Planning for Ground Source Heat Pumps

Highlights

Ground source heat pumps (GSHPs), provide efficient, low-carbon heating, which can contribute to emissions reduction in Aotearoa New Zealand (A-NZ) and a sustainable energy future.

The long-term environmental benefits and operational savings of GSHPs are recognized globally. GSHPs are widely deployed for residential and commercial heating and cooling, industrial processes such as product drying, and in controlled growing environments within the primary sector.

In A-NZ the policy instruments for GSHPs are ad hoc, lack national guidance and a comprehensive nationwide assessment of opportunities, needs and risks. Government and industry have an opportunity to better utilise this renewable energy technology, enable wider adoption of GSHP systems and raise public awareness to accelerate the transition to a low-carbon, resilient energy future. To enable this:

Central government can:

Include GSHPs in environmental, climate change, emissions reduction and energy policies and programmes to achieve co-benefits and improve awareness. E.g., GSHPs should be included in the New Zealand Energy Strategy.

Develop national **strategy**, **standards and guidelines** for GSHPs

Showcase GSHPs in public buildings and public housing developments. Encourage cluster installations and district heating for new developments and industries.

Provide **financial incentives** including grants, tax rebates, low interest loans and government guarantees to assist capital investment in GSHPs.

Develop GSHP-specific **resource consent application guides and templates** for local authorities, to ensure nationally consistent practice.

Define key terms such as "ground-source heat pumps", "open loop", "closed loop", and "non-consumptive takes", and add them to relevant policies for consistency.

Develop geospatial information about GSHP **suitability** and make it publicly available.

Fund and direct geothermal and groundwater research to better understand their potential as renewable energy sources and for thermal energy storage, as well as the impacts of energy projects to these systems.

Fund **skills training** and **public education**.

Local government can:

Collect and share data on **all** GSHP systems – including unconsented ones - so long-term cumulative effects on groundwater systems and ground heat can be properly evaluated.

Provide GSHP specific resource consent **application forms** based on central government's templates.

Showcase GSHPs in public buildings. Include GSHPs in relevant council plans and information pages (building, heating, etc.).

Build future capability and capacity through relevant technical expertise and regular training to staff processing GSHP consents.

Raise public **awareness** regarding GSHPs' potential and benefits.

Industry, including the Geothermal Heat-pump Association of New Zealand (GHANZ), installers, developers, and architects, can:

Expand on technical standards and design matters.

Provide **training** to members.

Advocate for policy change.

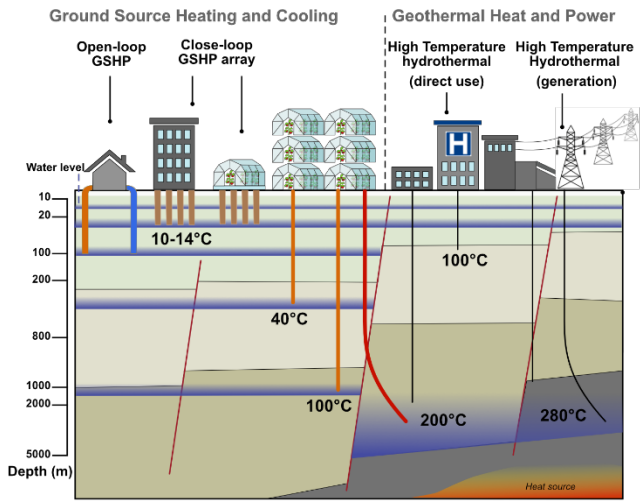
Who is this for?

This brief provides an overview for policymakers and planners on the current GSHP planning process, and how the regulatory framework may impact uptake. It may also be helpful for people in the energy and building sectors interested in GSHP applications.

Overview

GSHPs are a renewable energy technology. They utilise geothermal temperatures from about 10° – 100° C. They heat or cool space by extracting and transferring subsurface heat stored in soil, rock, surface water or groundwater (EECA & GNS Science 2013, Thrush 2022). GSHP systems are one of the most energy-efficient technologies for space heating and cooling (Gaur et al. 2020).

GSHP systems reduce carbon (and other) emissions, improve air quality, reduce peak demand for grid energy, and provide certainty during energy transitions as well as contributing to energy security (Gaur et al, 2020; Grover, 2021; IEA, 2022; Lowes, 2022).



Examples of existing GSHP-systems in NZ include the Christchurch Airport, Christchurch City Council and ECAN Council buildings, Canterbury University, Lower Hutt City Council, Hilton Hotel in Queenstown, and the Wairakei Golf Club. There is significant opportunity for greater use of GSHP technology in NZ.


