



Environmental issues

Session VI

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Mannvit

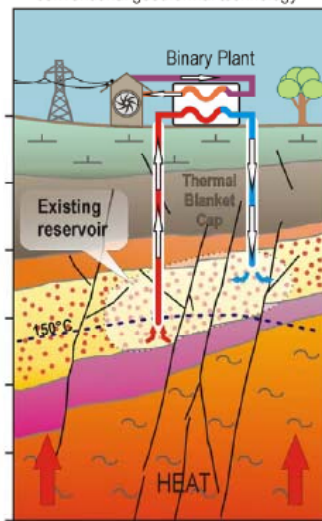
Potsdam, April. 18th, 2013



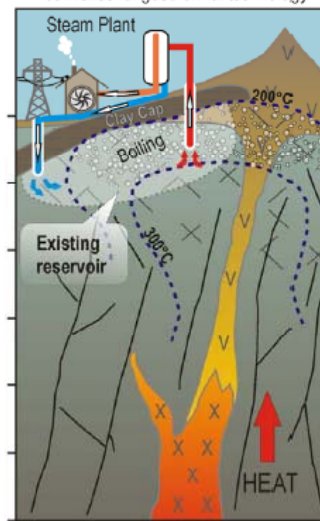
Geothermal systems-three types

- Geothermal facilities using flash-steam techniques for exploiting high enthalpy resources
- Geothermal facilities using binary cycles
- Enhanced Geothermal Systems (EGS)

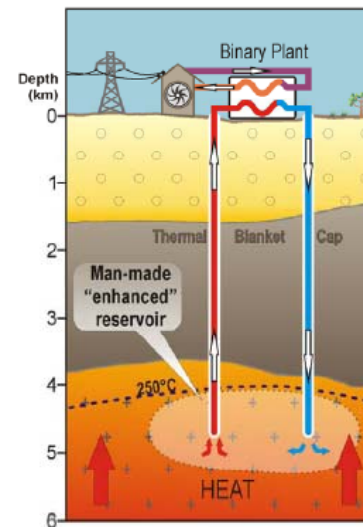
hot sedimentary aquifer



Magmatic play



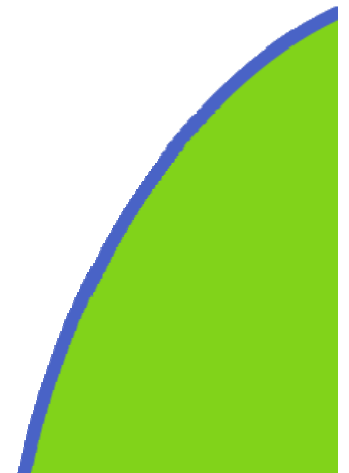
hot rock play





Environmental impacts-main categories

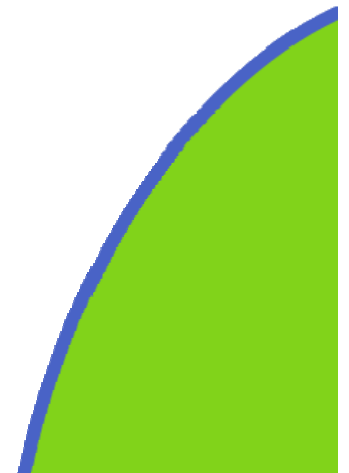
- Surface disturbances
 - Flora, fauna, surface water
- Physical effects
 - Land subsidence, induced seismicity, visual effect
- Noise
- Thermal pollution
 - Hot liquid and steam release
- Chemical pollution
 - Solid waste, gaseous emission to the atmosphere
- Protection





Activities causing environmental impacts

- Building of access roads, drilling pads and pipe laying
- Well drilling, repairs, stimulation and testing phase
- Plant construction and equipment installation
- Power plant commissioning and operation
- Decommissioning of facilities



Access roads, drilling pad and pipe laying

Predominant environmental concerns:

- Surface disturbance
- Visual impact
- Disposal of waste



Enclosed wellhead connected to a muffler

Well drilling, repair, stimulation and testing phases

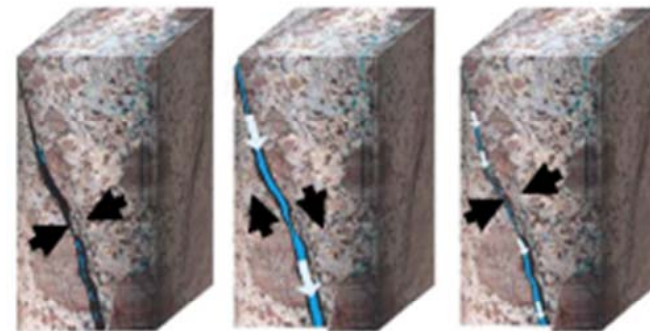
Predominant environmental concerns:

- Liquid and liquid carried pollutant release
- Noise and vibration
- Induced seismicity and seismic hazards
- Surface release of geothermal fluid
- Surface disturbances
- Visual impact

Holding pond in Hungary



Hydraulic stimulation



Plant construction and equipment installation

Predominant environmental concerns:

- Surface disturbances
- Noise
- Visual impact
- Disposal of waste

Nesjavellir flash power plant in Iceland



Bruchsal binary cycle power plant in Germany



Power plant commissioning and operation

Predominant environmental concerns are:

- Emission and injection of geothermal fluids
- Emission of geothermal gases
- Noise

Gaseous emission from various power plants

Plant type	CO ₂ Kg/MWh	SO ₂ kg/MWh	NO _x kg/MWh	Particulates kg/MWh
Coal-fired	994	4.71	1.955	1.012
Oil-fired	758	5.44	1.814	N.A
Gas-fired	550	0.0998	1.343	0.0635
Geothermal-flash steam, liquid dominated (USA)	27.2	0.1588	0	0
Geothermal-The Geysers dry steam field (USA)	40.3	0.000098	0.000458	negligible
Geothermal-closed binary/EGS	0	0	0	negligible
Geothermal-flash steam Hellisheidi-(Iceland)	21.6	17.6	0	0
Geothermal-flash steam – Tuscany (Italy)	324	1.65	-	-
Average. All European plants	369.7	1.1	0.5	0.1

Example of landscaping

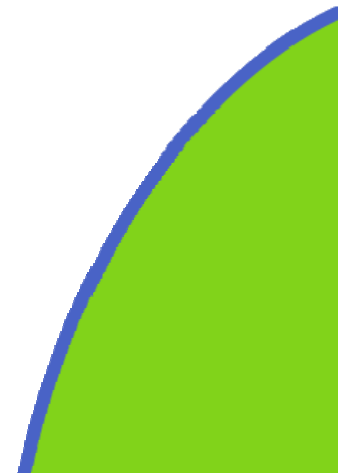




Decommissioning of facilities

Predominant environmental concerns:

- Chemical pollution and disposal of hazardous and other waste
- Surface disruption





Thank You!
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