How well does geophysical data improve the outcome of our geothermal prospecting decisions?

How much is this information worth ($)?

How can we quantify the “past performance” of MT data to predict geothermal production?

### Role of geophysical data in geothermal prospecting

- Darajat is a volcanic geothermal field, with total production capacity of 271 MW [1].
- Clay cap = high electrical conductivity feature in volcanic geothermal settings; can be indicative of geochemical alteration above the resource [2].
- MT data were collected to interpret the extension of the clay cap beyond the first development area and inverted to an electrical conductivity model [1].
- The conductivity model is used to determine relationships between the conductance & the overlying steam flow rates.

### Value of Information

Does the information improve (on average) our chances of drilling economic wells?

**Value of Information (VOI) Analysis Using Field Data:**

**Accounting for Multiple Interpretations & Determining New Drilling Locations**

Whitney Trainor-Guitton, G. Michael Hoversten, Gregg Nordquist, Robert Mellors & Rindu Grahabhak Intani

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### Deduce trends between conductance (g) & steam flow (θ)

1. Define 2 clay caps with 2 conductivity cutoffs (thresholds):
   - $0.12 \text{ S/m}$
   - Delineates thinner cap
   - $0.10 \text{ S/m}$
   - Delineates thicker cap

2. Determine co-located steam rates & conductance (thickness $x$ conductivity):
   - $750$ m as cutoff distance
   - Represents lower quartile ($Q1$) of distances between midpoint of feed zones and conductance voxels

### Quantify probabilistic relationships between $g$ and $θ$

- Each bar represents number ($c_{ij}$) of conductance voxels associated with each steam flow category
- Bayes Law to combine likelihood and prior:
  - Posterior Probability: $Pr(θ = θ_i | G = g_i)$
  - When posterior $>1$, conductance is more reliable in determining steam flow category

### Determine next drilling campaign

- MT data has more value if probability of "dry hole" is larger, e.g. alternate prior
- The VOI imperfect, using $0.1 \text{ S/m}$ clay cap calibration is higher when $Pr(θ > 30) = $ higher:
  - the conductance for this category has less overlap with others
- This reverses for alternate prior with higher $Pr(θ < 5)$

### Observed Steam Flow Rates

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### References


### Locations of Darajat Field

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