



February 3, 2011
Reno, Nevada



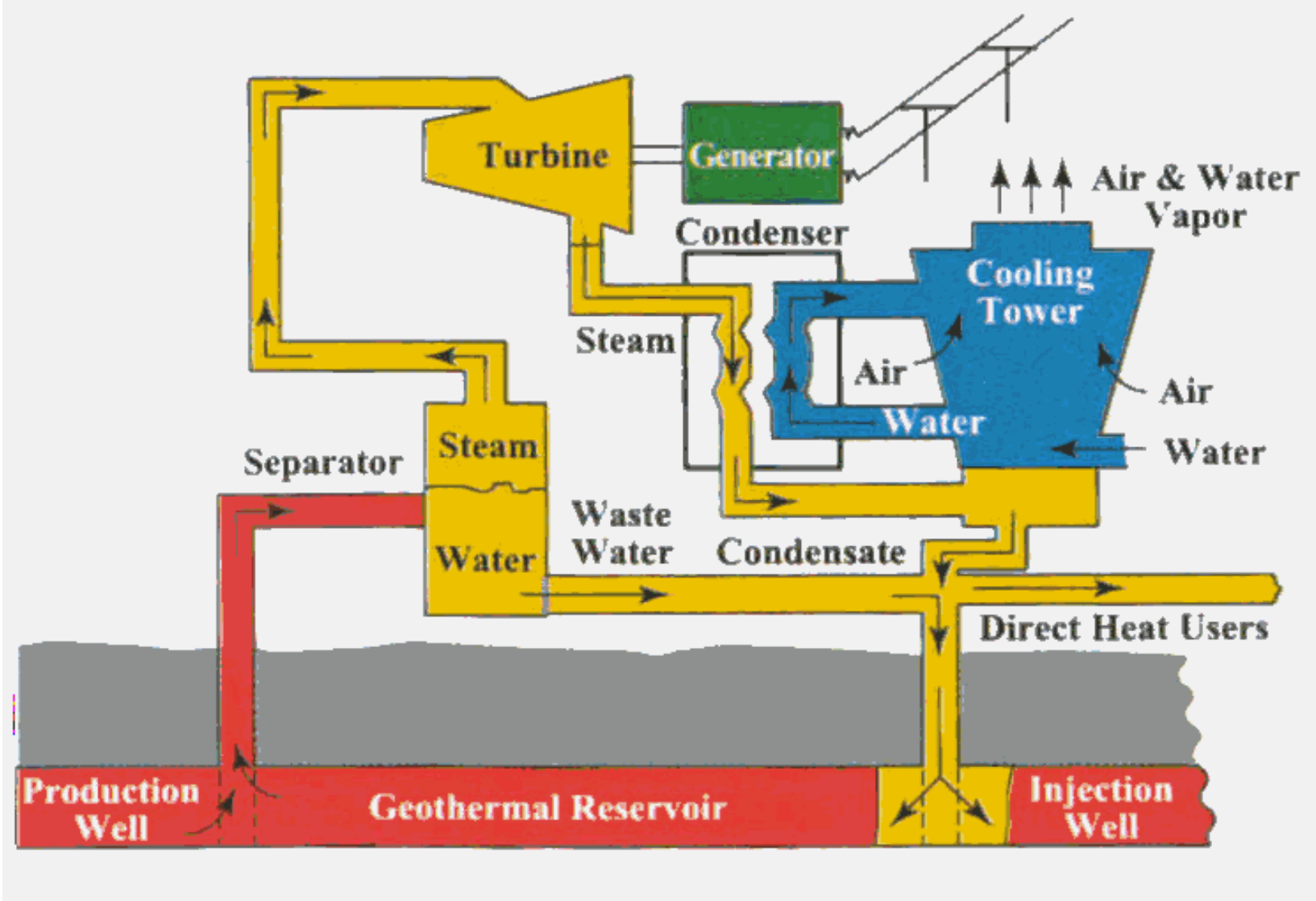
Nevada Geothermal Power Plants

Where Does The Water Come From and Go To?

