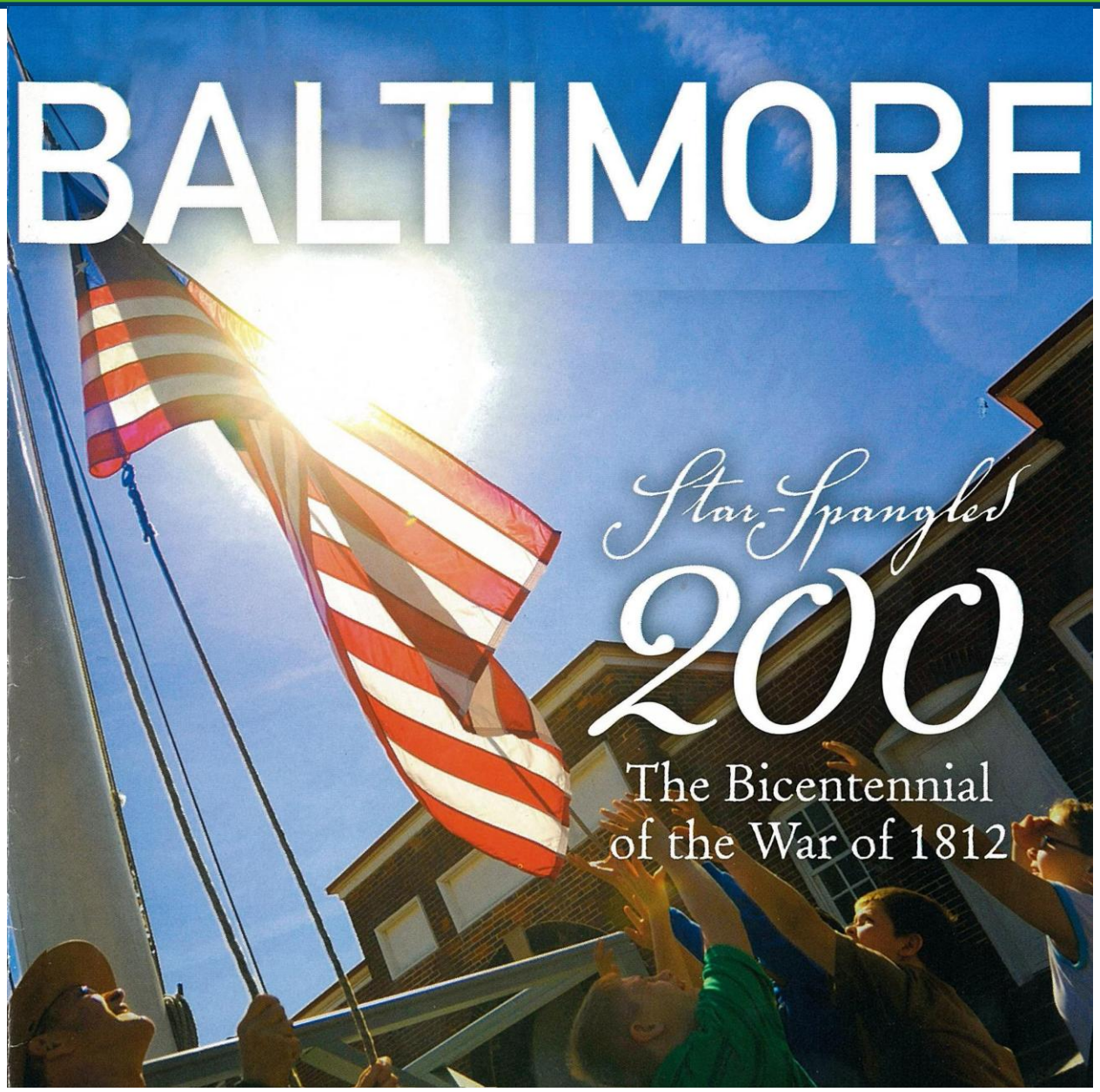
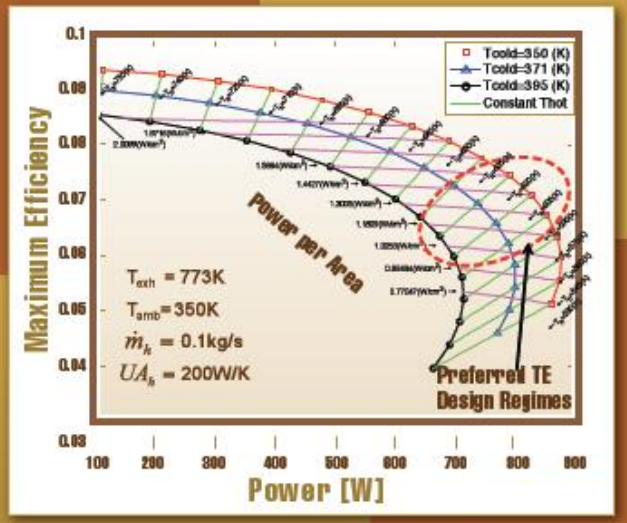
Welcome to Baltimore



