
CampusEnergy2021
BRIDGE TO THE FUTURE
Feb. 16-18 | CONNECTING VIRTUALLY
WORKSHOPS | Thermal Distribution: March 2 | Microgrid: March 16

After 40 years, Time to Complete the 1979 University of Regina GeothURmal Project

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UNIVERSITY OF REGINA

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Q&A Will Not Be Answered Live

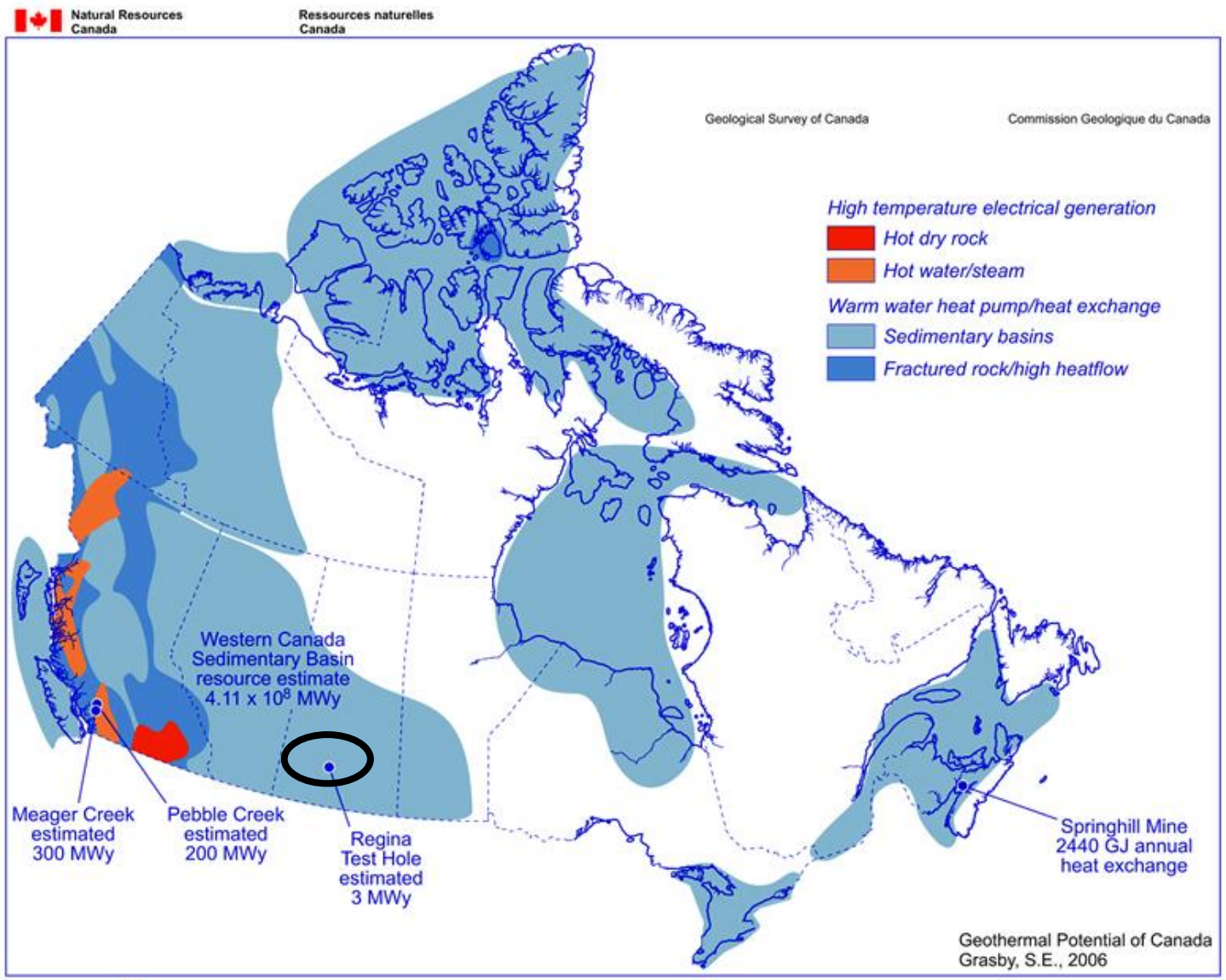
Please submit questions in the Q&A box.
The presenters will respond to questions off-line.

Outline

1. History of The University of Regina Geothermal Project
2. Geothermal Potential
3. University of Regina GeothURmal Project Proposal
4. Why Not Geothermal? Rationale
5. Current Status, Next Steps and Focus Groups
6. Summary

Geothermal Potential in Canada

- Geothermal development potential has widespread application throughout Canada.
- Western Canada Sedimentary Basin covers a large portion of Southern Saskatchewan



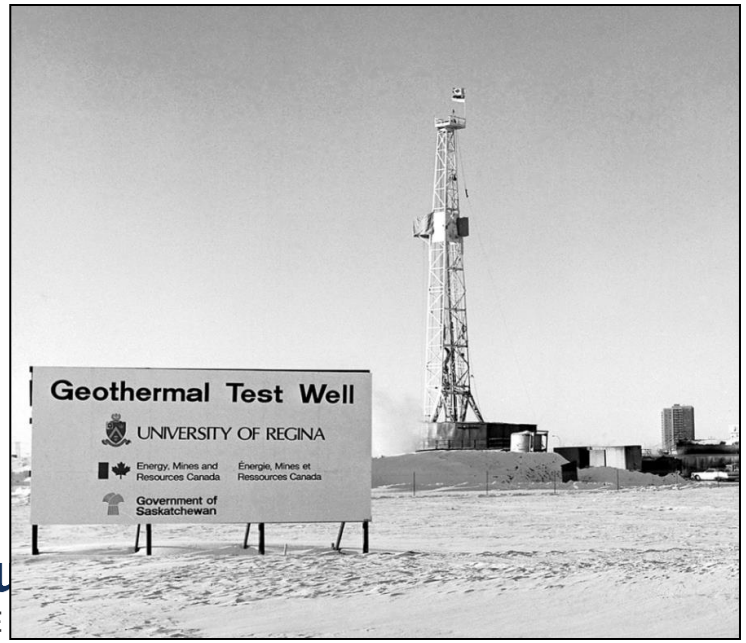
http://www.geni.org/globalenergy/library/renewable-energy-resources/north%20america/Geothermal/canada_files/canada-geothermal.jpg

