Geothermal Potential in Alberta:

Direct Heat From Oil and Gas Wells

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INTRODUCTION

This study looks at using geothermal heat from oil & gas wells in Alberta (Figure 1) to offset the burning of natural gas for domestic and commercial space heating, removing approximately **1.39 Mt CO_2e per year** [1]. This geothermal heat is effectively carbon neutral and harnessing it requires placing a heat exchange system at the surface of a well that will transfer heat from the produced fluid to a circulating fluid used for the heating of homes.

CanGEA quote:
"There are 440,000 of these wells in Alberta alone and while they're not all going to be in the right place and at the right cost, certainly when you have that big of a sample set, there's going to be lots of promise" [2].

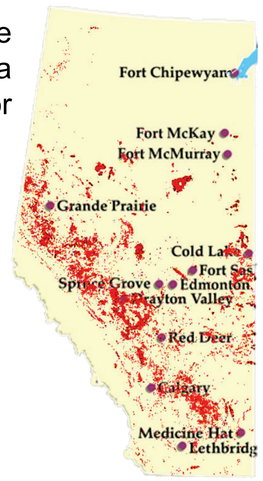


Fig. 1. Map of wells within Alberta.

METHODS

Red Deer, AB was chosen as a sample area to develop a business-as-usual (BAU) scenario for space heating requirements and well potential in Alberta.

For BAU case:
i. Well temps obtained from geoSCOUT & transfer fluid assumed to be 22℃ (Table 1)
ii. Natural gas use for space heating was provided by CanESS [3]

Table 1. Well heat potential <10km from Red Deer

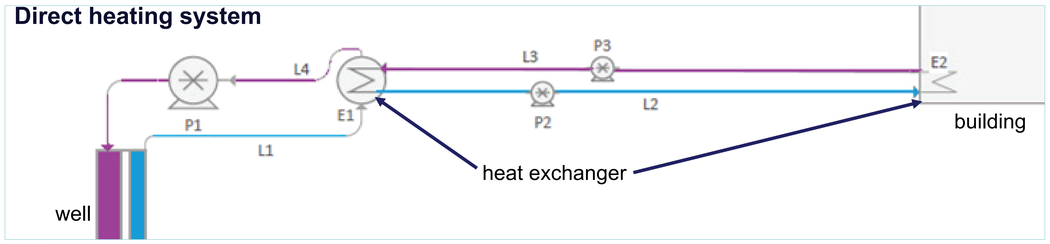
Well Type	Power (MW)
Suspended	42
Abandoned	512
Producing	73
Total	**627**

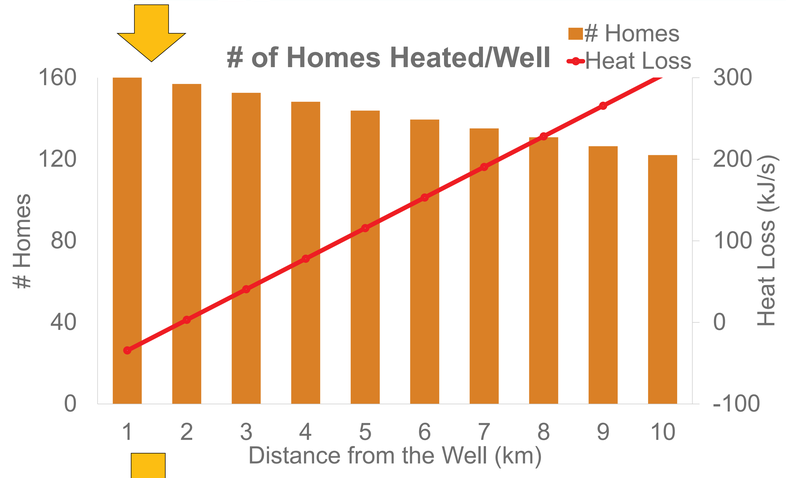
Major Assumptions:

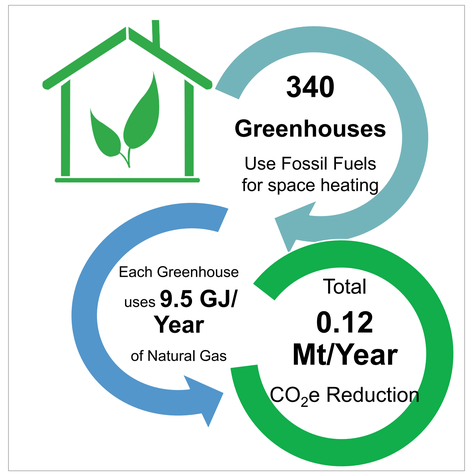
- *Temperature of the producing fluid at the surface is the same as downhole*
- *Carrier fluid would be ethylene glycol (density of 1113 kg/m3, heat capacity of 3.37 kJ/kg K)*
- *Only used wells with data available (more wells in area but no available data)*

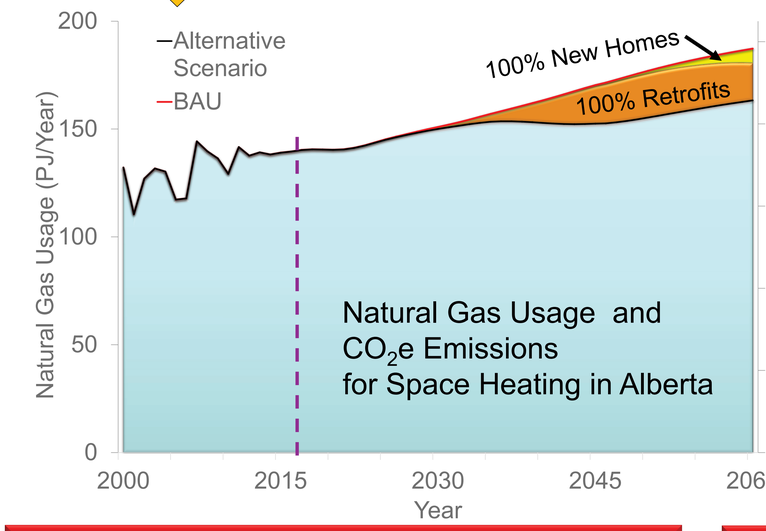
RESULTS

Alternative Scenarios: Geothermal space heating for Residential & Greenhouses

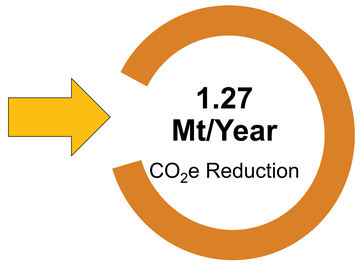








Assuming only **13%** of Albertans live within 10 km of wells



DISCUSSION

The major constraints with using existing wells is location and low temperatures (<80℃).The wells need to be within 10km of buildings to be economic and minimize heat loss [4]. Geothermal systems could be built into new homes, but costs associated with retrofitting may be a limiting factor.

Adding heat pumps can increase the number of homes heated from one well, decreasing the number of wells required to implement geothermal heating. A heat pump would need 1 GJ/s of electricity for every 3 GJ/s of heat produced [5]. Doubling the number of houses heated per well would require 0.61 kJ of electricity annually per heat pump. Heat pumps could be used to also increase the distance that heat travels, but due to the price of the pipelines, it would be more economic to stay within 10km.

CONCLUSIONS

Using heat from oil and gas wells to replace natural gas space heating in homes and greenhouses is a gradual step towards reducing Alberta's GHG emissions. Further applications to increase emission reductions include using geothermal space heating in work camps and warehouses.

To implement geothermal energy, there needs to be government incentives to push for early adoption and help fund projects. Making it easier to obtain rights to abandoned wells would help harvest lost potential energy, and eliminate the need to seal up abandoned wells. Furthermore, using geothermal sources outside of oil and gas wells would allow more Albertans to access this energy source and contribute to higher GHG reductions.

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