

Design Requirements for Commercial Sedimentary Geothermal Projects

Chad Augustine

National Renewable Energy Laboratory

*Power Plays: Geothermal Energy in Oil
and Gas Fields*

Southern Methodist University

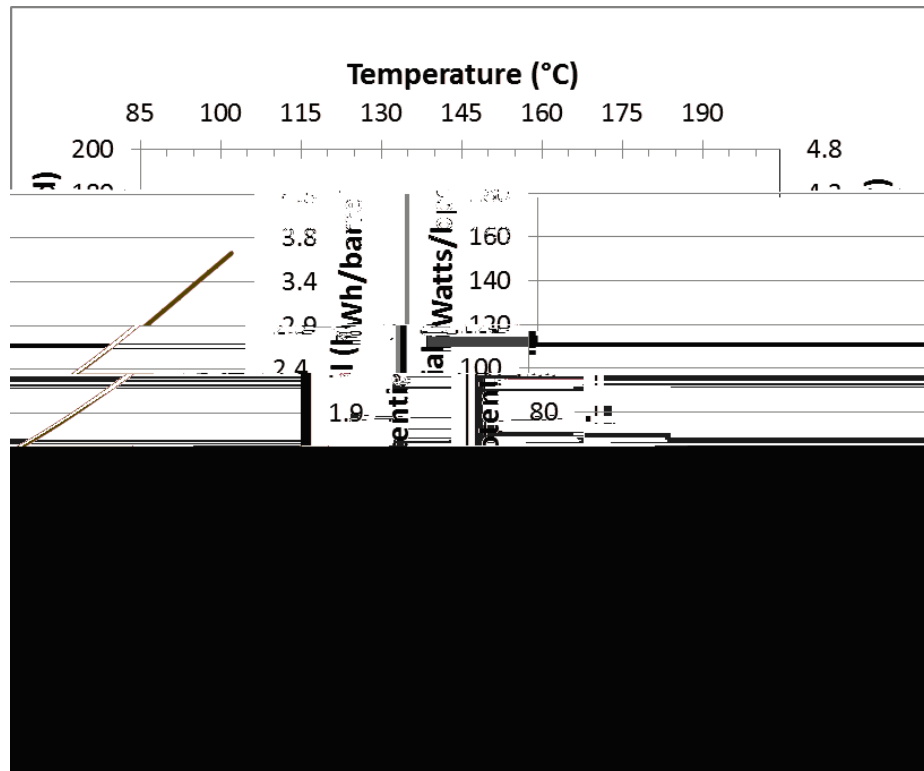
April 25-26, 2016

Geothermal vs. Petroleum – a Comparison

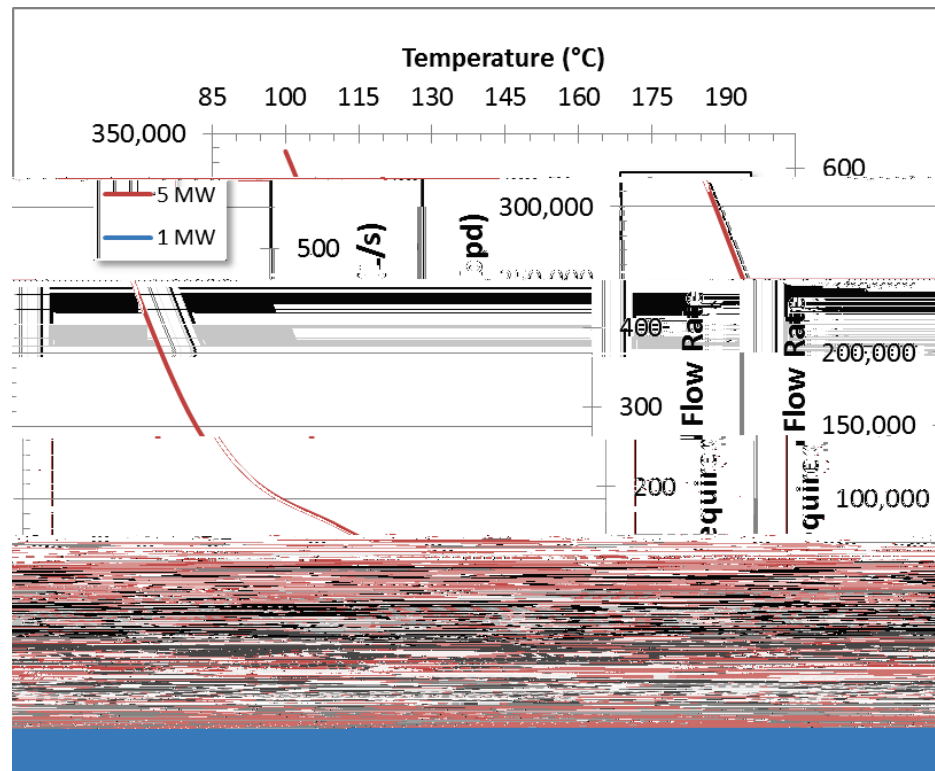
Petroleum		Geothermal
	Temperature	
	Flow Rates	<i>average</i>