David Rowe

THERMOELECTRICS AND ITS ENERGY HARVESTING

MODULES, SYSTEMS, AND APPLICATIONS IN THERMOELECTRICS



Edited by **D. M. Rowe**

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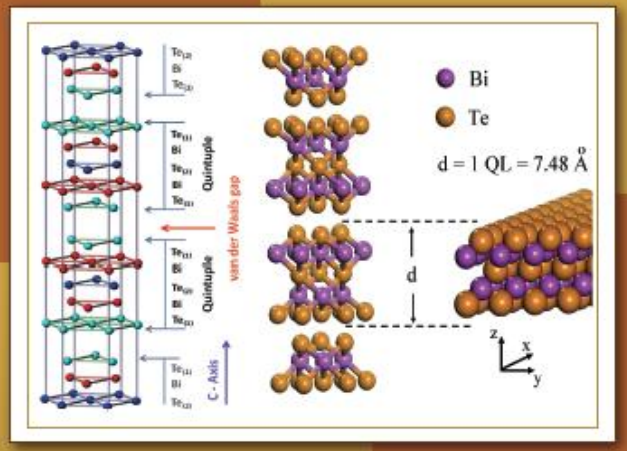
THERMOELECTRICS AND ITS ENERGY HARVESTING

MATERIALS, PREPARATION, AND CHARACTERIZATION IN THERMOELECTRICS



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Maryland Crabs and Crabcakes

Typical Transportation Entering The 20th Century

- Stage coach
  - 6 Passengers
  - 4 Horsepower (quadrupeds)
    - Drive by Line
  - Fare $.06/Mile
- Bio-Mass Derived Fuel
  - Minimally processed
  - Fuel infrastructure in place
  - "Stable" Fuel Costs
- Emissions
  - Equine methane
  - Agglomeration of macro particles
    - Minimally airborne
    - Recyclable

Evolution of Personal Transport

1902

2012

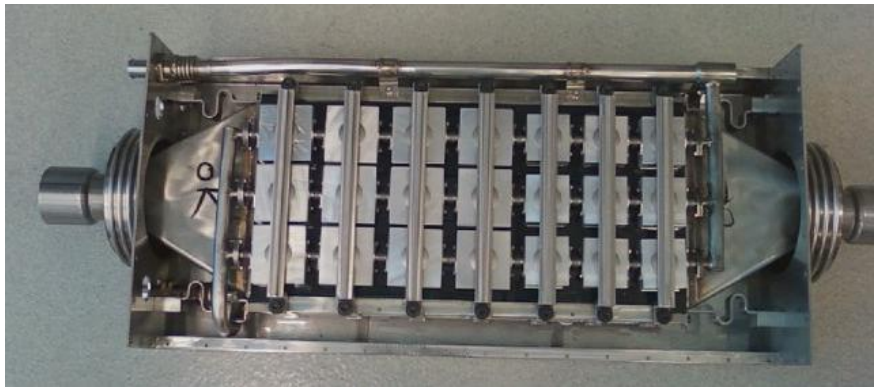
Entering the 22 Century?

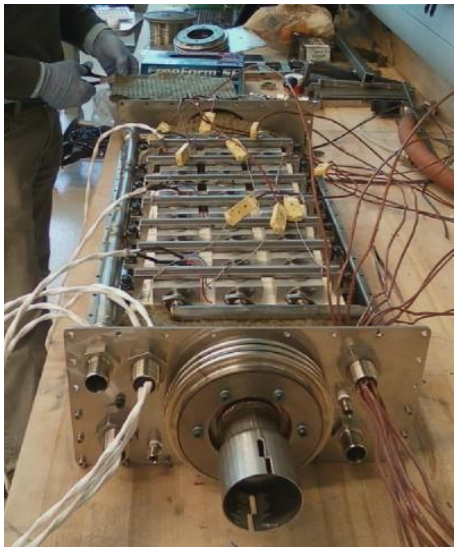
- All-electric vehicle
- Advanced batteries
- Fast Inductive-charging
- Lightweight materials
- No emissions

