



New Renewable Power To Meet The California RPS

Presentation To S.T.E.P

May 8, 2003

Vulcan Power Company
Silvan Power Company
Bend, Oregon
(541) 317-1984

Geothermal Generation of Electricity

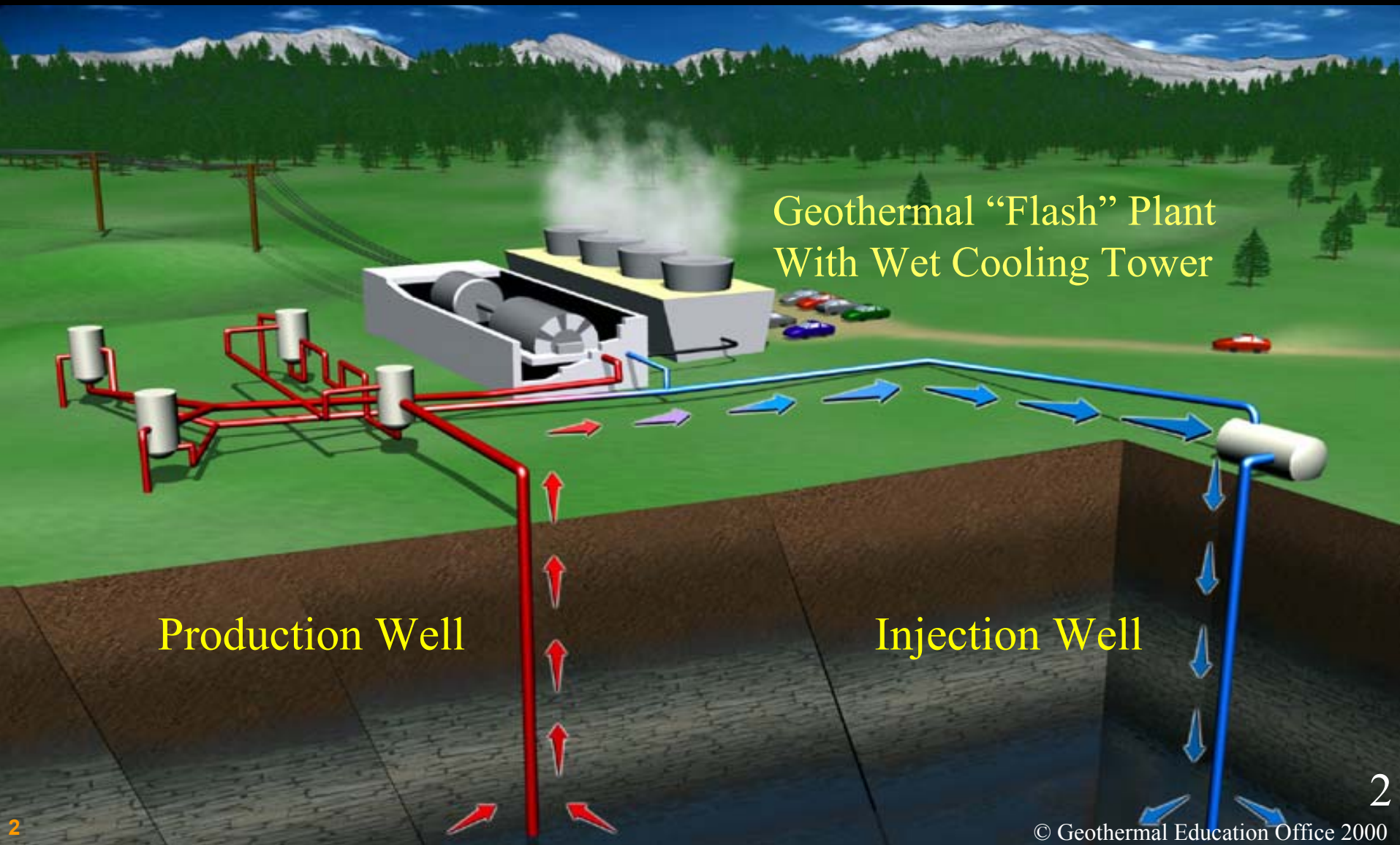
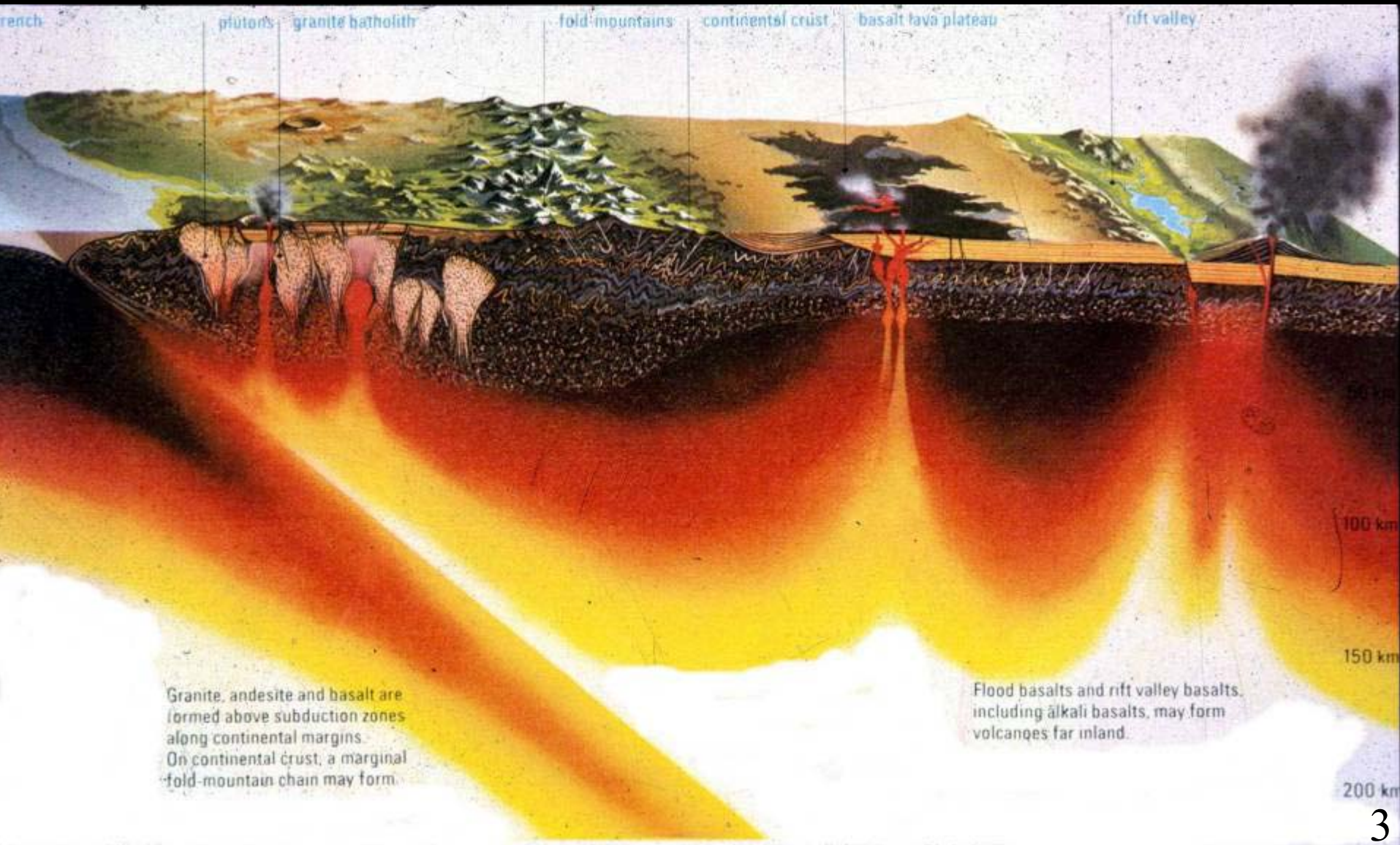
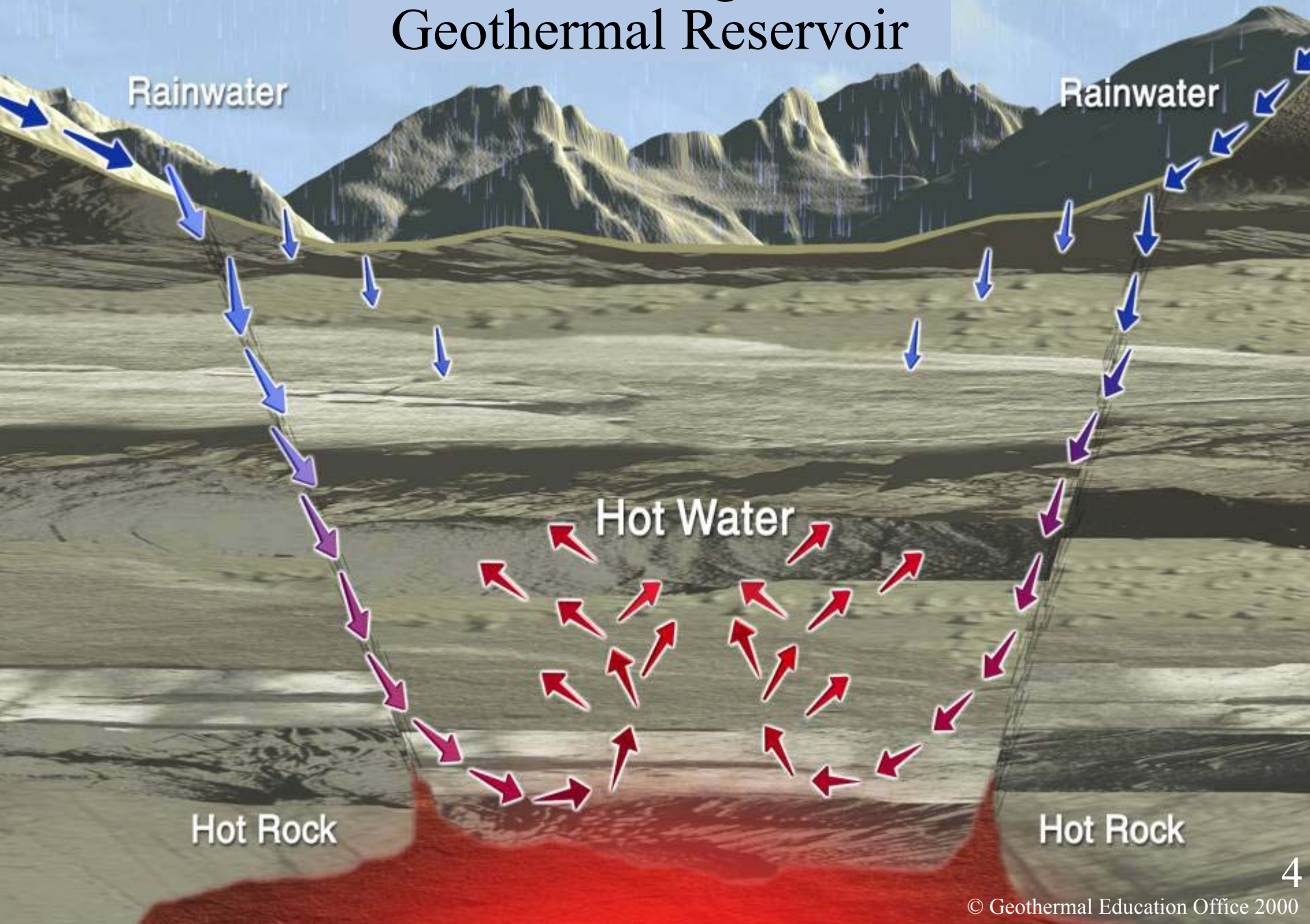