Temperature is important, but is not enough...

Need both Temperature AND Flow Rate for commercial power generation:



Electricity Generation vs. Temperature



Flow Rate Requirements vs. Temperature

-
-

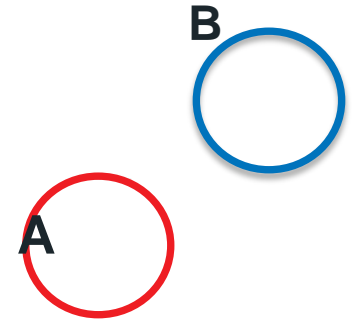
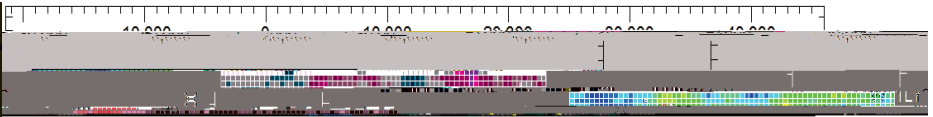
-

$$k \phi \quad k \phi$$

- Area B is selected due to its higher porosity (hir.1() pe16.7e)-.6(dmT0.30540 r



Temperature Distribution



Temperature

Sedimentary Geothermal
Reservoir Requirements

-

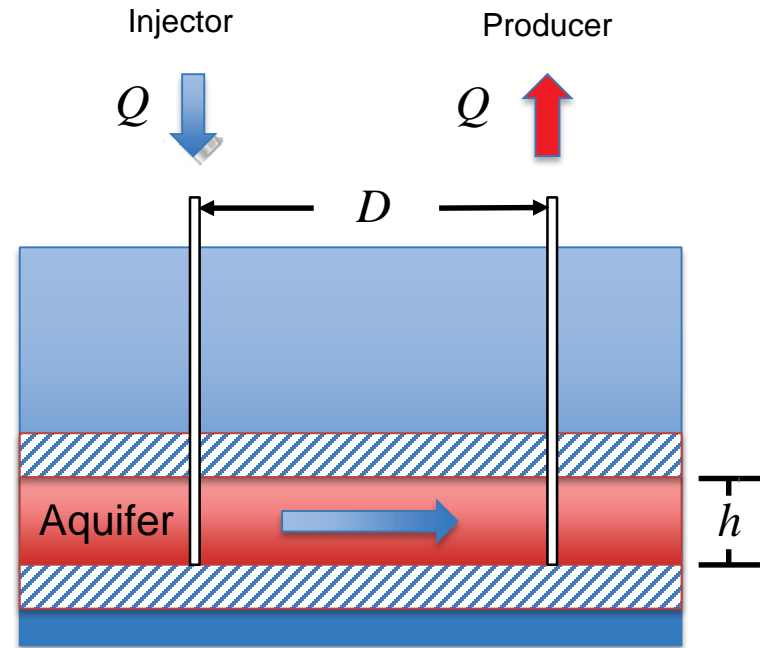
Sedimentary Geothermal Doublet – Analytic Model

