municates between the heated water injection well **224** and the cool water production well **222**. The temperature gradient across the subterranean heat exchange area **226** is substantially constant except proximate the injection completion interval **216** where the injection of heated water **205** causes the temperature to rise. Heated water **205** is cooled in the subterranean heat exchange area **226** and is re-circulated through the cool water production well **222** and into the tube-side inlet **217** of the cooling heat exchanger **210** for cooling a known heat load of a geothermal electricity generating system. Water may be extracted from the cool water aquifer **202**, circulated through the geocooling system **200** and injected back into the cool water aquifer **202** by a pump, thermal siphon, gravity or any other method known in the art for circulating fluids to and from an aquifer.

In accordance with FIG. **2**B, the geothermal electricity generating system may be a binary power plant including a heat producing well (not shown) drilled in a geothermal formation (not shown), a vaporizing heat exchanger **250** and a turbine **228**. Geothermal brine, water and/or steam **240** may be produced from the heat producing well and circulated into the shell-side inlet **232** of the vaporizing heat exchanger **250** to vaporize a working fluid **242** entering the tube-side inlet **236** of the vaporizing heat exchanger **250**. Preferably the working fluid **242** has a vaporization point lower than the geothermal brine, water and/or steam **222** used to vaporize the working fluid **223**. Suitable working fluids for use in binary power plants include, but are not limited to, isobutane or other organic liquids having a boiling point lower than geothermal brine and/or water produced from the heat producing well. The geothermal brine, water and/or steam **240** is discharged from the shell-side outlet **238** of the vaporizing heat exchanger **250**, re-injected into the geothermal formation for heating through an injection well, produced from the heat producing well and re-circulated into the vaporizing heat exchanger **250**. The vaporized working fluid **242** is discharged from the tube-side outlet **234** of the vaporizing heat exchanger **250** and circulated into a turbine **228** to generate electricity. The production of electricity and the efficiency of the binary power plant increases as the temperature of the working fluid **242** discharged from the turbine **228** decreases.

The working fluid **242** discharged from the turbine **228** enters the shell-side inlet **230** of the cooling heat exchanger **210** where it is cooled and/or condensed by cool water **204** from the aquifer **202** entering the tube-side inlet **217** of the cooling heat exchanger **210**. The cooled and/or condensed working fluid **242** is discharged from the shell-side outlet **244** of the cooling heat exchanger **210** and may be re-circulated into the tube-side inlet **236** of the vaporizing heat exchanger **250** where it is vaporized. Water, brine and/or steam **240** may be extracted from the heat producing well and circulated through the binary power plant by a pump, thermal siphon, gravity or any other method known in the art for circulating fluids. The binary power plant may be a closed-loop system wherein the geothermal brine, water and/or steam **222** produced from the heat producing well is brought to the surface, circulated in the vaporizing heat exchanger **250**, re-injected back into geothermal formation, produced from the heat producing well and re-circulated through the binary power plant without being exposed to the atmosphere.

The geo-cooling system **200** may derive cooling capacity from any aquifer having a fluid and/or rock temperature lower than temperature of the working fluid exiting the turbine **228** of the binary power plant. The geo-cooling system **200** may derive cooling capacity from a cool water aquifer **202** such as a confined aquifer, unconfined aquifer, a porous matrix aquifer, a naturally fractured aquifer or an aquifer fractured by aquifer stimulation. During aquifer stimulation naturally occurring fractures in a fractured aquifer in the geo-cooling system **200** may be artificially developed through stimulation of a low permeability aquitard **223**. These fractures may be developed by pumping water under pressure sufficient to relieve the stresses on the rocks in the aquitard **223**, thus allowing the rock to shift along plains of weakness and create shear fractures. These fractures may enhance the naturally low permeability of the aquitard **223** or may create permeability in rock which has little to no permeability. Cool water aquifers having substantially constant year round groundwater temperatures between 5° C. and 25° C. are capable of cooling a heat load such as the working fluid **242** exiting the turbine **228** of a binary power plant throughout the economic life of the power plant.

The efficiency of the binary power plant is in part controlled by the difference between the temperature and pressure of the heated working fluid **242** entering the turbine **228** and the temperature and pressure of the cooled working fluid **242** discharged from the cooling heat exchanger **210**. This temperature difference may be governed by the fluid and/or rock temperature of the cool water aquifer **202** from which the cool water **204** is sourced. Cool water aquifers **202** with lower fluid and/or rock temperatures provide greater cooling capacity and geothermal formations with higher fluid and/or rock temperatures provide greater heating capacity for generating electricity. The cooling capacity of the geo-cooling system **200** is also affected by the distance (d) between the heated water injection well **224** and the cool water production well **222**. By increasing the distance (d) between the heated water injection well **224** and the cool water production well **222**, a larger flow rate of heated water **205** can be returned to the cool water aquifer **202** for cooling without causing a significant increase in the overall temperature of the cool water aquifer **202**. To maintain a substantially constant water temperature of the cool water aquifer **202** over the typical 30-year life of a binary power plant, the increase in temperature of the cool water **204** passing through the heat exchanger **210** must be minimized. To increase the efficiency of the binary power plant, the decrease in temperature of the working fluid **242** passing through the heat exchanger **210** must be maximized. In an example embodiment, the temperature increase of the cool water **204** passing through the subterranean heat exchange area **226** is maintained at about 10° C. or less.

In another exemplary embodiment, the geo-cooling system **200** may be used to cool a working fluid exiting a turbine for generating electricity in a solar thermal power plant. The working fluid entering the turbine for generating electricity in a solar thermal power plant is vaporized by the sun.

Example embodiments have been described hereinabove regarding improved geocooling methods and systems for cooling a known heat load. Various modifications to and departures from the disclosed example embodiments will occur to those having skill in the art. The subject matter that is intended to be within the spirit of this disclosure is set forth in the following claims.

What is claimed is:

1. A system comprising:

at least one cool water production well open to a cool water aquifer and in hydrologic communication with a subterranean heat exchange area that provides requisite cooling capacity to a known heat load; and

at least one heated water injection well in hydrologic communication with the subterranean heat exchange area and open to the cool water aquifer at a prescribed distance from the cool water production well,