Regina Geothermal Test Well Winter 1978-79

Objectives:

1. **To demonstrate sedimentary basin geothermal energy in Canada.**
2. **To supply air and hot water heating for a new sports complex.**

- **Promoted by U of R President, Dr. Lloyd Barber**
- **Funded largely from Energy, Mines and Resources Canada (NRCan), Govt. of SK**



Drilling the first geothermal test well on a cold day in January 1979! (Photos by Dr. Laurence Vigrass)

Regina Geothermal Test Well Winter 1978-79

- **A single exploratory test well drilled to 2226 m, cased to 2034 m, open last 192 m.**
- **Project never completed, second well never drilled. Capped in 1999.**
- **Several factors including: a drop in fossil fuel prices; changes in government; increased availability & renewed optimism after fuel crisis of the 70's.**

The first geothermal test well January 1979 and the site today 2018 Photos L. Vigrass, J.Dale

Regina Geothermal Test Well Winter 1978-79

- **Cambrian-Ordovician Aquifer (Deadwood-Winnipeg) hosts ~111 net metres of effective sandstone porosity in several connected units.**
- **Average porosity over the section is 13.2%, with average permeability values of 350 mD *(millidarcy)***

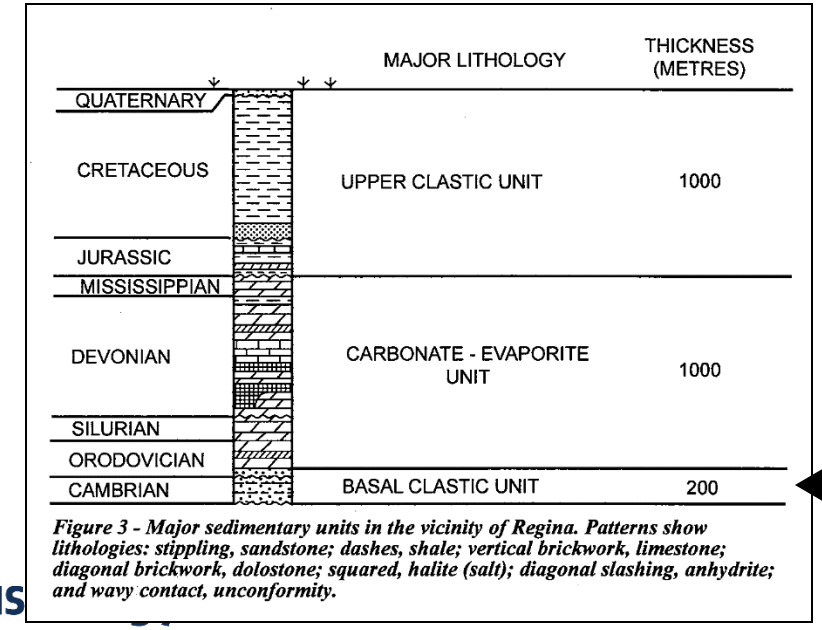
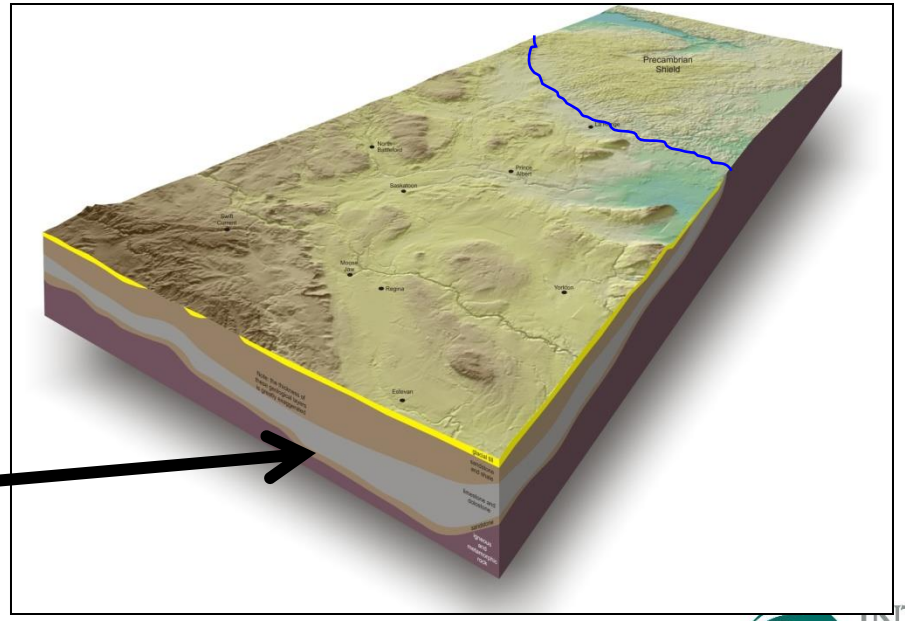
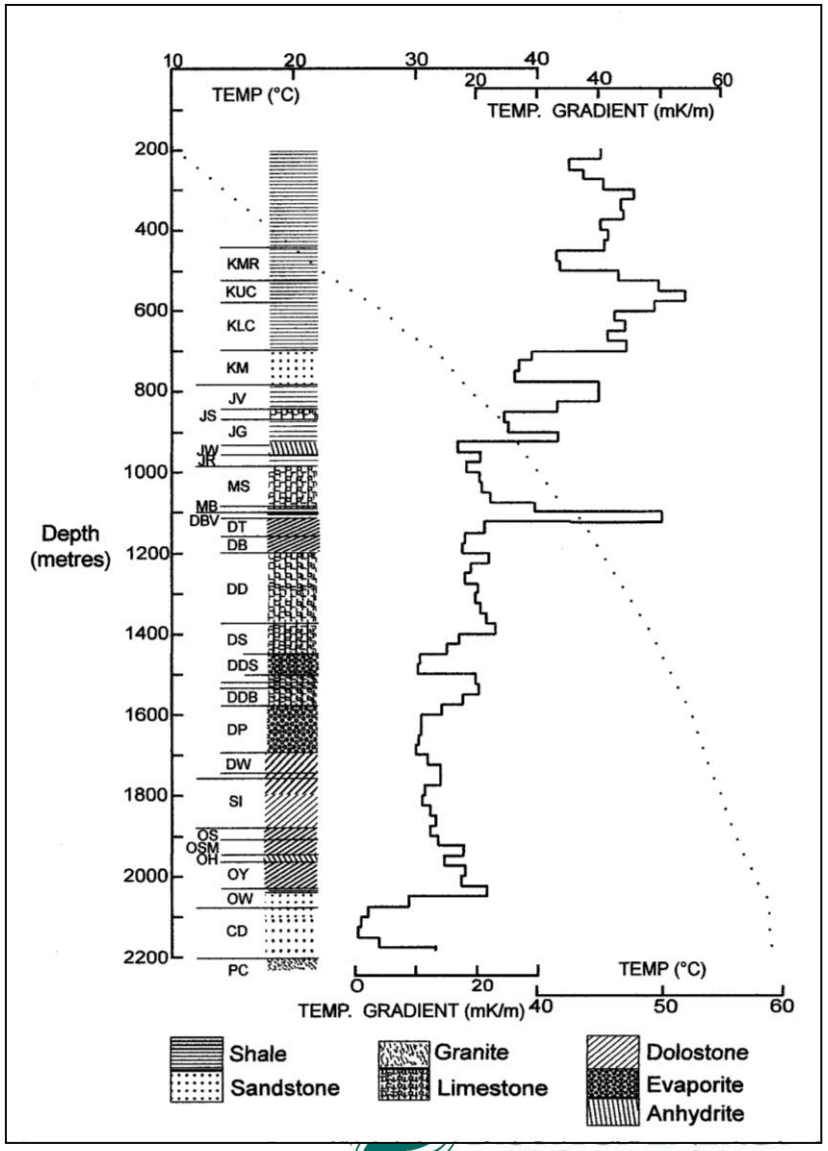