- Time for **thermal breakthrough** at production well (Gringarten, 1979)

$$\Delta t = \left[\phi + (1 - \phi) \frac{\rho_r C_{p r}}{\rho_w C_{p w}} \right] \frac{\pi D h}{Q}$$

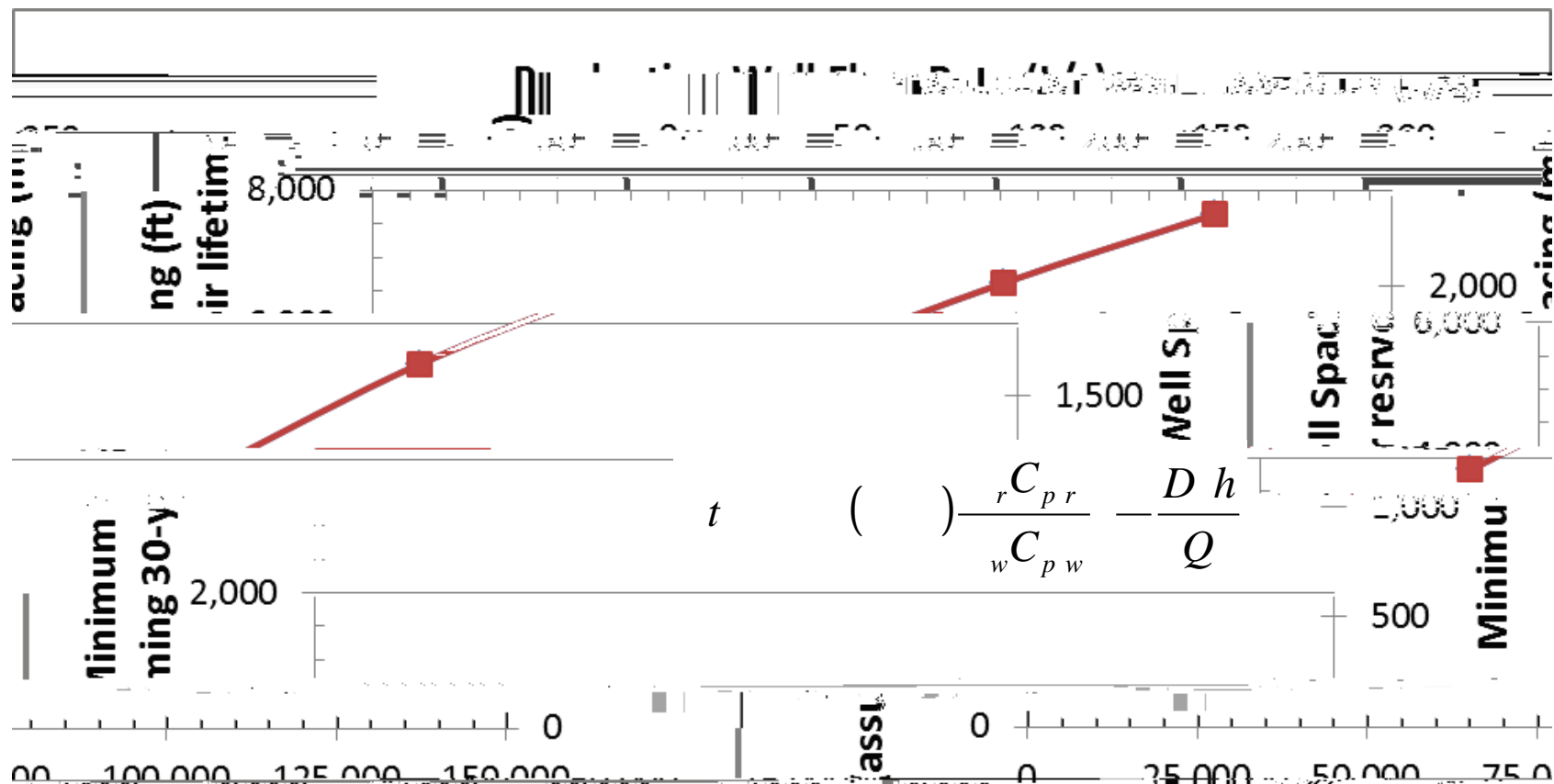
- Pressure difference** between injection and production wells (Gringarten, 1979; Muskat, 1939)