Lower Hutt City Council Building heated by a GSHP

GSHPs have very low operating costs, though the high initial capital outlay, compared to other heating technologies, could provide a barrier for adoption. Sector-specific policies and faster permitting procedures are key incentives used by overseas governments for the wider adoption of GSHPs (Gaur et al, 2020; European Heat Pump Association, 2023). In addition, financial incentives - grants, loans, subsidies, government guarantees (insurance) - are crucial to encourage increased uptake of GSHPs. Industry initiatives, provide support for adoption of the technology amongst users.

State of play

The status quo and recommendations for better GSHP planning are based on a study by GNS Science.

To understand the current permitting process for GSHP activities and its regulatory context, and the implications on GSHP development, the project team reviewed local and international literature and policy documents and analysed current GSHP resource consents with regional and district/city councils. The findings are:

- Most of the GSHP-related resource consents that were readily available from the past decade are within the Canterbury and Otago regions.
- The majority of the GSHP systems installed are for commercial and public buildings.
- Most of the GSHP systems consented are open loop systems utilising groundwater through borehole. This requires applications for a water permit and a discharge permit.
- Under the RMA, the duration of water permit and discharge permit cannot exceed 35 years (s123A), though a few of the reviewed consents expire much sooner, ranging from eight to twenty years. GSHP systems typically have a 20–40-year life expectancy (Weeratunge et al 2021) and a high initial investment cost, which requires a longer consent duration to reduce the uncertainty for investors and users.
- Environment Canterbury provides for the adoption of GSHPs by permitting certain water takes for district heating and cooling schemes in the Canterbury Land and Water Regional Plan (Rule 9.5.15).
- Councils may risk not having the full picture of local GSHP systems when relevant activities are permitted in plans, which makes it harder to monitor and assess the accumulated effects.
- Iwi's recommendations have important indications for consent decisions including consent durations. Applicants and councils have obligation to consult with tangata whenua and assess proposed projects' effects on tangata whenua interests.
- There is currently no one organization, such as government department or research institute, responsible for collecting the country's GSHP-related data which can be used to support nationwide evaluation and planning.
- GSHPs are not mentioned in many existing climate change and energy legislation, policies and programmes, such as the Emissions Reduction Plan, Energy Efficiency (Energy Using Products) Amendment Regulations 2020, the Healthy Homes Standards and Warmer Kiwi Homes programme. From the Terms of Reference: New Zealand Energy Strategy (Ministry of Business, Innovation & Employment 2022), it is unclear if the New Zealand Energy will include GSHPs.

Recommendations

The diversity of local planning rules across New Zealand and differing geological and economic conditions makes it difficult to have a "one size fits all" solution to GSHPs. There is, however, potential for GSHPs to play a significant role in A-NZ's transition to a low-carbon and resilient energy future. Key recommendations for policymakers to support update of GSHPs are:

1. Develop a national strategy for GSHPs as part of enabling a just transition to a low(er) carbon energy future.
2. Collect and collate necessary data through a national monitoring programme, including geospatial assessment and screening for GSHPs' suitability based on ground heat, hydrogeological, economic and regulatory factors to support management of subsurface resources and evaluation of GSHP systems.

3. Standardise consenting processes, through the provision of baseline data and key definitions to support regulatory activities. nationally consistent guides and templates, to support councils and enable GSHP installations.
4. Government should subsidise GSHP systems and showcase GSHPs to deliver multiple benefits and boost confidence. Government agencies can take the lead in demonstrating GSHPs in public buildings. Government could facilitate dialogues between investors, manufacturers, installers and policymakers.
5. Educate policymakers, professionals and the general public about the benefits and risks, and identify where to upskill related workforce.

Research & Development Needs

- Better understand GSHP technology and thermal energy storage potential, and the impacts of such energy activities on subsurface and groundwater systems.

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Selected Reading

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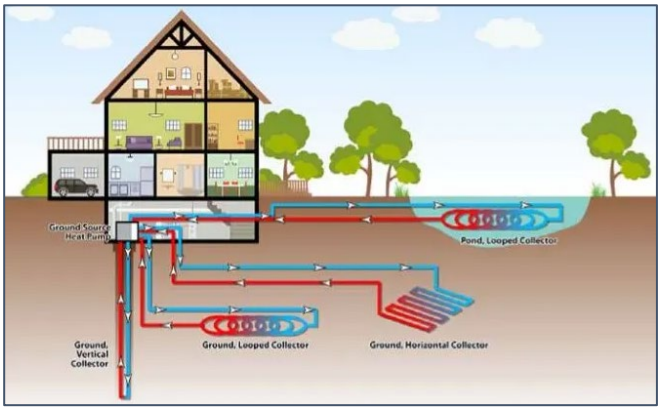

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