Plate Tectonics: North America



Basin and Range Steam Geothermal Reservoir



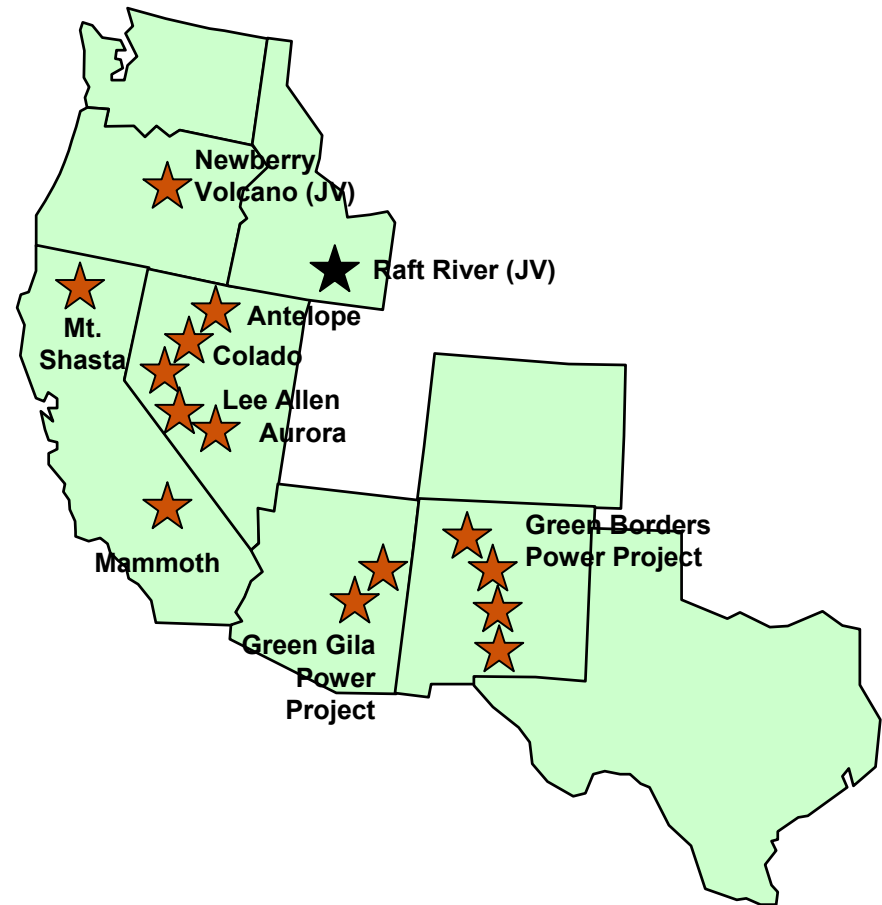
Double Flash Steam Plant - Over 350° F

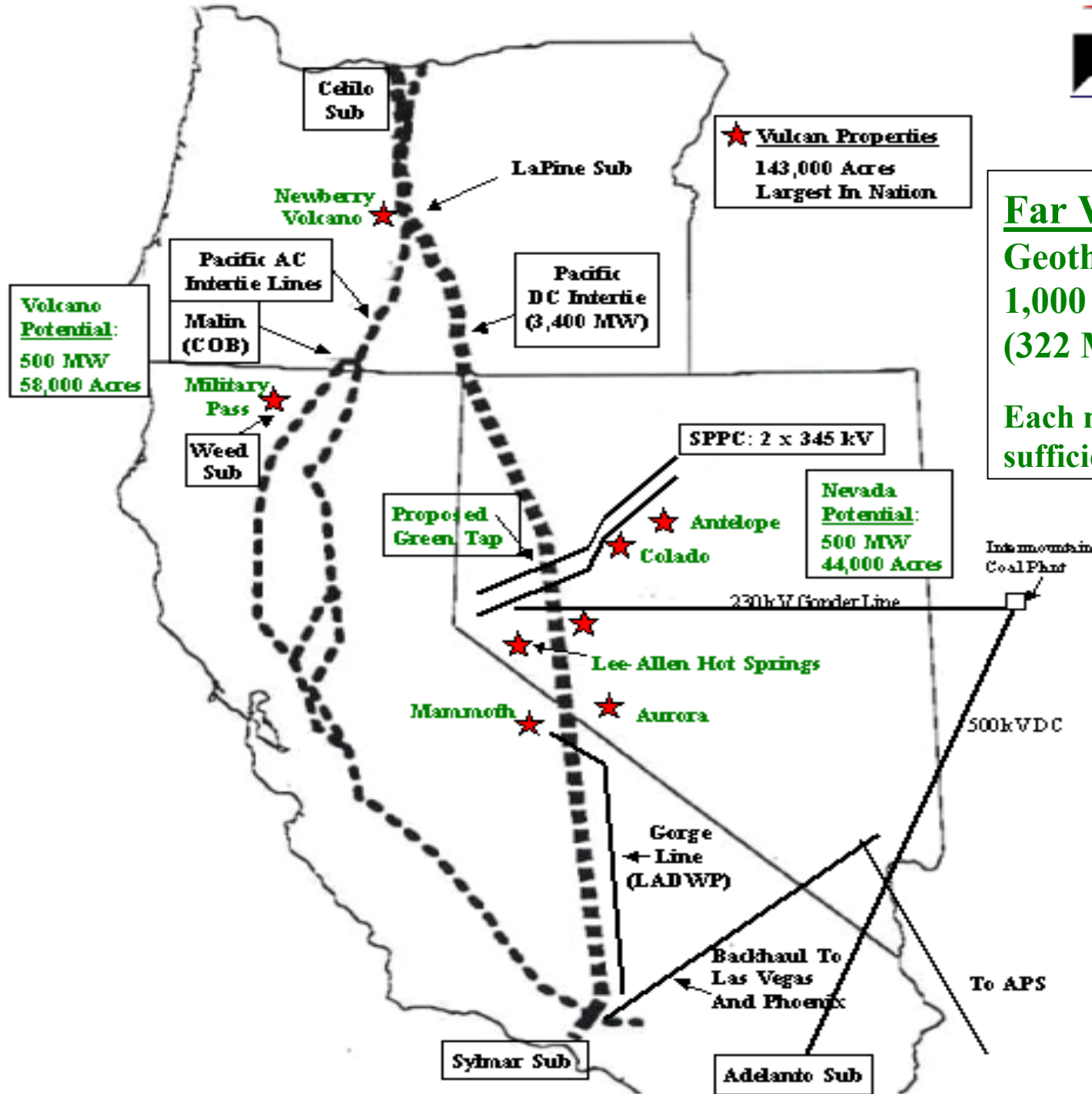
(Water Vapor Cooling)



