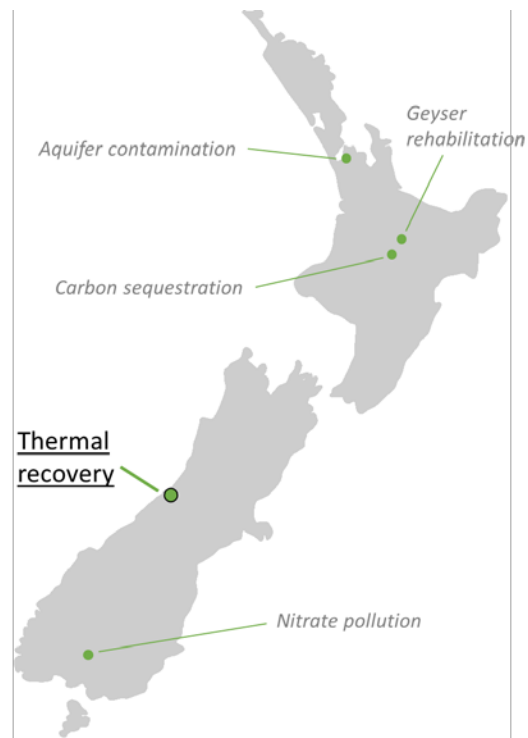


Thermal recovery of Bitumen from West Coast tar sands

Bitumen is a viscous oil product used in road construction. Because it doesn't flow like traditional oil, it is often produced by surface mining and separation. However, in recent decades, thermal recovery by steam injection has emerged as a technology to extract deep bitumen deposits from tar sands. By heating the bitumen, its viscosity is reduced several orders of magnitude so that it can be extracted through a well.

In 2018, the New Zealand government announced a ban on Oil and Gas exploration. Three years later, in the face of a pandemic that has cratered the economy, the ban has been deferred by a decade and new projects are being developed. On the West Coast of the South Island, a pilot scale thermal recovery project has been completed, and resource consent is being sought for an expanded operation.



The pilot project, which began in March 2021, involved two cycles of 260°C steam injection into a well at rates of up to 460 tonnes per day, followed by production of an oil-water mixture. Pressure and temperature were monitored at 350m depth in the well, increasing during the injection phases and decreasing during production.

Given the success of their pilot study, Todd Energy have proposed a commercial joint venture with Ngāi Tahu. Commencing in June 2022, the project would involve steam injection up to 1000 tonnes per day for 60 days, followed by 90 day production periods. The cycle would then repeat. The resource consent application is supported by the New Zealand Transport Agency, who are concerned about overreliance on bitumen imports from Canada. The application is opposed by Greenpeace and a group of local farmers, the latter who are concerned by leaching of toxic organics into groundwater. These contaminants are known to dissociate from the bitumen above 240°C.

You have been retained by the applicant to develop a numerical modelling study that demonstrates the safety of the proposed operation. To support your study, the following data have been made available:

- Time series records of steam injection, and water and oil production during the pilot study.
- Time series records of pressure and temperature during both injection and production phases.
- Reservoir engineering reports indicating trace amounts of non-toxic oil products in local groundwater, assumed to have been driven away from the near well region by the elevated pressure.

Project expectations:

You should undertake a computer modelling study that will assist the applicant in their resource consent application, in particular addressing the noted concerns of other stakeholders where they are relevant to the study. The model you develop should be defensible, reflective of reality, and take appropriate account of uncertainty. You will be required to communicate the model findings in both oral and written formats.

Recommended literature:

Summary of a similar pilot project conducted in Alberta, Canada in 2012.

Mohebati, MH, D Yang, J MacDonald. (2014), "Thermal Recovery of Bitumen From the Grosmont Carbonate Formation—Part 1: The Saleski Pilot". *Journal of Canadian Petroleum Technology* 53, 200-211.