control on when the batches of birds go in and out of the sheds. As a result, commercial operation of the poultry sheds continues, and installation of the new systems must be adjusted accordingly. This may have implications on the program and delay commissioning.

Implications for future projects:

Installation of the geothermal-solar systems must be planned around the commercial operation of the sheds for all gear to be installed inside them. Biosecurity measures are strict and activities inside shed needs to be scheduled for during the short cleaning period between batches of birds. Clear and fluid communications with farm managers are required to avoid lengthy and costly program delays due to this constrain.