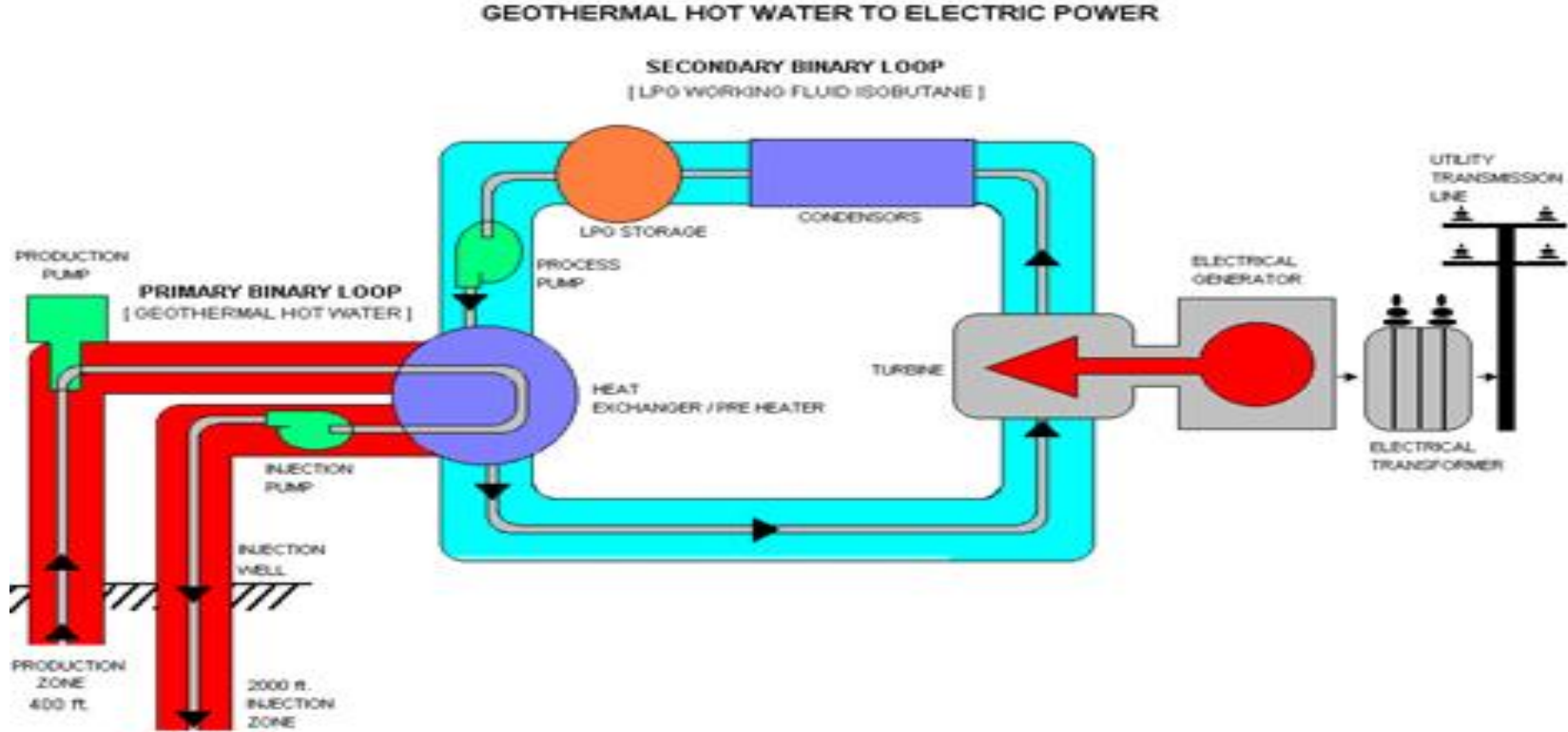
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Typical Geothermal Power Plant (Flash Type)



Typical Geothermal Power Plant (Binary Type)



Typical Geothermal Power Plant (Binary Type, Cooling options)



Hot air

Dry Air Cooled Condensers
No Water Consumption
Emission is only hot air
(like the presenter)