Figure 3 - Major sedimentary units in the vicinity of Regina. Patterns show lithologies: stippling, sandstone; dashes, shale; vertical brickwork, limestone; diagonal brickwork, dolostone; squared, halite (salt); diagonal slashing, anhydrite; and wavy contact, unconformity.



Regina Geothermal Test Well Winter 1978-79

- Base of the hole, temperature is ~61°C.
- Using pumping rates in excess of 110 m^3/h the water would be ~59°C at the surface.
- Reservoir water is a sodium-chloride-sulphate brine.
- Total dissolved solids of ~ 108,500 g/m^3
- Corrosion tests show low corrosion rates within acceptable limits. Reduce contact of aquifer water with air to reduce oxidation.



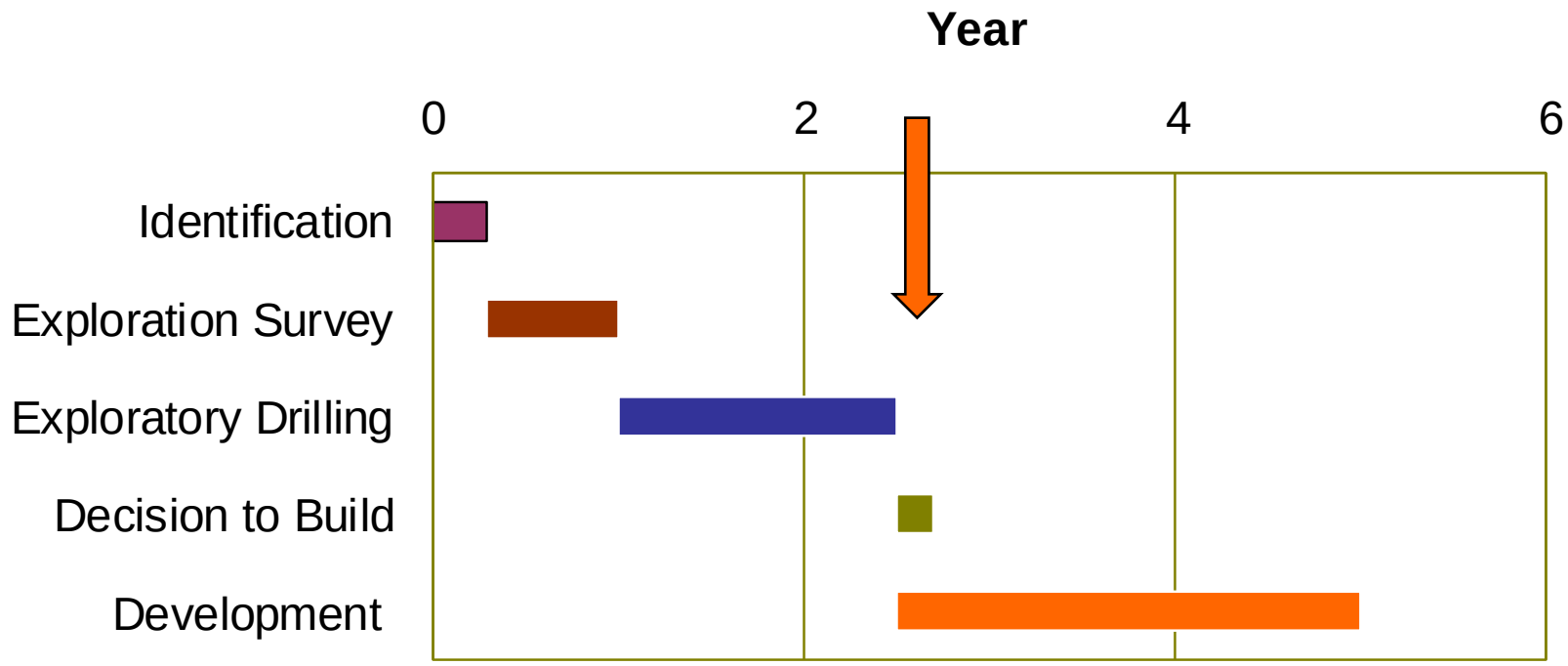
Lithological section for the Regina well
Temperature (dots)
Temperature gradient (solid lines)

