ALBERTA INNOVATES

CLEAN RESOURCES

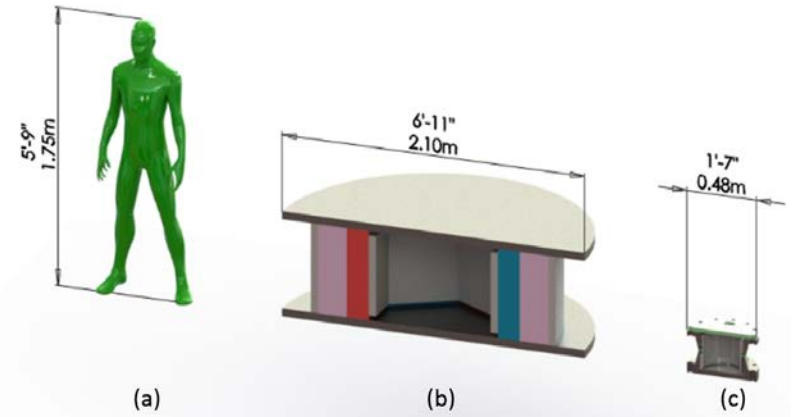
CLEAN TECHNOLOGY

ELECTRICITY GENERATION

FUNDING DETAILS

Development of Low Temperature Stirling Engine Technology for Power Generation

Alberta has vast, untapped geothermal and industrial waste heat energy resources that are currently underutilized due to the lack of technology to produce electricity from heat sources <100°C. Stirling engine technology could potentially fill this gap because it allows a wide variety of heat sources to be used, compared to other types of engines. At the University of Alberta, Dr. Nobes' team is focusing on developing a mathematical model to accurately predict the performance of Stirling engines with heat sources under 100°C. This project will construct a large-scale Stirling engine to provide important experimental data to validate the developed mathematical models. These models will then be used to predict engine performance under unique conditions and be used to optimize engine design and size allowing an economic analysis to determine if the technology is economically and technologically viable.



The (a) human scale compared to the (b) proposed engine scale compared to the (c) current engine scale

RECIPIENT:

Dr. David S. Nobes

University of Alberta

PARTNERS:

CES Power and Control Eavor Technologies

TOTAL BUDGET:

$728,000

AI FUNDING:

$200,000

PROJECT DATES:

July 2020 – June 2023

PROJECT TRL:

Start: 4

End: 7

APPLICATION

This technology is targeted at the geothermal industry and any industry with a substantial waste heat stream. In both cases, where the heat source is low-grade (90-150°C), advanced technology is required to convert the heat into a useful form like electricity. The knowledge generated in this project will provide experimental data that can be used to validate models primarily for the design of large-scale Stirling engine technology.

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PROJECT GOALS

- Design a large-scale, low temperature Stirling engine for experimental testing.
- Build, instrument and commission the Stirling engine.
- Run a wide range of test cases to collect experimental data.
- Validate low temperature mathematical models using the experimental results obtained from the testing of the Stirling engine.
- Use the models to predict engine performance for larger size engine design and industrial deployment.
- Complete an economic analysis to predict the economic potential of this technology for industrial deployment.

BENEFITS TO ALBERTA

- Advancement in applied research for low temperature engine design and development.
- Collaboration and training of mechanical engineering and business students to support the establishment of new technology development companies.
- If the Stirling engine is commercialized and deployed in Alberta, it could:
  - Increase lower carbon electricity generation from geothermal and industrial waste heat resources,
  - Help to reduce Alberta's large carbon footprint, and
  - Develop a new industry with associated jobs, technology and knowledge.

10 Publications

7 Students Trained

17 Project Jobs

1 New Products/Services

1 Spinoff Company

Enabler of Future GHG Reductions

CURRENT STATUS

July 2020

To date, several different small-scale Stirling engine configurations have been built and tested to identify which configuration is most promising for low temperature applications. This work has allowed the development of a comprehensive mathematical model for predicting Stirling engine performance that includes many unique features for low temperature operation. The research and development work is now poised to leap forward with the building and testing of the large-scale engine.