Thermoelectrics

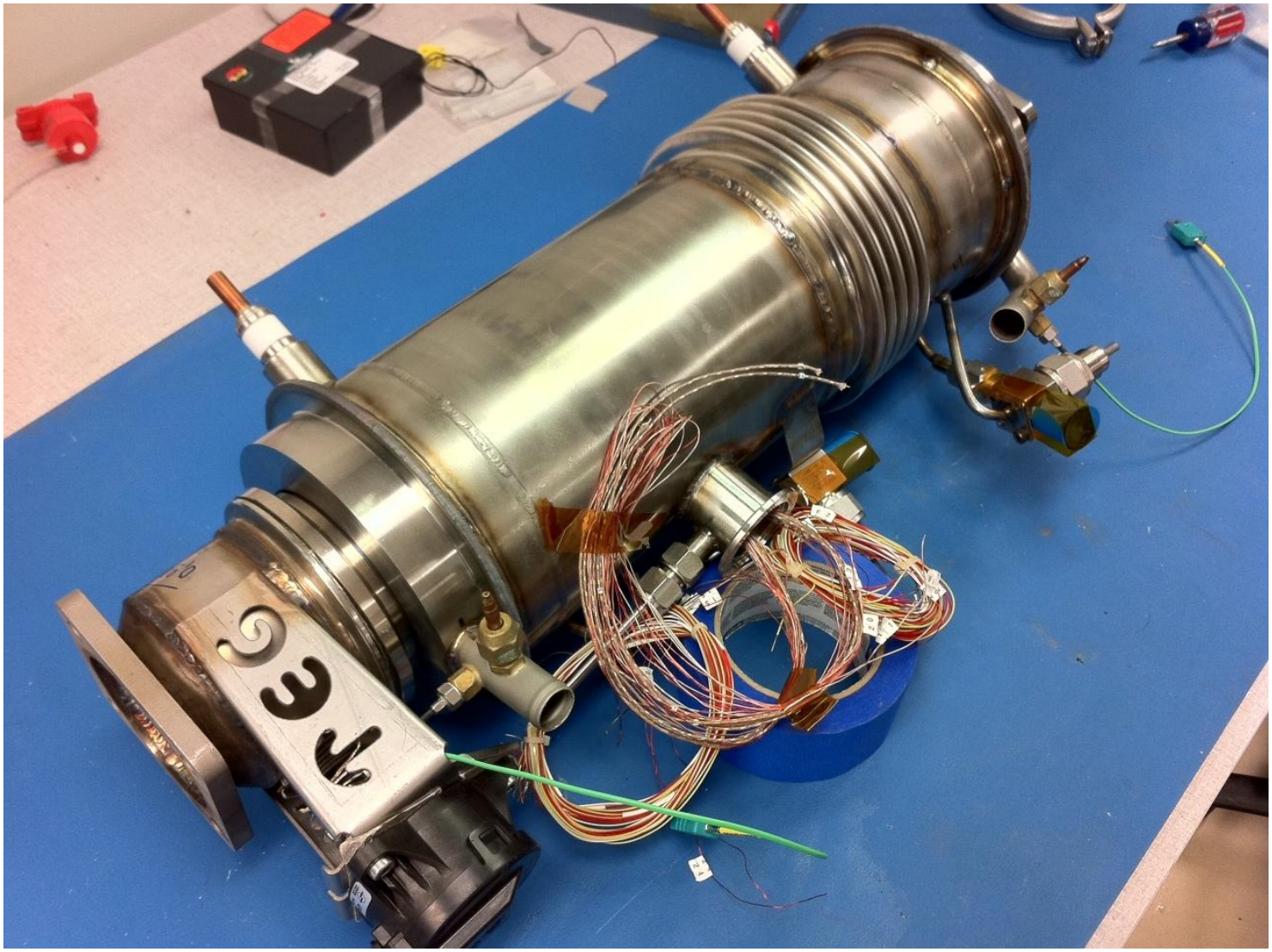
- TE AC/heater
- TE thermal management of batteries
- TE-cooled collision avoidance system and computers
- TE-cooled/heated beverage holders
- TE-regenerative braking

GM Prototype TEG





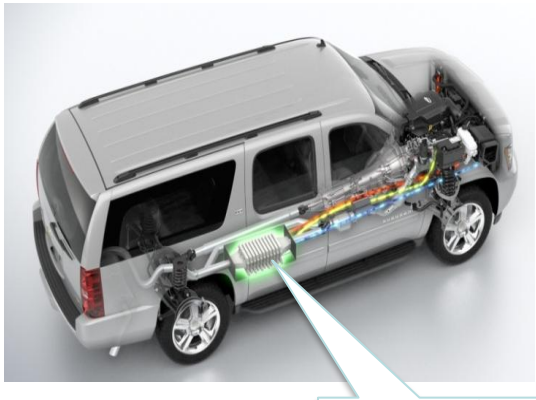
Amerigon TEG for Ford Lincoln MKT, BMW X6