(Vigrass, Jessop and Brunskill, 2007)

Regina Geothermal Test Well Winter 1978-79

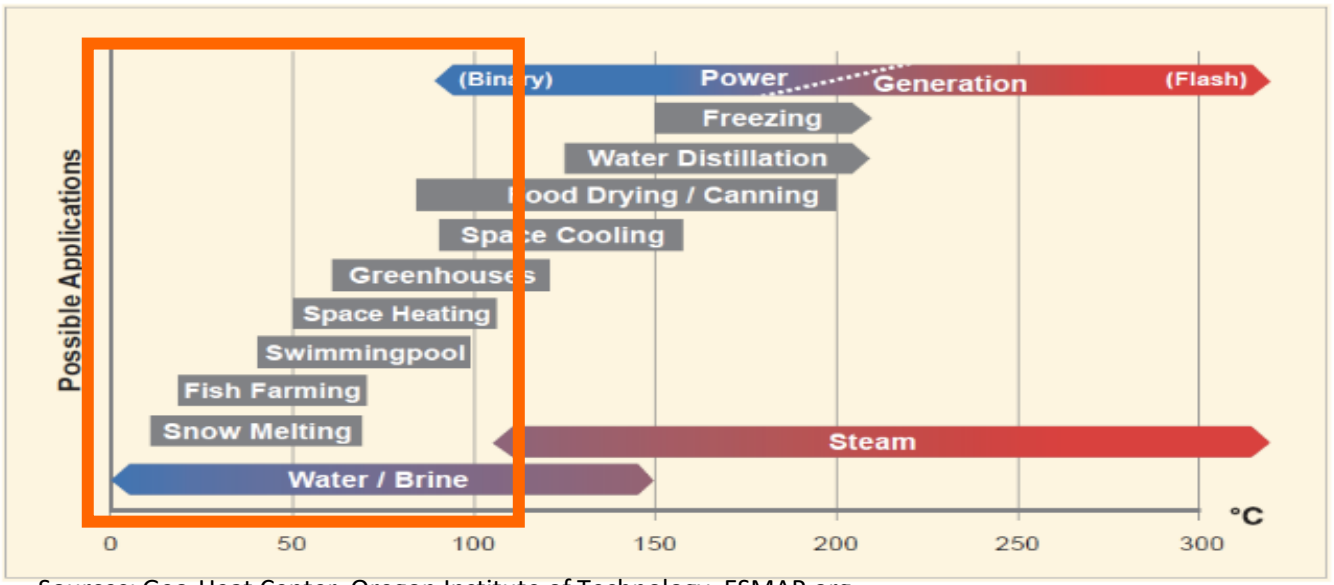
- **Over 40 research papers and technical documents reported on the geothermal conditions under the Regina campus (Dr. Laurence Vigrass, U of R Energy Research Unit).**
- **Geothermal Exploration Timelines and Project risk, most of the risk has already been taken!**
- **Where is the project now?**

Geothermal Exploration Timeline of a Geothermal Development
(C. Hickson, 2019)

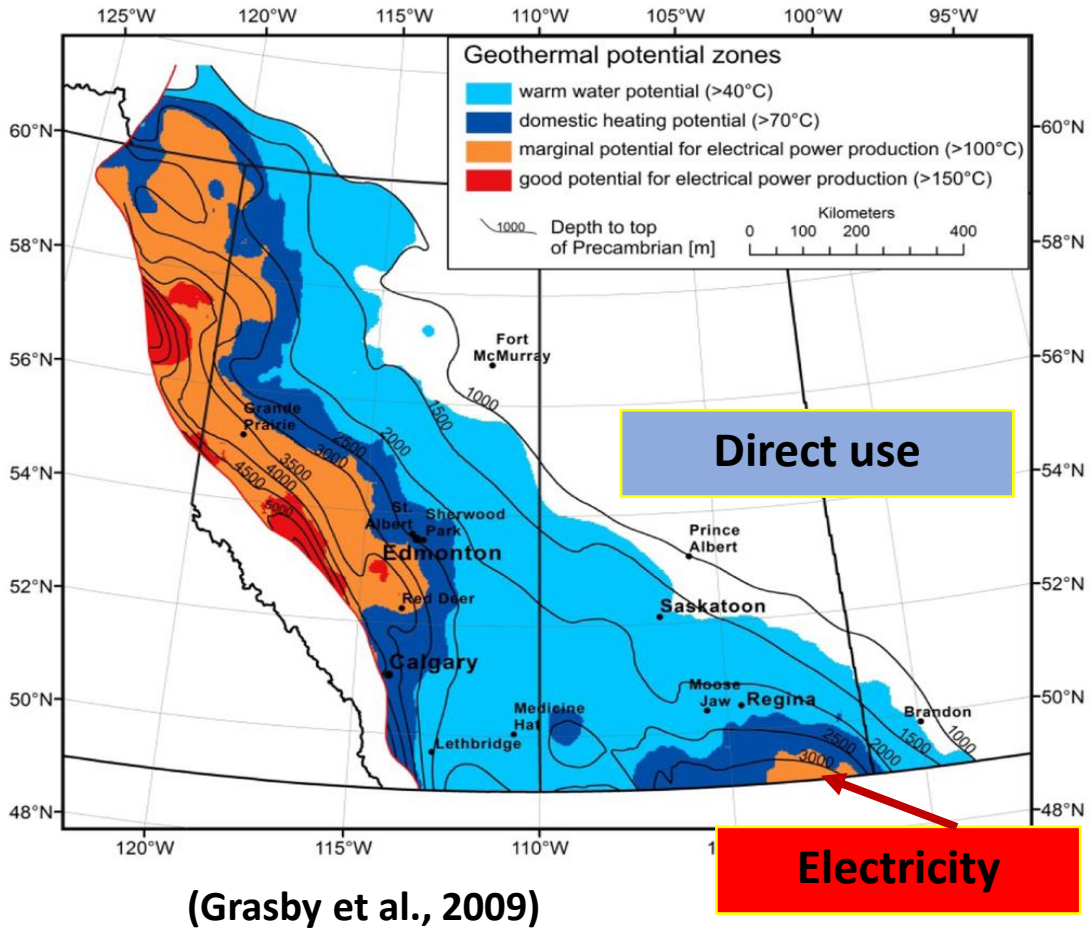


2 Geothermal Potential

- **Southern Saskatchewan has widespread Geothermal development potential for many communities and industrial applications.**
- **Aquifer temperatures >40°C used for direct-use applications, district heating of water and air (U of R). Higher temperatures >100°C electrical production (DEEP Project).**



