GEO-HEAT CENTER

Oregon Institute of Technology, Klamath Falls, Oregon 97601 541/885-1750 FAX 541/885-1754

John W. Lund, Director
Andrew Chiasson
Tonya "Toni" Boyd
Debi Carr

COMMENTS ON THE DRAFT FEASIBILITY STUDY FOR GEOTHERMAL DIRECT USE IN THE KAPOHO/POHOIKI AREA

CHAPTER 2 – GEOTHERMAL DIRECT USE ENTERPRISES

- Pg. 2-35 – **2.4.12 Biodiesel Production** The biodiesel market and economics should be re-examined, particularly if ethanol is available on the island.

- Pg. 2-36 – **2.4.13 Ice Plant, Cold Storage, and or Refrigeration**
  - Absorption chillers are on the market that are rated for 190°F (i.e. Yazaki Energy Systems).
  - Low-temperature heat pumps with geothermal coupling should be considered. In a "loads integration" design, some heat could be rejected to a greenhouse or other application.

CHAPTER 3 – GEOTHERMAL HEAT RESOURCES

- Pg. 3-13 – **3.4.2 Geothermal Resources – Drilling New Wells**
  - This section needs to be re-examined with smaller diameter wells in mind. Eight-inch wells should be considered since drilling costs in Hawaii are so expensive. Shallow, smaller diameter wells are sufficient for downhole heat exchangers or submersible pumps in applications that don't require high temperatures (i.e. greenhouse bottom heating or heat pump applications)

Chapter 5 – ENGINEERING ANALYSIS and Chapter 6 – ECONOMIC ANALYSIS

- General Comments
  - Chapter 5 presents calculations for peak heating requirements, but Chapter 6, the associated economic analysis has not been completed. Therefore, it is difficult to comment on these sections at this time, except for one important point. Geothermal part-load opportunities should not be overlooked. For example, depending on actual annual load factors, a geothermal system sized at 50% peak capacity with conventional fossil-fuel peaking may be economically optimum.

- Pg. 5-13 – **5.5 Available Heat**
  - In direct-use heating applications, a more typical temperature drop, particularly with 200°F fluid, is 40°F to 60°F. For example, in space heating applications at the Oregon Institute of Technology, typical temperature drops are on the order of 50°F. When separated by plate heat exchangers, the geothermal flow rate can be considerably reduced if temperatures are high enough.

- Also, the temperature does not need to be limited to a consideration of 200^{o}F to avoid steam. The fluid stream can be kept under back pressure to prevent flashing. For example, the Klamath Falls geothermal district heating system pipes 224^{o}F water for about 1 mile under a back pressure of about 15 psi.

- Pg. 5-18 – **5.7 Summary of Engineering Analysis**
  - Larger design temperature drops can significantly increase the heat extraction rates of a geothermal system. Perhaps the allowable temperature drops could be analyzed in more detail, based on water chemistry (probably beyond the scope of this report).

APPENDIX E – COST ESTIMATE WORKSHEETS

- Heat exchanger costs seem high, especially labor hours of 133 per heat exchanger installation.
- Pipe labor hours seem excessive. The pipe should be pre-insulated, so there should be no labor hours for this item.