

Fire & Ice

Energy Recovery Team



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Sponsored by University of Idaho Facilities Department

MISSION STATEMENT

Our teams mission is to capture the waste heat at the steam plant by utilizing thermoelectric generators to produce power. The power generated will be used to charge radio batteries at the steam plant.

CONCEPT DEVELOPMENT

- Thermoelectric Generators
- Heat Sinks
- Mounting bracket
- Charger

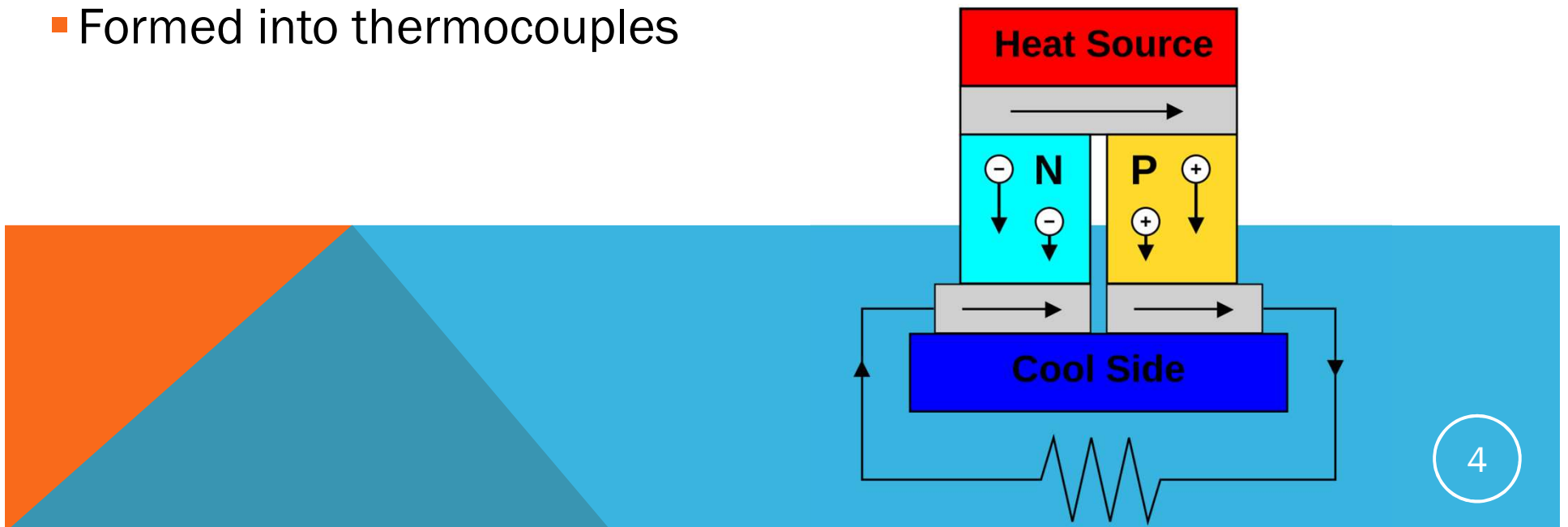
HOW A TEG WORKS

Operate according to the Seebeck Effect

- Temperature difference across thermoelectric material can be converted directly into electrical power

Constructed of n-type and p-type semiconductors

- Formed into thermocouples



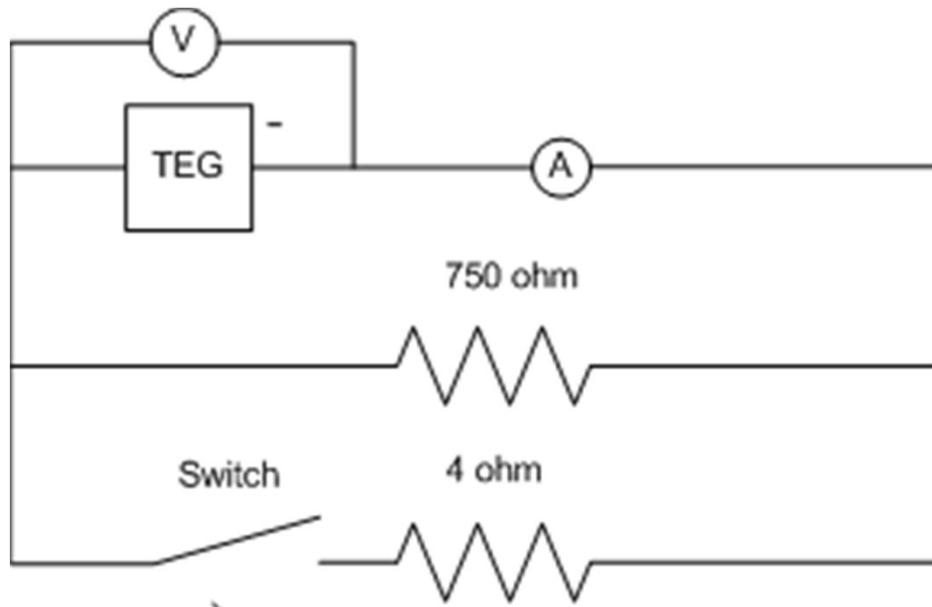
CONCEPT DEVELOPMENT

Thermoelectric Generators

- 22 Watt 7 Volt
 - Higher outputs at our operating temperatures
 - Used less space
 - Fit into square design



CALCULATING INTERNAL RESISTANCE OF TEG



$$R_{\text{TEG}} = \frac{V_1 - V_2}{I_2 - I_1}$$

$$V_1 = 1.47 \text{ V} \quad V_2 = 0.65 \text{ V}$$

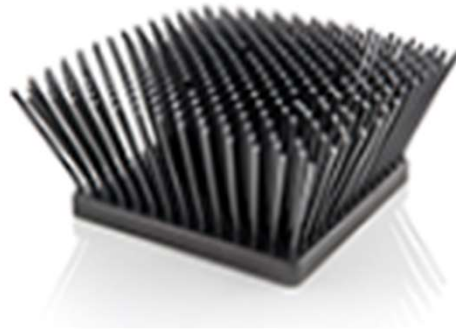
$$I_1 = 0.0019 \text{ A} \quad I_2 = 0.16 \text{ A}$$

$$R_{\text{TEG}} = 5.19 \Omega$$

CONCEPT DEVELOPMENT

Heat Sinks

- Flared pin fins
- Low thermal conductivity ($R_{\text{thermal}} = 0.57 \text{ K/W}$)
- Aluminum – Cost effective and sustainable



CONCEPT DEVELOPMENT

Mounting Bracket

- Easy to achieve compression on TEGs
- Makes design module
- Easily manufactured
- Air Gaps on all sides
 - Easier to wire TEGs
 - Added air flow



CONCEPT DEVELOPMENT

Battery Charger

- Charges all types of batteries
- Variable DC input range(11-30V)
- Only one needed

Show Excel Test data for
radio charging



PROOF OF CONCEPT

Solid works simulations

- Thermal analysis
- Stress analysis

EES calculation

Testing in progress



SYSTEM DESIGN

Visio Wiring Diagram

BILL OF MATERIALS

Open Excel Spreadsheet

Deliverables

PROJECT TIME LINE

Open Gantt Chart



QUESTIONS????