Sources: Geo-Heat Center, Oregon Institute of Technology, ESMAP.org



(Grasby et al., 2009)

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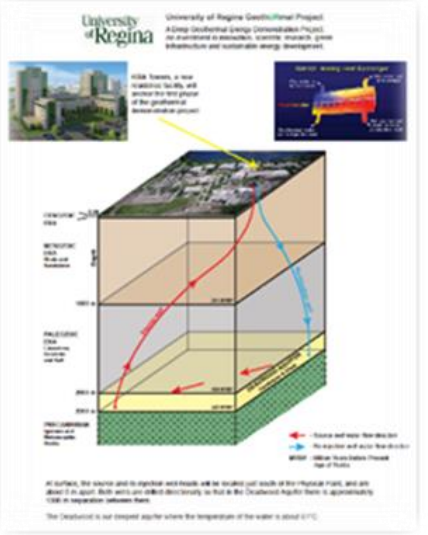
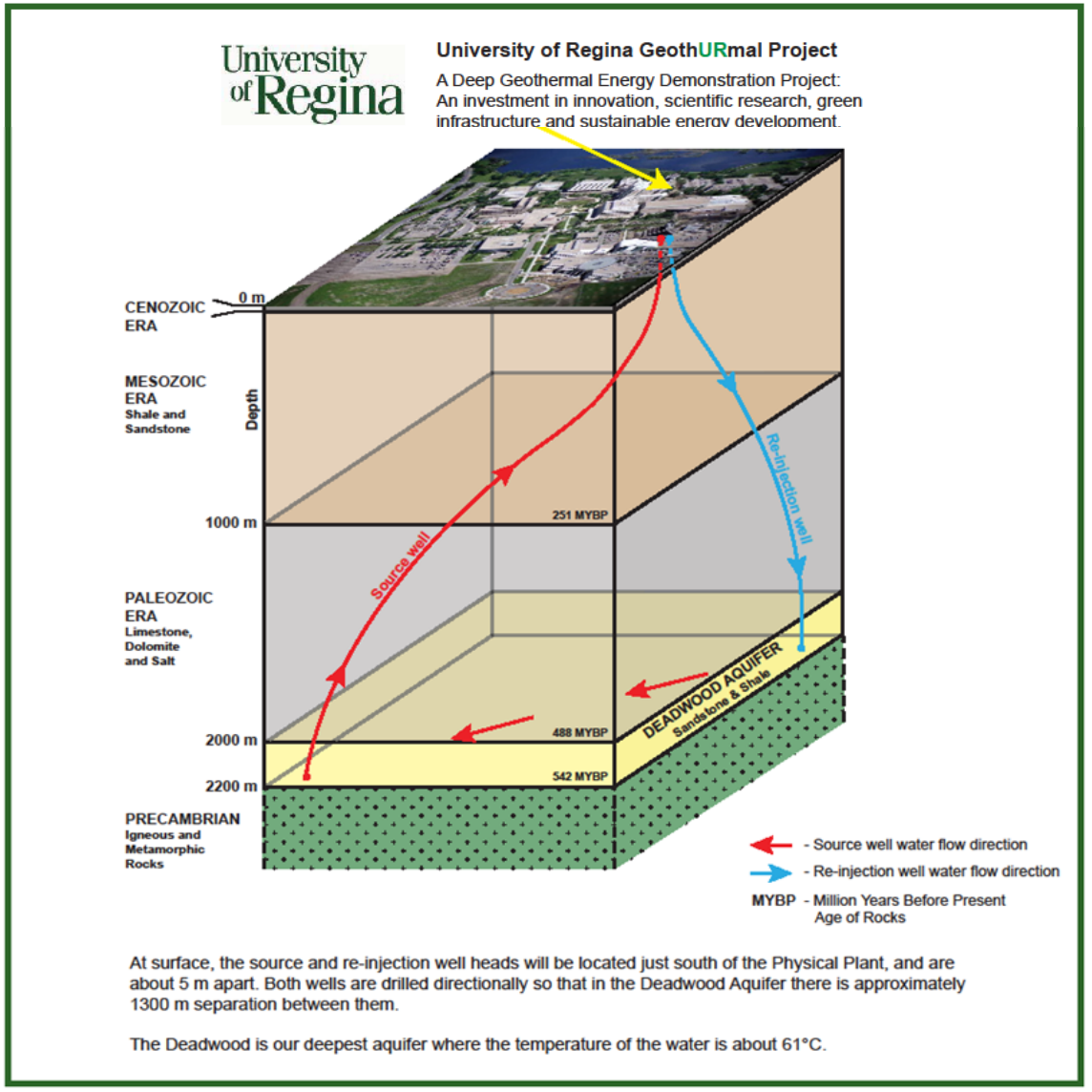
University of Regina GeothURmal Project Proposal



- In 2015, our research team presented a proposal to construct a deep geothermal demonstration project on the university campus, using heat from the Deadwood Aquifer.
- This proposal would complete the 1979 exploratory geothermal test well project, utilizing the data and experience gained then.
- This is a small-scale demonstration model, a legacy project which will last several generations of students.
- It will provide base load heating and act as a site for research, innovation and training HQP in the geothermal industry.
- Saskatchewan would be one of the first provinces to use direct-use geothermal aquifer district heating in Canada.

