Optimizing Geothermal Energy Production and Utilization Technology

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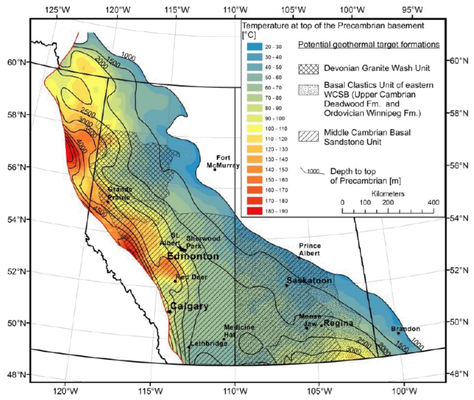
BACKGROUND

GEOTHERMAL POTENTIAL

Alberta possesses a vast low enthalpy geothermal resource (below 100 ℃); however, it is currently not financially viable to convert this resource to electricity.

STIRLING ENGINES

Stirling engines are externally heated, closed-cycle heat engines. With unconventional engine materials functional near a maximum temperature of 100 ℃, Stirling engines present a financially sound solution to producing electricity from low enthalpy resources .



Alberta Ground Temperature at Precambrian Basement

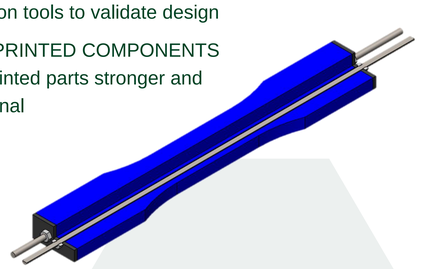
SHORT-TERM OBJECTIVES

UNIT EVALUATIONS

- Explore mechanical coupling approaches
- Use simulation tools to validate design

IMPROVE 3D PRINTED COMPONENTS

- Make 3-D printed parts stronger and more functional

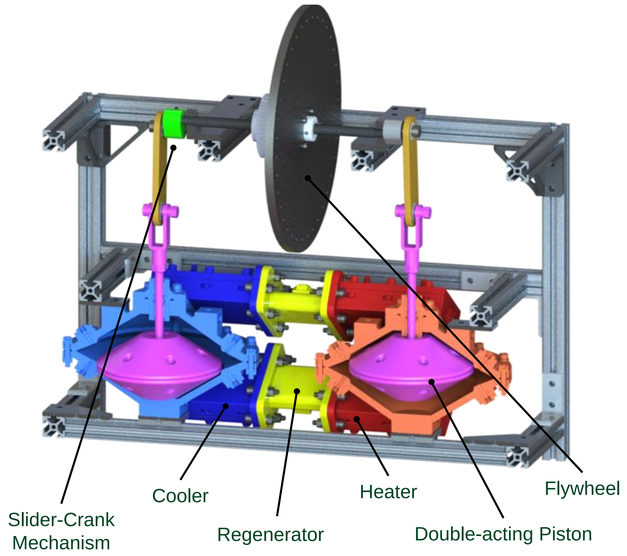


Solid Model of a 3D Printed Part with Tensioned Rods

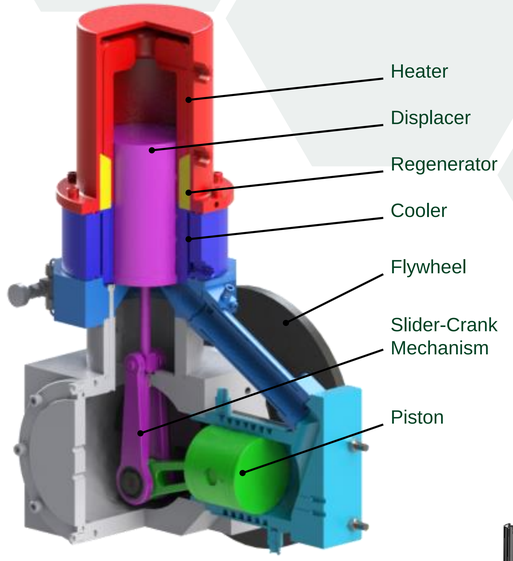
EXTERNAL PARTNERS

TERRAPIN GEOTHERMICS is a privately owned, Edmonton based geothermal energy company. Terrapin is developing and commercializing an engine capable of extracting usable energy from waste heat and geothermal brines.