Projects and Markets

- Vulcan acquired: Over 140,000 acres of leases, lease applications, permits, and options.
- Vulcan and joint ventures properties proven or highly prospective over \$70 million in prior exploration and development.
- Many Vulcan properties advanced, ready for power projects.
- Selected by electric utilities to supply 322 MW new power.





Volcano Potential:
500 MW
58,000 Acres

★ Vulcan Properties
143,000 Acres
Largest In Nation

Far West Region:
Geothermal Baseload
1,000 MW Plan
(322 MW selected to date)

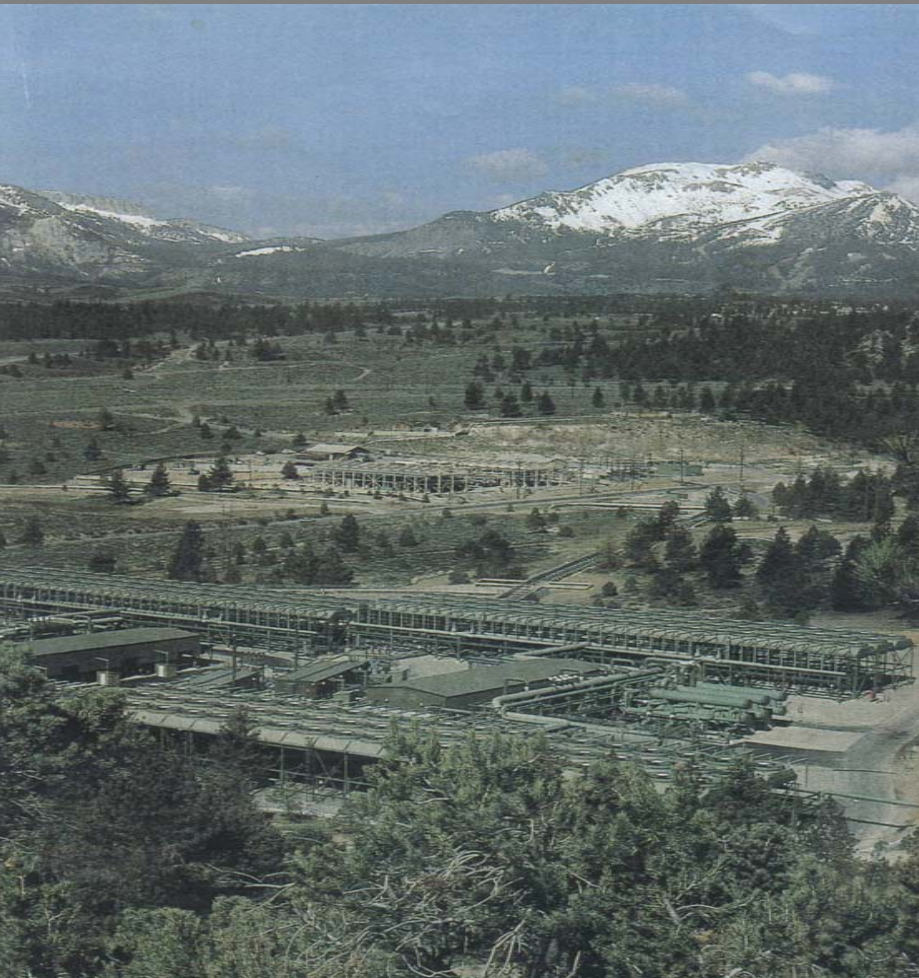
Each megawatt (MW) is
sufficient for 1,000 Americans

Nevada Potential:
500 MW
44,000 Acres



VULCAN POWER COMPANY

Mammoth, California



- USGS Rated: 2,100 MW
- Proven 340° F Resource
- Vulcan Adjacent to 40 MW Operating Geothermal Plant
- Selected to provide 92 MW Municipals and state: CPA