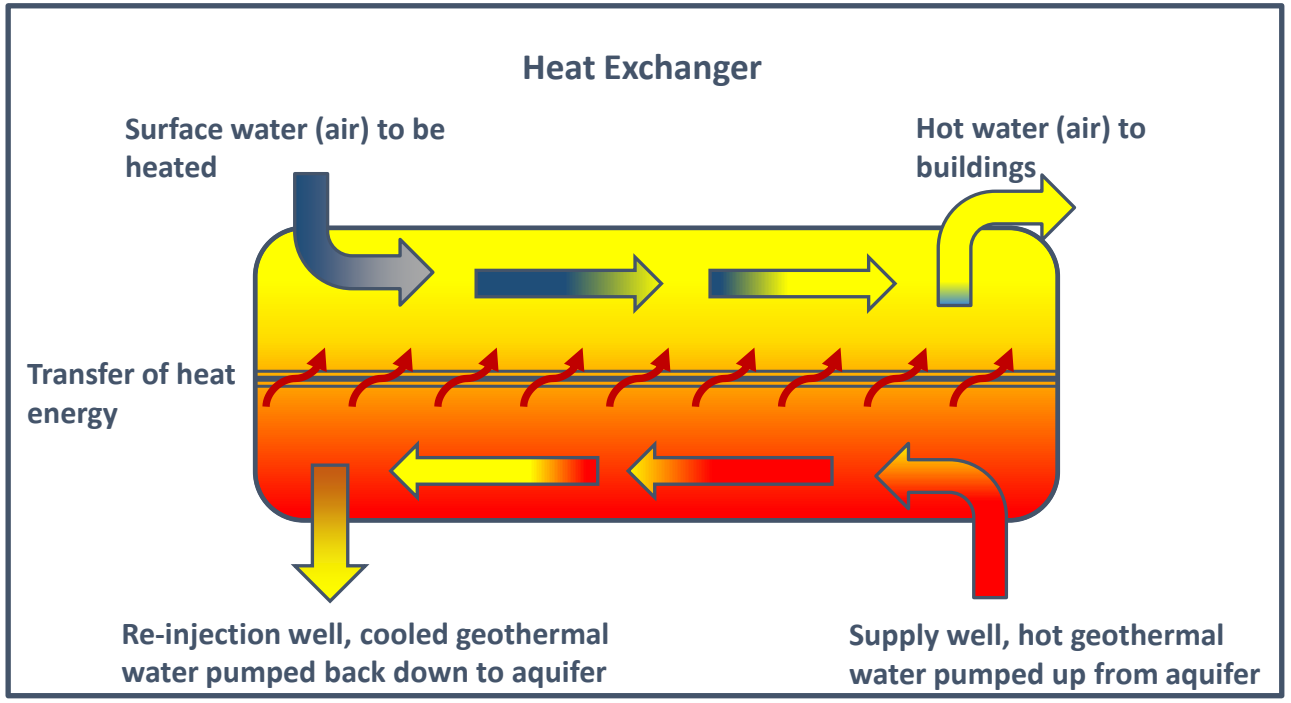
University of Regina GeothURmal Project Proposal

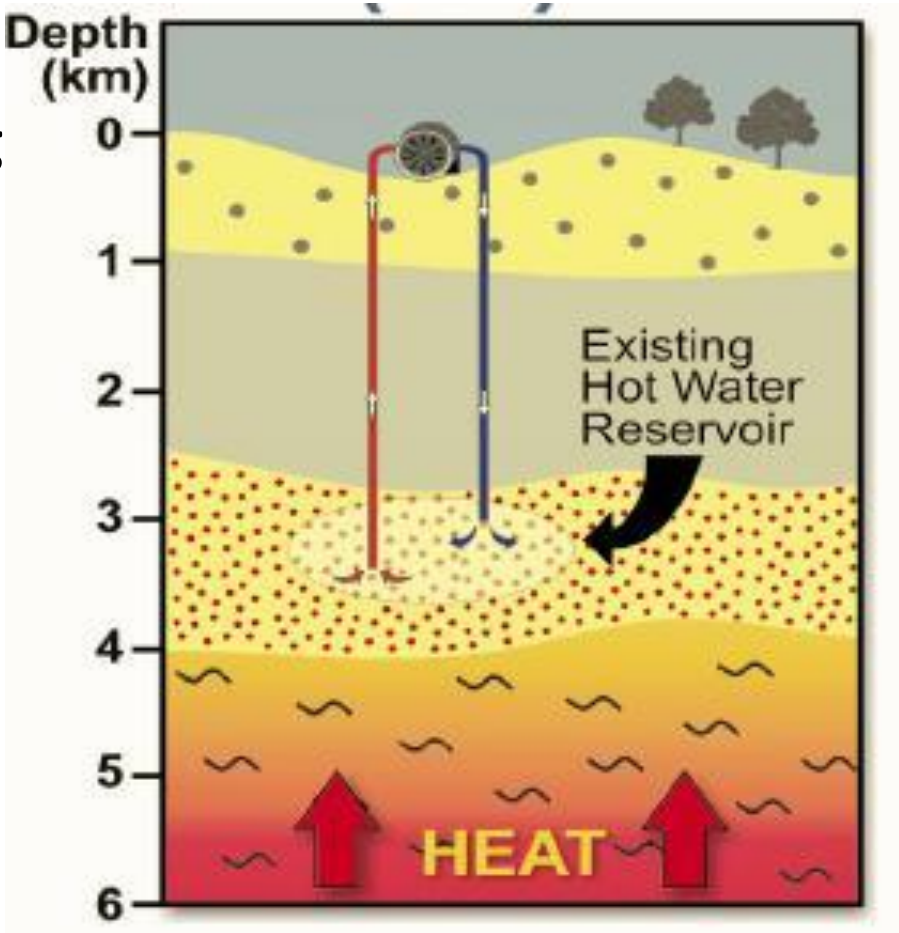
- Develop a geothermal doublet system with a source well and a re-injection well.
- Two 2200 m deep directional wells will be drilled to the Deadwood/Winnipeg aquifer beneath the University campus, beside the existing physical plant.
- 5 m apart at surface, drilled directionally ~1300 m apart at depth.