$$\Delta P = \frac{\mu Q}{k h} \left(\frac{D}{r_w} \right)$$



Parameter	Value
ϕ	0.15

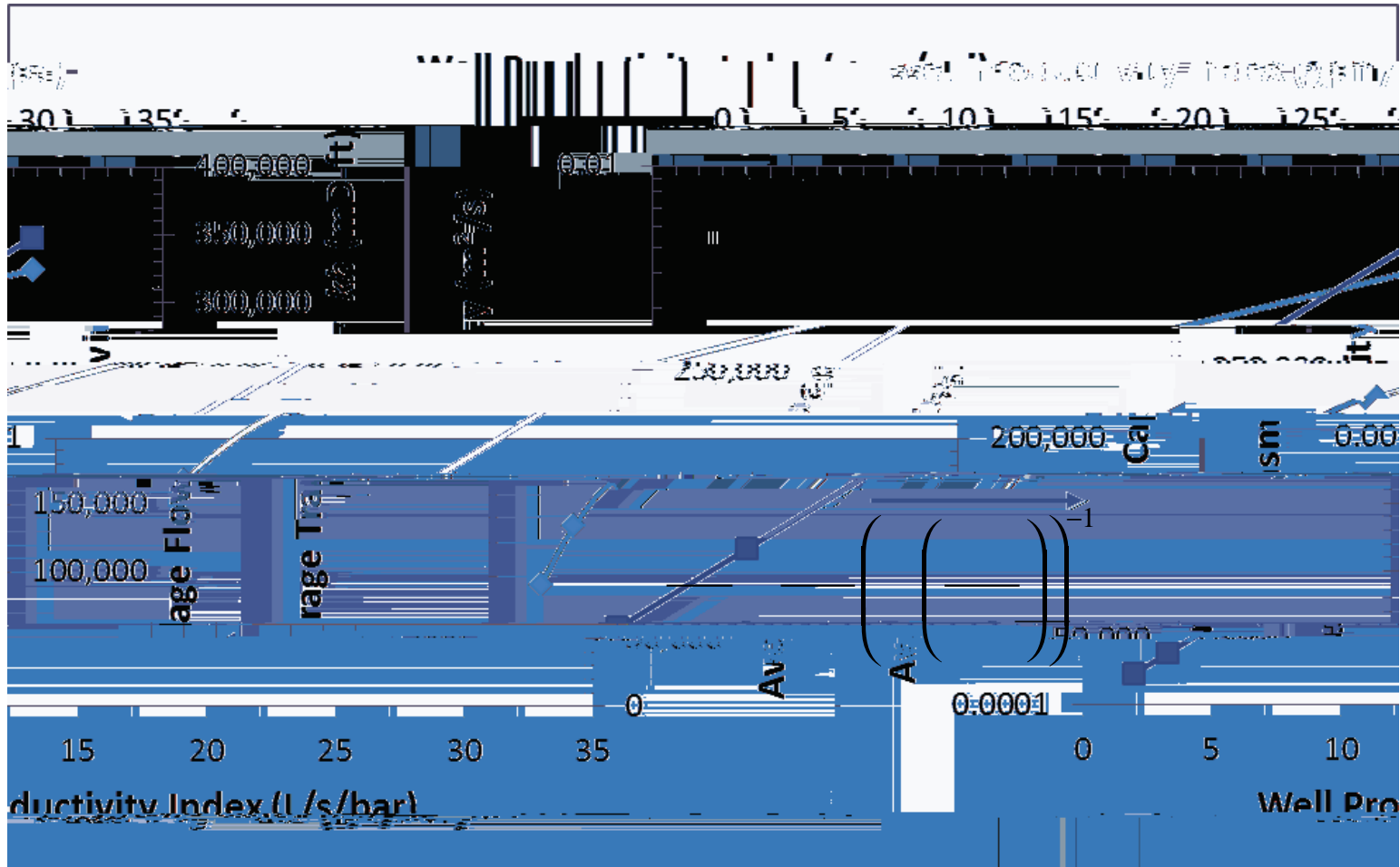
Reservoir Lifetime and Well Spacing



Production Well Flow Rate (bbl/day)

