# OPTIMIZATION OF GEOTHERMAL CIRCULATION COUPLING SURFACE DISSOLUTION CO2 STORAGE

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Implementing geological carbon sequestration involves the injection of CO2 into deep saline aquifers. An alternative way to injecting CO2 as a buoyant phase is to dissolve it into brine extracted from the storage formation, then inject the CO2-saturated brine into the storage formation. On the other hand a common way to produce geothermal energy is to extract hot water and re-inject the heat-depleted water back into the aquifer. Coupling geothermal circulation and surface dissolution CO2 storage maintains reservoir pressure, permits heat recovery from permeable rocks, eliminates the risk of buoyant migration of stored CO2 and mitigates the extent of pressure elevation during injection.

The geothermal circulation involving CO2 injection creates low-temperature/high-CO2-concentration zones around injectors and these zones will grow with time and eventually reach the extraction wells. Heterogeneity of the aquifer often leads to early breakthrough of CO2-dissolved brine. We develop an optimal control strategy of the extraction/injection wells to delay the breakthrough of injected brine in a heterogeneous aquifer. The objective function aims to improve the areal sweep by equalizing the temperature of producing water at the extractors. The approach significantly delays the breakthrough time. In an example case the breakthrough is delayed from 18 years to 28 years.

Surface dissolution CO2 storage in geothermal aquifer likely yields less amount of thermal energy that could be extracted from the aquifer, because the front of CO2-dissolved brine tends to reach the extractors earlier than the temperature front by a factor of heat capacity. Credit for carbon sequestration would help compensate the cost of CO2 storage in geothermal aquifer. The minimum credit needed for the implementation is calculated in this study.