ULCAN POWER COMPANY

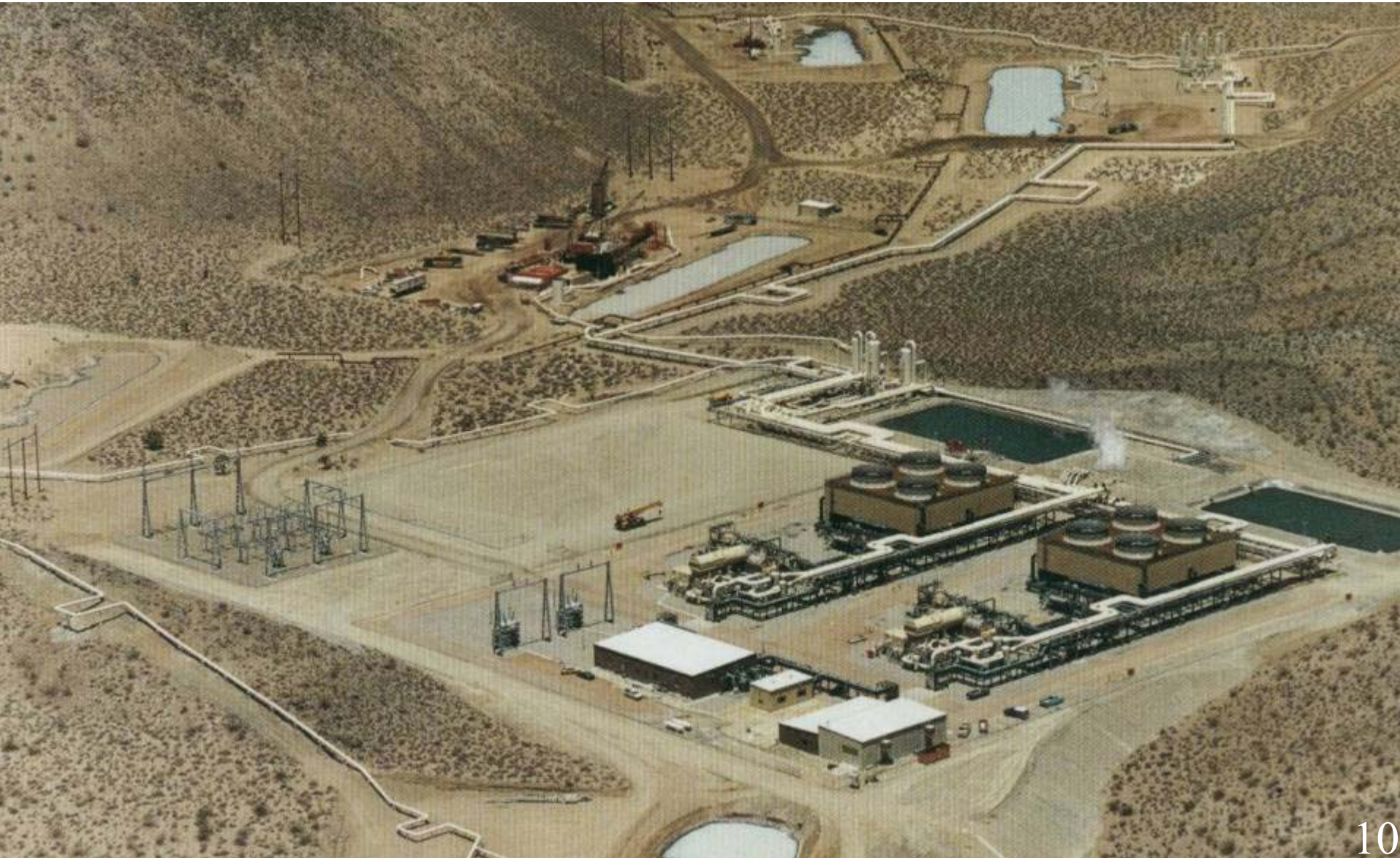
Newberry Volcano, Oregon

- Northwest Geothermal Company.
- 38,000 Acre Joint Venture.
- USGS Rated: 730 MWa.
- Steam at 509 F - 600 F. Data Indicates 10 Square Mile Production Zone.
- Most Advanced Major Geothermal Project in Pacific Northwest.
- Two Adjacent 30 MW Plant Sites Permitted.
- Selected to provide 30 MW



Newberry partner and shareholder, Tony Bingham, was formerly President of this Southern California project owner.

Coso California: 270 MW and \$550 Million



Green Borders Power Project

2002

2003

2004



Radium: 20,000 Acres
BLM Apps, Partially proven
Hillsboro: 8,000 Acres
Potential 320° F

Site
Selection

Based upon results BLM
issuance/exploration.