3 University of Regina GeothURmal Project Proposal

- **Hot water from the Deadwood Aquifer pumped to the surface via the source well.**
- **Heat extracted by a heat exchanger located in the existing physical plant on campus to heat surface water.**
- **The cooled aquifer water will be re-injected back into the same aquifer using the re-injection well.**





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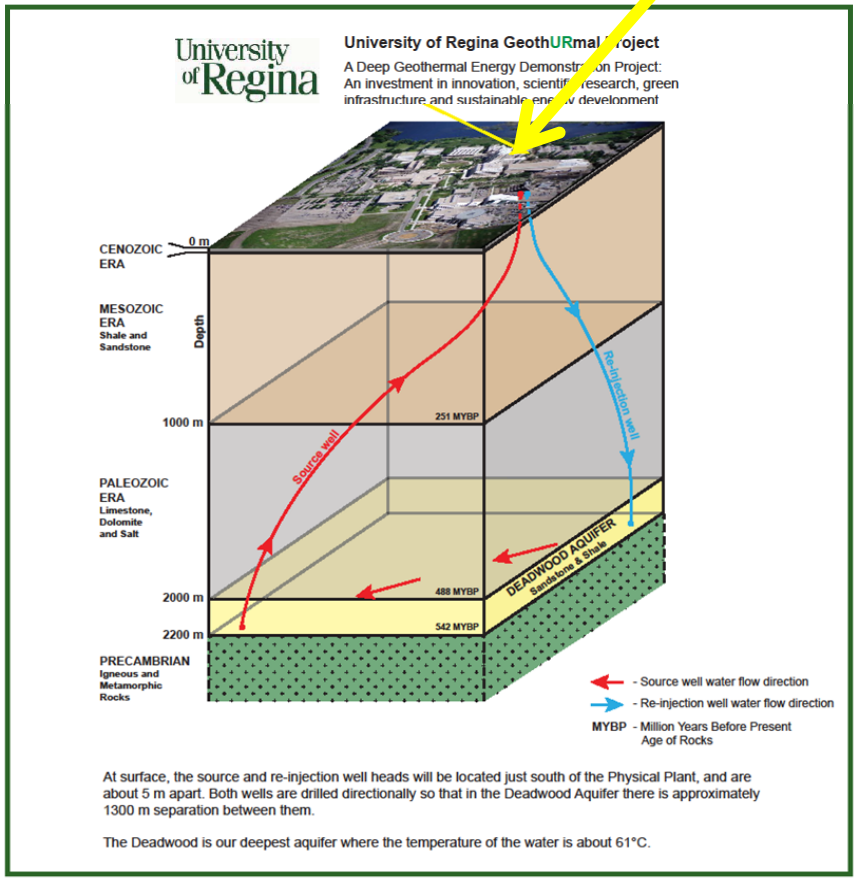
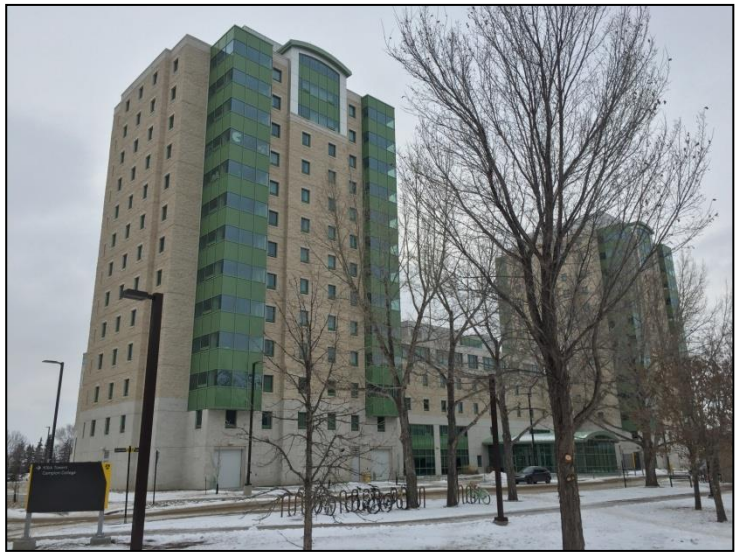
University of Regina GeothURmal Demonstration Project Proposal

- **Heated surface fluid is then distributed using the district heating system to provide base-load heating for space and domestic water**
- **This doublet system has the capacity to provide base-load heating for over 1.2 mill ft² of residential space or over 500-1400 ft² new homes for over 60 years.**
- **The energy is sustainable, reliable and green.**



University of Regina GeothURmal Demonstration Project Proposal

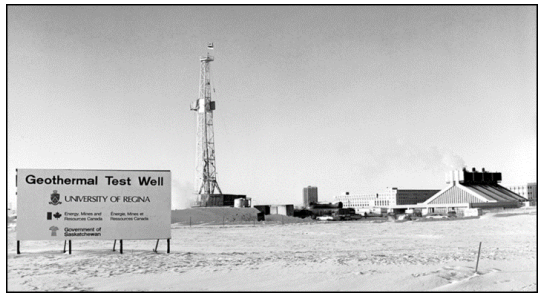
- Ties into existing heating infrastructure (grid).
- Uses space in the current physical plant, no additional enclosure.
- Augments existing physical plant.
- Kisik Towers residences (300,000 ft^2 area), are Geothermal-ready, use radiant heating, could anchor the first phase of the project (60% capacity).
- Could also heat domestic water at Paskwaw and Wakpá Towers, university pool and provide combustion pre-heating at the central physical plant.
- Or any future builds!