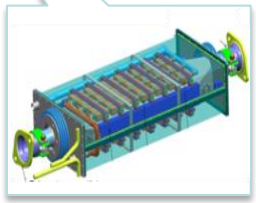


Prototype TEGs Developed in DOE-VTP Programs

Ford Lincoln MKT

Chevy Suburban





BMW X6

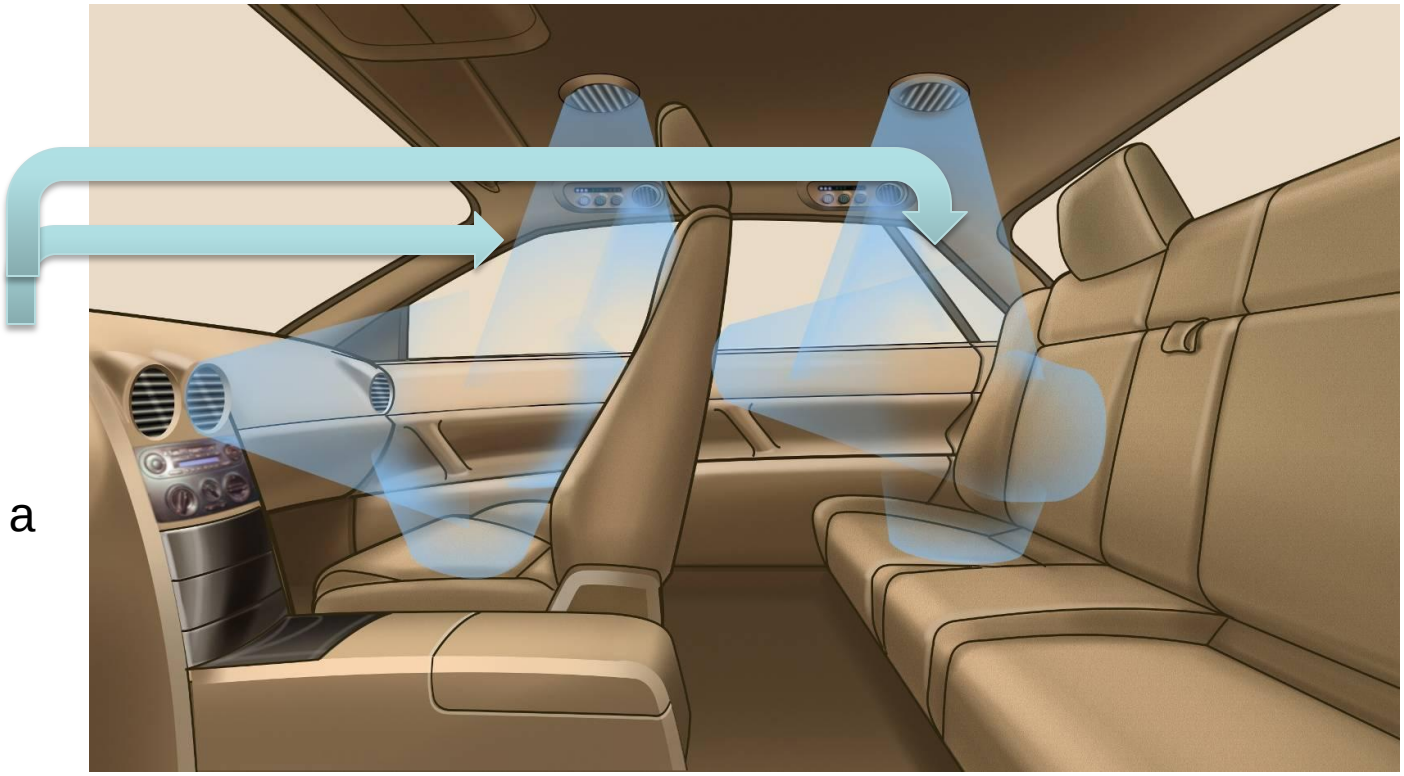
- Amerigon TEG's Developed for Ford and BMW, and GM's Production Prototype TEG to Provide 5% Improvement in Fuel Economy
- Amerigon TEG Bench Test Peak output was 608 Watts with 620^{0}C inlet air and 20^{o}C cold side temperatures
- TEG tested in a BMW X6 in Munich **(in the lobby NOW!)**
- A second TEG is being tested in a Ford Lincoln MKT in Dearborn
- GM installed their TEG in Chevy Suburban and is undergoing similar testing