- Well spacing on the order of 4,000-6,000 ft (1-2 km)

Well Productivity

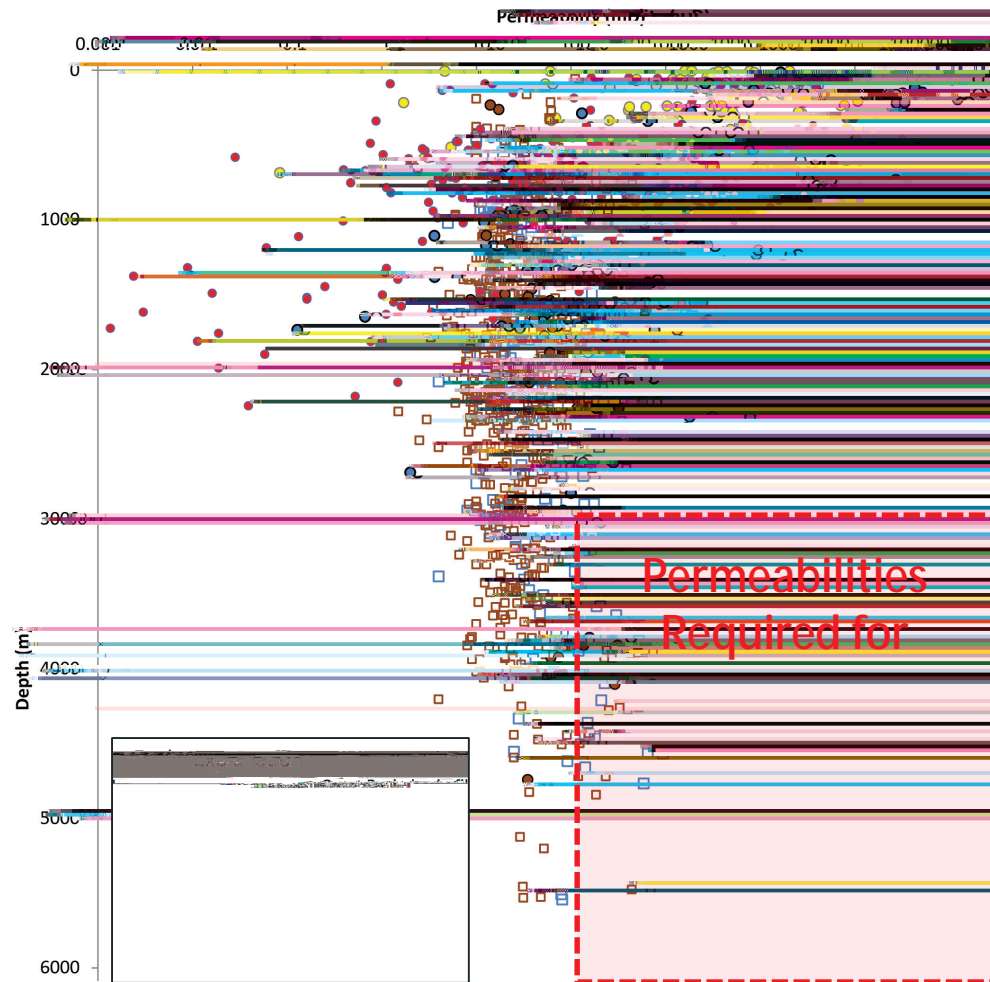


-
-

hundreds to thousands of mD

reservoir permeabilities of

Sedimentary Geothermal Doublet – Analytic Model



Can Reservoir Performance Be Improved?



- Studied impact of well-configurations on well productivity
- Found that use of horizontal wells and fracturing can increase well productivity by factor of 3-5

Questions?

Contact Info:

Citations

- *Geothermal Resources Council Transactions*

- *Geothermal Resources Council Transactions*
- *Geothermal Resources Council Transactions*
- *Optimization of Well Configuration for a Sedimentary Enhanced Geothermal Reservoir.*

-
-