PROJECT OVERVIEW



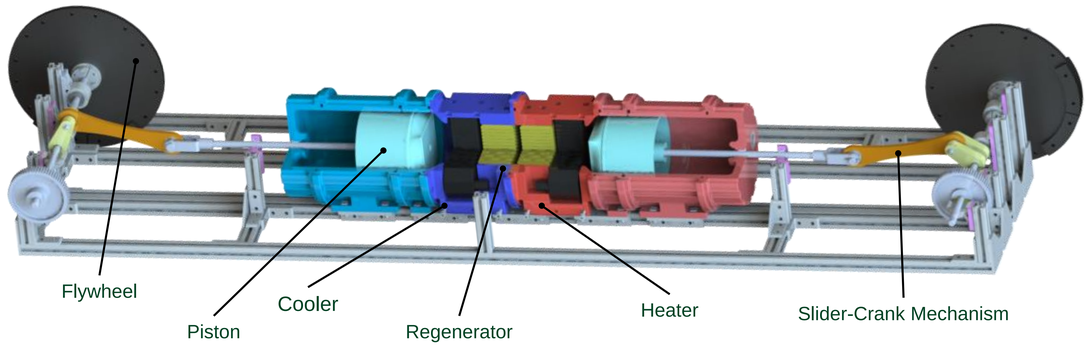
FRANCHOT STIRLING ENGINE



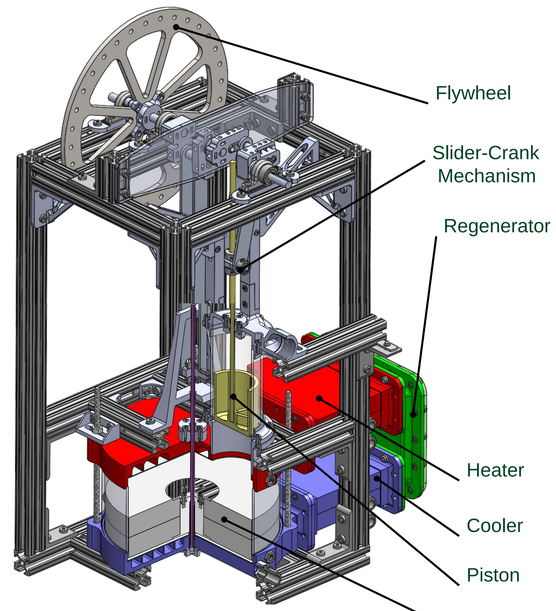
90 DEGREE GAMMA STIRLING ENGINE

STIRLING ENGINE DESIGN

The aim of this project is to develop engines for conversion of low grade heat into electricity. Candidate unit designs will first be manufactured at the lab scale, to gain experience and compare options. Successful unit designs will be mechanically coupled to form engines, and electrically coupled to form modular power stations.



OPPOSED PISTON ALPHA STIRLING ENGINE



IN-LINE GAMMA STIRLING ENGINE

THEME OVERVIEW

GEOTHERMAL

Canada's geoscape possesses more potential geothermal energy than hydrocarbon energy, but numerous challenges must be overcome if this renewable resource is to be effectively harnessed. Reservoirs of geothermal energy must be located, characterized, and modeled. The nature of the interaction between rock at reservoir sites and geothermal fluids must be understood, and the potential costs of exploiting them in real-world scenarios must be understood. At the same, new engine technologies must be developed to enable generation of power from geothermal heat sources with non-ideal temperatures.

EXPECTED OUTCOMES

DESIGN KNOWLEDGE

Experience gained in design and construction of seals, heat exchangers, drive mechanisms, instrumentation, and control systems will guide design of industrial scale systems.

CANDIDATE UNIT SELECTION

Candidate units for mechanical coupling to the cell level will be selected. Considerations will include manufacturability, reliability, specific power output, and versatility.

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