Why Not Geothermal? Rationale

Historical Value Estimate of U. Regina Geothermal System if utilized from 1980 – 2020 (40 years):

- Assuming operating at 60% capacity for 212 days per year (heating season), over 52,800 Giga Joules of energy (GJ)/yr or 2.1 million GJ would be utilized over 40 years.
- Using an average delivered gas price of $4.50/ GJ, gross saving would be about $9.5 million
- Avoided production of CO_2 would be roughly 2660 tonnes per year or approximately 106,300 tonnes over 40 years (Trudeau (2021) potential carbon tax may be $130 per t)
- Anticipated lifetime is approximately 66 years, with roughly 26 years remaining – by 2046 (saved $15 mill and 175,000 t natural gas emissions)
- Few infrastructure projects have a life expectancy of over 60 years



5 Current Status, Next Steps and Focus Groups

- To advance the project we are proposing a project partner feasibility study to advance the completion of the deep geothermal heating project on campus , and
- To obtain feedback on the viability of integrating additional innovative projects such as municipal solid waste to energy demonstration to the project. Applying for funding.
- As part of the feasibility study conducting focus groups to better understand barriers to geothermal energy development in Saskatchewan .

5 Current Status, Next Steps and Focus Groups

- Nine focus sessions over 200 participants.
- University students, 1st to 4th year (general) and 3rd to 4th year (Geoscience).
  - All groups commented on fears regarding the cost, and when would the project pay for itself?
  - Concerns about climate change was noted, but only seriously by one of the first year student focus groups.
  - Student groups varied in their understanding of Geothermal but all groups recognized they wanted and needed to know more.
  - The groups were split as to the best way to educate the public. Conflicted on how and who should provide more scientific knowledge about geothermal systems. Feeling of distrust among students with the government, journalists and even the experts (so called). Thought social media was a better way to spread information than paper products or brochures, yet they do not trust most social media outlets.

Current Status, Next Steps and Focus Groups

- **Facilities Management and Management Focus Groups at the University of Regina**
  - **Most concerned about costs (poor business case) and long term maintenance. Who will own it? Who is responsible for it? But open to further conversations and wish it had been completed in 1980.**
  - **They see this as a research facility, and support research, but noted two main barriers to it,**
  - **1) they do not understand why it needs to be done at the University of Regina?**
  - **2) they do not think the research questions and potential benefits to knowledge are well formulated. They anticipate turning the geothermal system off when the research is completed.**

6 Summary

- **Ongoing promotion of the benefits of GeothURmal use at the U of Regina, City of Regina, and several industries.**
- **Pursuing funding for a Feasibility Study and potential collaboration with other research groups such as municipal solid waste to energy demonstration project.**
- **Using deep geothermal energy will aid developing new energy sources and reducing our environmental footprint. Contributing to an investment in Innovation, Sustainable Energy Development and Green Infrastructure. With benefits reaching well beyond the university, and provide a significant opportunity for community engagement.**

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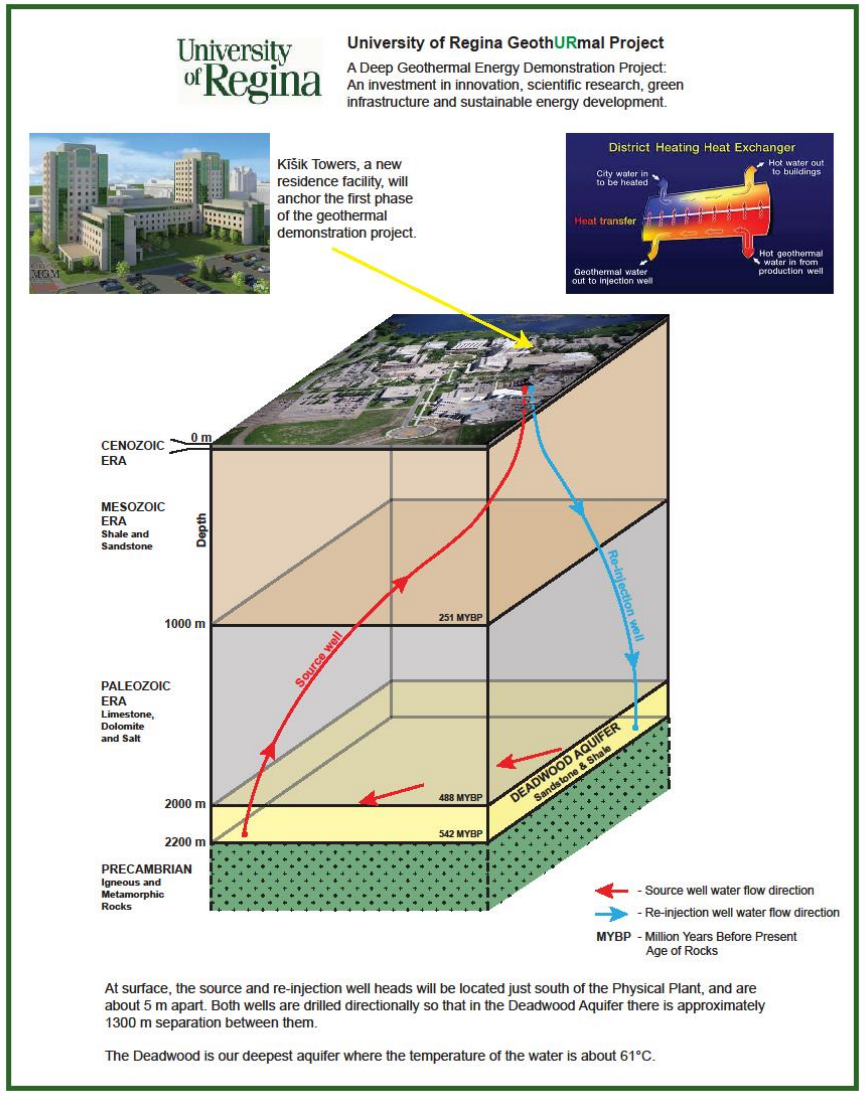
6 Summary



- ***Thank you to our GeothURmal Working Group:***
- ***Dr. Amr Henni, P. Eng, Faculty of Engineering; Dr. Lawrence Vigrass, Dr. Stephen Bend, Dept. of Geology; Stephen King, Presidents Office; Sally Gray, Raymond Deschamp , Dr. Kathleen McNutt, Research Office; and others!***