Household Thermoelectric Cooling Devices

Vehicular Thermoelectric HVAC Zonal Concept

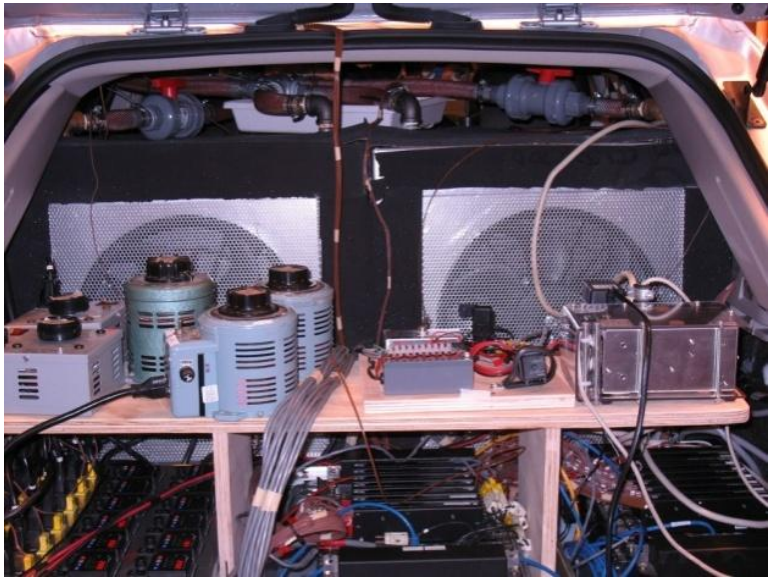
Energy Requirements (Analytical)

- **Zonal Concept**: cool/heat each occupant independently
- **630** Watts to cool a single occupant
- Current A/Cs: **3,500 to 4,500** Watts to cool the entire cabin

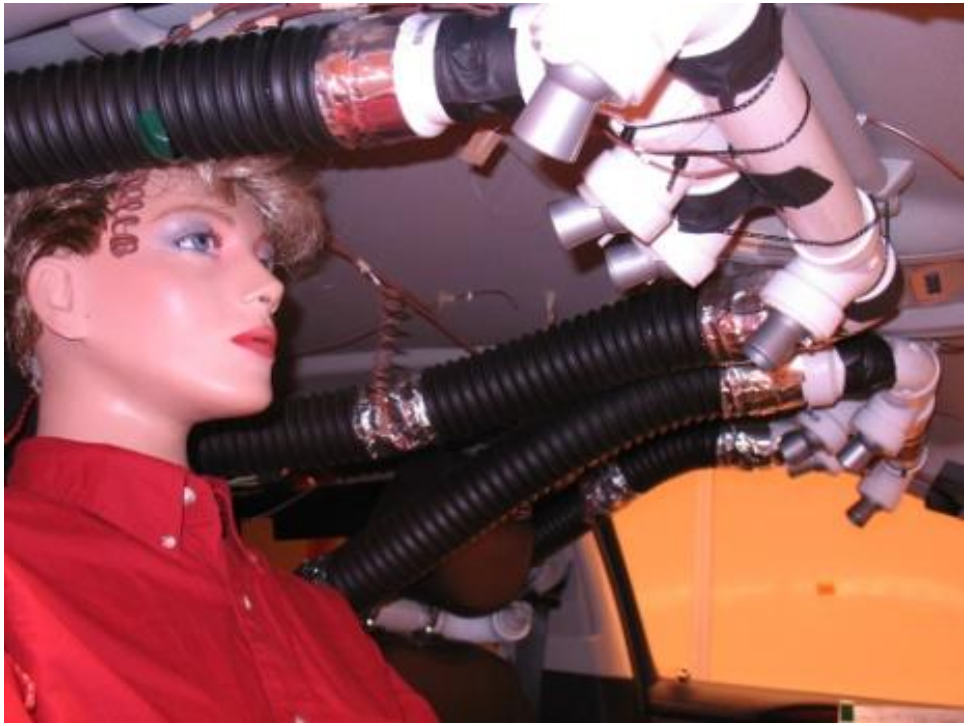


Zonal TE units located in dashboard, headliner, A&B pillars and seats/seatbacks

Delphi's Climatic Wind Tunnel Testing to Emulate Local Spot Cooling



UC-B thermal mannequin and human subjects used to evaluate spot cooling



Questions?


THERMOELECTRICS:
THE NEW GREEN
AUTOMOTIVE TECHNOLOGY
.....AND MORE.....