# Seminário CGE/UE

## Heat flux measurement of hot ground
## (high temperature liquid dominated geothermal systems)

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## Resumo

The total heat transfer at the surface of hot ground is characterized by the magnitude of heat energy transferred through various surface discharge features. Diffusive heat discharge is typical for large areas of warm and hot ground surrounding manifestations with high, focussed heat discharge. This applies to hot ground over high-temperature geothermal systems and to thermal ground associated with burning coal seams. Measurement of the heat output of warm and hot ground surrounding high temperature manifestations is described here with reference to examples from the well studied geothermal area of Karapiti (Wairakei Field, New Zealand).

Heat flux measurement at the surface of hot ground over geothermal systems involves the assessment of convective -, conductive -, and radiation fluxes. The total flux and most flux components can be measured with a water-filled ground calorimeter. The conductive component can be assessed independently using near-surface soil parameters. All fluxes are affected by daily and seasonal variations. Over hot ground the total heat flux, when measured with a ground calorimeter, contains convective, conductive, and radiation components. By

lifting the calorimeter slightly above ground, heat transfer by conduction can be eliminated; this shows that the observed heat flux contains a small radiation component (c. 10 to 20 % of total flux in our field studies). The convective component becomes significant once the total flux is > 200 W/m$^2$. The magnitude of total flux measured was between 50 and 1,500 W/m$^2$ and correlates well with the boiling point depth; this points to a power-law relationship which can be used to infer the total flux for any site with a known soil temperature profile. Analysis of soil parameters and temperature sections point to a ‘heat pipe’ transfer mechanism that can maintain a high conductive transfer in a thin surface layer where sub-surface steam condensation is enhanced.