Wet cooling tower and Condensers

Water consumption through evaporation

Emission is water vapor and PM_{10}



Water vapor
lost to
atmosphere

Reinjection of cooled geothermal fluids

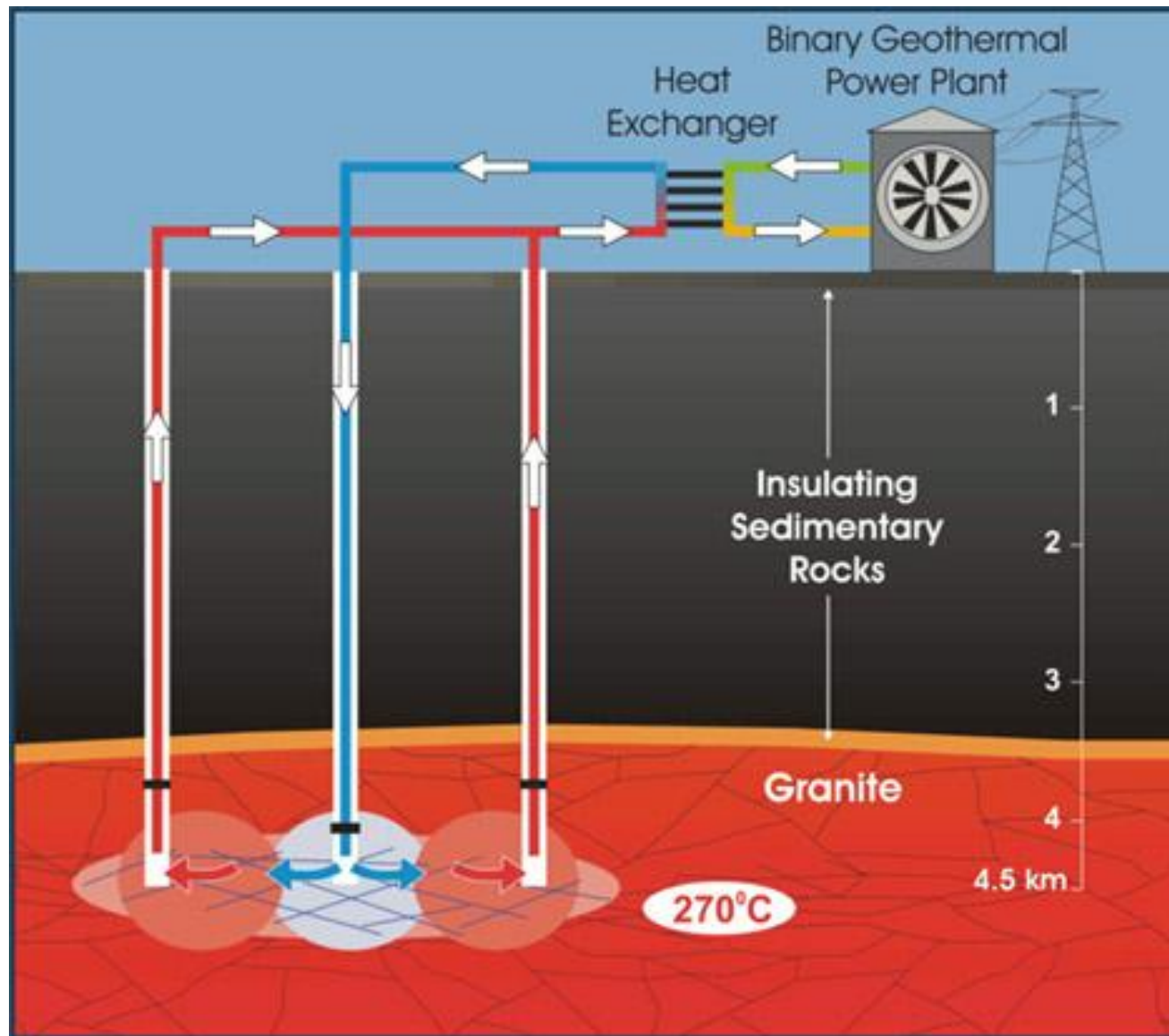
Binary Power Plants:

- ✔ Hot water is piped through the power plant and cooled
- ✔ The heat is converted to electrical energy and inefficient waste heat.
- ✔ The cooled water (150-180°F) is piped (sometimes pumped) to injection wells
- ✔ 100% reinjection
- ✔ Only losses are due to well testing, leakage (UIC) and draining for maintenance
- ✔ Proper resource management will maintain the water in area near the producing zones with little loss of water table

Flash Power Plants:

- ✔ Steam and water is produced to the surface
- ✔ Steam is used to drive the turbine and generate electricity (more efficient)
- ✔ Water is collected in separators (and re-flashed and then injected) or injected back into the resource directly
- ✔ Water vapor from the cooling process is lost to the atmosphere
- ✔ Creative uses for reclaim or meteoric water can replenish the resource

Reinjection of cooled geothermal fluids



Consumptive Use and Water Rights

Binary Power Plants:

- ✔ 100% reinjection leaves very little consumptive use requirement
- ✔ Can be problematic to reconcile with agencies (in the past)
- ✔ Little to no water rights needed for air cooled power plants
- ✔ Domestic needs will need to be obtained but are minimal
- ✔ Wet cooling does require water rights and has water consumption that is significant

Flash Power Plants:

- ✔ Less than 100% reinjection results in consumptive use
- ✔ Requires water rights to operate
- ✔ Domestic needs are covered by the steam condensate and require no additional water rights

Conclusions and Q&A

Conclusions:

- ✔ There is no right answer
- ✔ All system types have benefits and liabilities
- ✔ Water is a valuable commodity (said the preacher to the choir)
- ✔ Usually higher consumptive use results in higher efficiency and therefore higher generation and higher revenue
- ✔ Very dependant on local situation

Questions and Answers (hopefully)