Public or Private Site

Power
Markets

NMPUC 10% RPS Rule
Potential PPA contracts.

PNM, EPE and Mexico CFE

Binary Demo
and GeoHy®
Fuel Demo

Demo 1 MW binary plant
Design geoelectrolysis plant for saline water
Construct plant
Produce power and GeoHy® fuel
Arrange GeoHy® demo autos
Demo GeoHy® fuel in crossborder autos

30 MW Geo
Binary Plant

Geothermal Well Flowtest, May 1983
Radium Springs, New Mexico





Mission: The Native Range Restoration Project combines scientific research, development of new technologies, field demonstrations and unique educational opportunities to restore degraded rangelands with native plant species.

- **The Native Range Alliance**

Native Range Restoration Project:

(Vulcan has dedicated 5% of power income)

- Restore arid lands with native species
(Bunchgrass and shrubs)
- Increase carrying capacity for all species
(sage grouse, livestock, desert sheep)
- Billions of dollars of public benefits
- American arid land restoration plan.

Saline water wetlands restoration:

- Salt Wells, NV plant waterfowl wetlands
- Green Borders Power Project, NM

Alliance seeking applied research funds for arid lands native seed industry growth. Needs 20 million pounds per year. Supply of regional native seed under 1% of needs.

Forest and Rangelands Biomass

The Biomass Type Depends on Annual Precipitation (and Elevation)

Mountains: higher elevation forests with over 12” annual water

Mixed conifer pine, fir, other

Rangelands: lower elevation “high deserts” with 8” to 12” annual water

West: invasive juniper

Southwest: invasive mixed pinyon-juniper (PJ)

Forest Thinning: to reduce forest fire costs and increase forest health.

Invasive Juniper Removal: to return rangelands to verdant grasslands.

Forest Biomass Resources

100 Million Acres of Western Forests Need Thinning

Why Thin Forests?

- Reduce forest fire threats and costs.
- Reduce global warming CO₂ with wood chip boiler burning.
- Increase forest health for future benefits.
- Jobs and tax base in depressed rural lumber towns.
- Massive watershed supply increase for urban-ag uses.

Excellent sustainable supply of renewable baseload power.

Fuel supply for up to 100 new 30 MW biomass power plants in the West.
(3,000 MW)

Forest Biomass Project Sites

Some projects being sited next to some of few remaining sawmills.

- Benefits include use of industrial zoned land.
- Existing power lines to sites, existing cooling water supply.
- Add mill waste to forest wood chip fuel supply.
- Sell cogen steam back to sawmill for lumber dry kilns.

Most projects being sited on abandoned sawmill sites.

- Benefits include use of industrial zoned land.
- Existing power lines to sites, existing cooling water supply.
- Some biomass sites may add high-efficiency small diameter log mills.
- Some sites may add other wood products, fuel or other.

Rangelands Biomass Resources

West: 10 Million acres of juniper needs removal.
(CA, OR, NV, etc.)

NE and SE California, Oregon, Nevada massive juniper infestation.

Southwest: 20 Million acres of PJ needs removed.
(AZ, NM, CO, etc.)

Why Remove Juniper?

Invasive trees (80-120 years old) each waste 30 gallons per day of water.
Invasive juniper and PJ turning former verdant grasslands into desert.

Resulted from combination of fire-cycle interruption and overgrazing.
Grasslands so degraded they will not sustain a natural burn of the invasive juniper, must remove with machines.

Biomass power from wood chips only economic treatment for these lands.
Alternative to treatment is desertification of American West this century.

Excellent long term supply of green power.

Benefits Include:

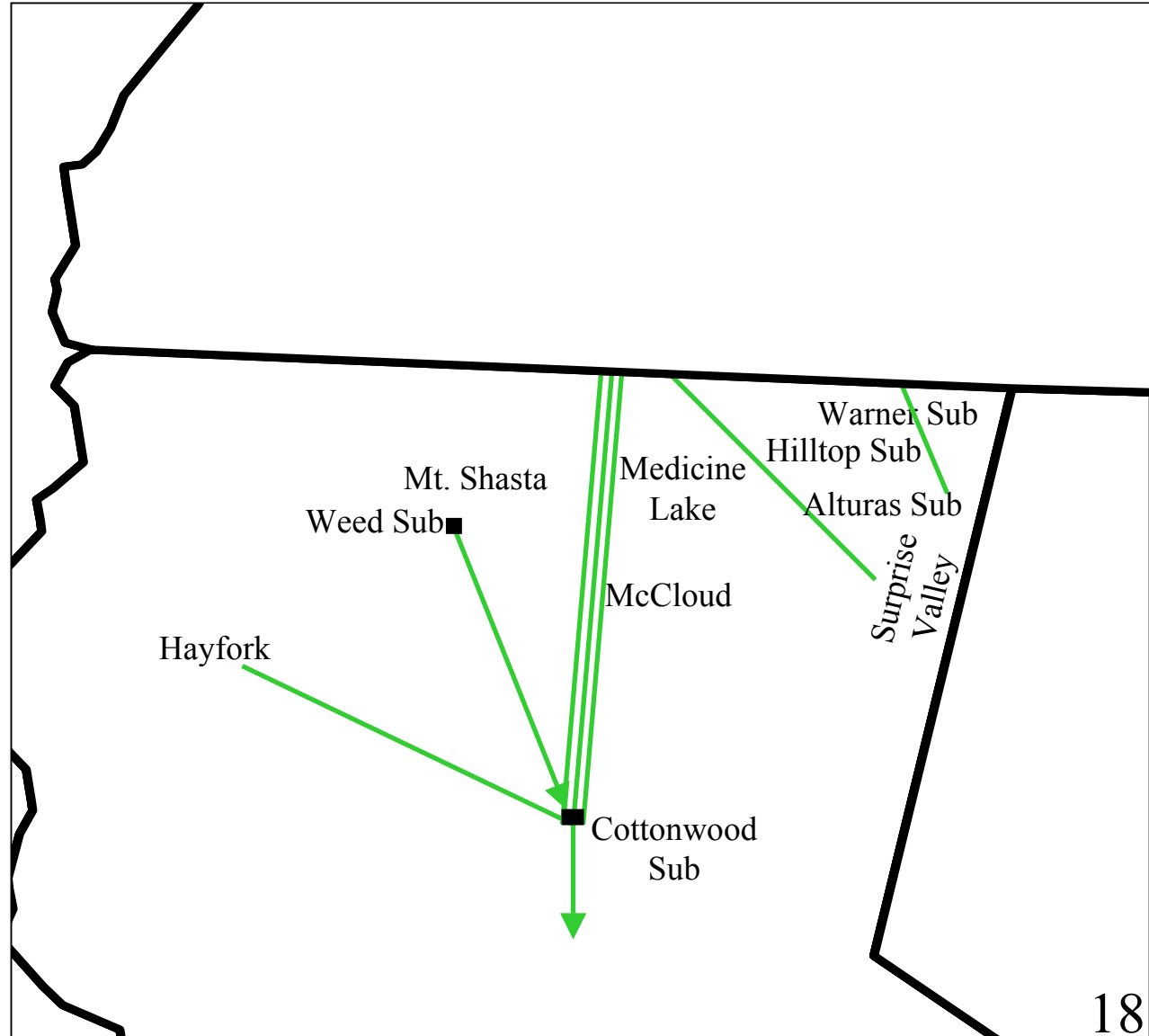
- Massive amounts of water to restore native grassland steppe.
- Quadruple forage, feed and cover for all species, wild and domestic.
- Jobs and tax base in depressed rural regions.

Green Power Grid For Northern California

New Renewables

<u>GEO</u>	<u>Biomass</u>	<u>Location</u>
240 MW		Newberry Volcano
	30 MW	Summer Lake Sub
5 MW		Paisley
5 MW	30 MW	Lakeview
	30 MW	Klamath Falls
	30 MW	Alturas
30 MW		Surprise Valley
240 MW		Mt. Shasta
120 MW		Medicine Lake (1)
	30 MW	McCloud
	30 MW	Hayfork
640 MW	180 MW	TOTAL

(1) Estimate stand-in only, uncertain of owner's estimates.



— Existing Transmission

New Renewables

<u>GEO</u>	<u>Biomass</u>	<u>Wind</u>	<u>Location</u>
240 MW	60 MW	200 MW	PDCI Line
120 MW	60 MW	120 MW	Upgrade Line
100 MW			Dixie Valley
120 MW	120 MW		Navaho Line (10%)
120 MW	360 MW		Navaho Line (20%)
300 MW			Devers Line
			SCE Palo Verde Line
		?	Tehachapi Upgrade(1)
880 MW	240 MW	320 MW	TOTAL w/ 10% Nav.

(1) Uncertain of upgrade size.

Green Power Grid For Southern California

