Thermoelectric Wood Stoves

Thursday, May 18, 2017
11:00 AM ET

In support of the Alliance for Green Heat’s 4th Wood Stove Competition in November 2018
Quick Notes

- Two Audio Options: Streaming Audio and Dial-In.
  1. Streaming Audio/Computer Speakers (Default)
  2. Dial-In: Use the Audio Panel (right side of screen) to see dial-in instructions. Call-in separately from your telephone.

- Ask questions using the Questions Panel on the right side of your screen.

- The recording of the webinar and the slides will be available after the event. Registrants will be notified by email.
✓ 501c3 nonprofit
✓ Promotes clean & efficient biomass heaters
✓ National voice for wood heat consumers
✓ Hosts design competitions
✓ Encourages transparency from manufacturers and regulators
• 4th Wood Stove Design Challenge
  • 3rd Week of November 2018
  • National Mall in Washington DC
• Two Competition Categories:
  • Automated stoves
  • Thermoelectric stoves
2018 Thermoelectric Stove Challenge

• Huge potential for thermoelectric power to supplement winter time solar energy production.
• Homes in Northern hemisphere produce large amounts of wood heat exactly when homes and the grid need electricity.
• NREL estimates typical solar panels in VT make 571 kWh in summer and 191 kWh in winter.
• Efficient thermoelectric generation is still in early stages. Raising efficiency and lowering cost – just like solar PV did – is the challenge.
Thank you!

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(for thermoelectric issues)

Alliance for Green Heat
Takoma Park, MD
www.forgreenheat.org
301-204-9562
About BTEC

The national trade association for the modern wood heating industry.

Engage in technical codes and standards development, public advocacy, and education.

100+ members and associates across the US and Canada:

- Fuel Producers
- Manufacturers
- Sellers
- Installers
- Service Providers
- Universities
- Non-profits & NGOs
- Government agencies
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THERMAL ELECTRONICS CORP.

What we provide

• 25 years of Thermoelectric experience
• Library of custom components
• Application specific DC to DC Charge Controllers
• Largest inventory of Semi-conductor material modules

Discussion of Thermoelectric Power Generation
Managing Thermal Resistance

When designing a system it breaks down into 3 thermal resistances

\[ R_1 = \text{Hot Side} \]
\[ R_2 = \text{Module} \]
\[ R_3 = \text{Cold Side} \]

Optimal design is when

\[ R_1 = R_2 = R_3 \]
Management of Thermal Resistances

Optimum Design Parameters

- **Fig 1:**
  - HOT: R1 >
  - COLD: R2 =
  - COLD: R3 >

- **Fig 2:**
  - HOT: R1 >
  - COLD: R2 =
  - R3 <

- **Fig 3:**
  - HOT: R1 =
  - COLD: R2 =
  - COLD: R3 =

- **Fig 4:**
  - HOT: R1 <
  - COLD: R2 =
  - R3 >
## TEG Thermal Ranges and Efficiency

<table>
<thead>
<tr>
<th>Material</th>
<th>Temp Range</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>BiTe TEG 1 Series</td>
<td>50C to 300C, sweet spot 200C to 280C</td>
<td>3% best</td>
</tr>
<tr>
<td>BiTe PbTe TEG1 Hybrid</td>
<td>200C to 310C, sweet spot 260C to 290C</td>
<td>4% best</td>
</tr>
<tr>
<td>PbTe/PbTe TEG1 sealed</td>
<td>400C to 575C, sweet spot 350C to 575C</td>
<td>6% best</td>
</tr>
<tr>
<td>PbTe/TAGS Series</td>
<td>400C to 600C, sweet spot 400C to 600C</td>
<td>12% best</td>
</tr>
<tr>
<td>CMO Oxide Series</td>
<td>650C to 900C, sweet spot 650C to 875C</td>
<td>3% best</td>
</tr>
</tbody>
</table>
Key Parameters for design!

• Heat source & temperature?
• Space considerations?
• Available cooling processes?
• Heat flow rate?
• Power requirements?
• Cost consideration?
## Absorbing & Moving Heat Flux Rapidly

<table>
<thead>
<tr>
<th>Hot side Best to Worst</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hot Liquid Parallel Flow</td>
</tr>
<tr>
<td></td>
<td>Heat Sink</td>
</tr>
<tr>
<td></td>
<td>Heat Pipe</td>
</tr>
<tr>
<td></td>
<td>Plate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modules</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Depends upon Design ?</td>
</tr>
<tr>
<td></td>
<td>Available amount of Heat?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cold side</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Liquid Flow Parallel Flow</td>
</tr>
<tr>
<td></td>
<td>Reservoir Thermosiphon</td>
</tr>
<tr>
<td></td>
<td>Heat Pipe w/fan</td>
</tr>
<tr>
<td></td>
<td>Heat Sink w/fan</td>
</tr>
<tr>
<td></td>
<td>Heat sink natural convection</td>
</tr>
<tr>
<td></td>
<td>Flat plate</td>
</tr>
</tbody>
</table>
Thank You

Project Light Up!
Questions? Contact: Gerard Campeau, Thermal Electronics Corp.
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(905) 751 – 1362 or 1 (800) 769 – 2395 Toll Free