GenaSys™ Geothermal: Mining energy from natural and abundant Hot Sedimentary Aquifers

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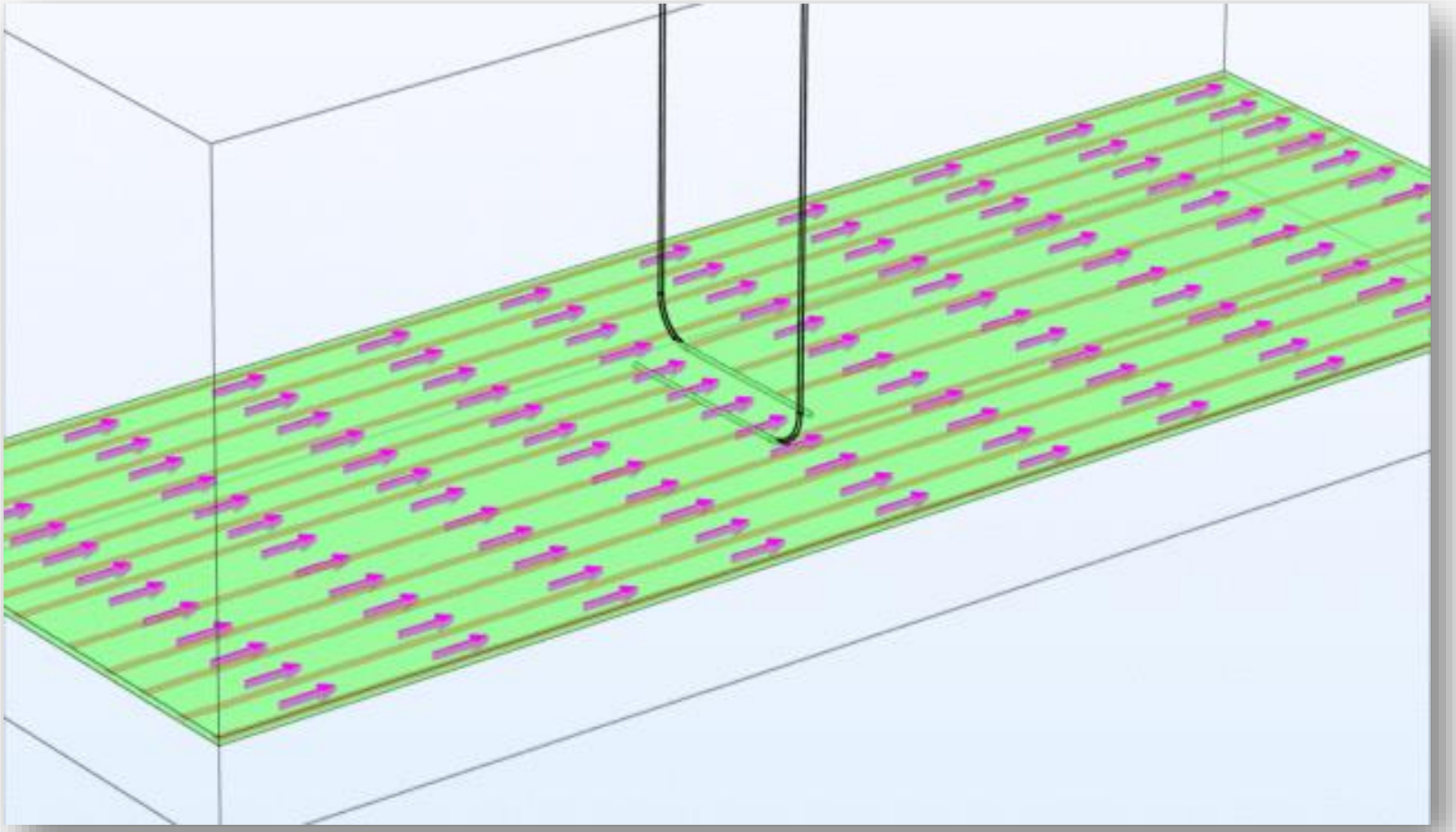
GenaSys™ Geothermal Energy Systems

GTI and JHU have developed **GenaSys** Geothermal Heat Extraction and Power Generation technology that addresses the limitations of conventional and experimental systems to producing clean, renewable, scalable, baseload energy.

- Harvesting Energy from abundant Hot Sedimentary Aquifers (HSAs)
  - ➢ Solves Scalability Problem
- Subsurface Characterization and Drilling
  - ➢ Reduces Cost and Risk by reusing Oil & Gas Technologies and Data
- Heat Extraction and Power Generation
  - ➢ GTI Technology Dramatically Reduces the Cost of Heat and Power by Extending System Longevity via Induced Convection

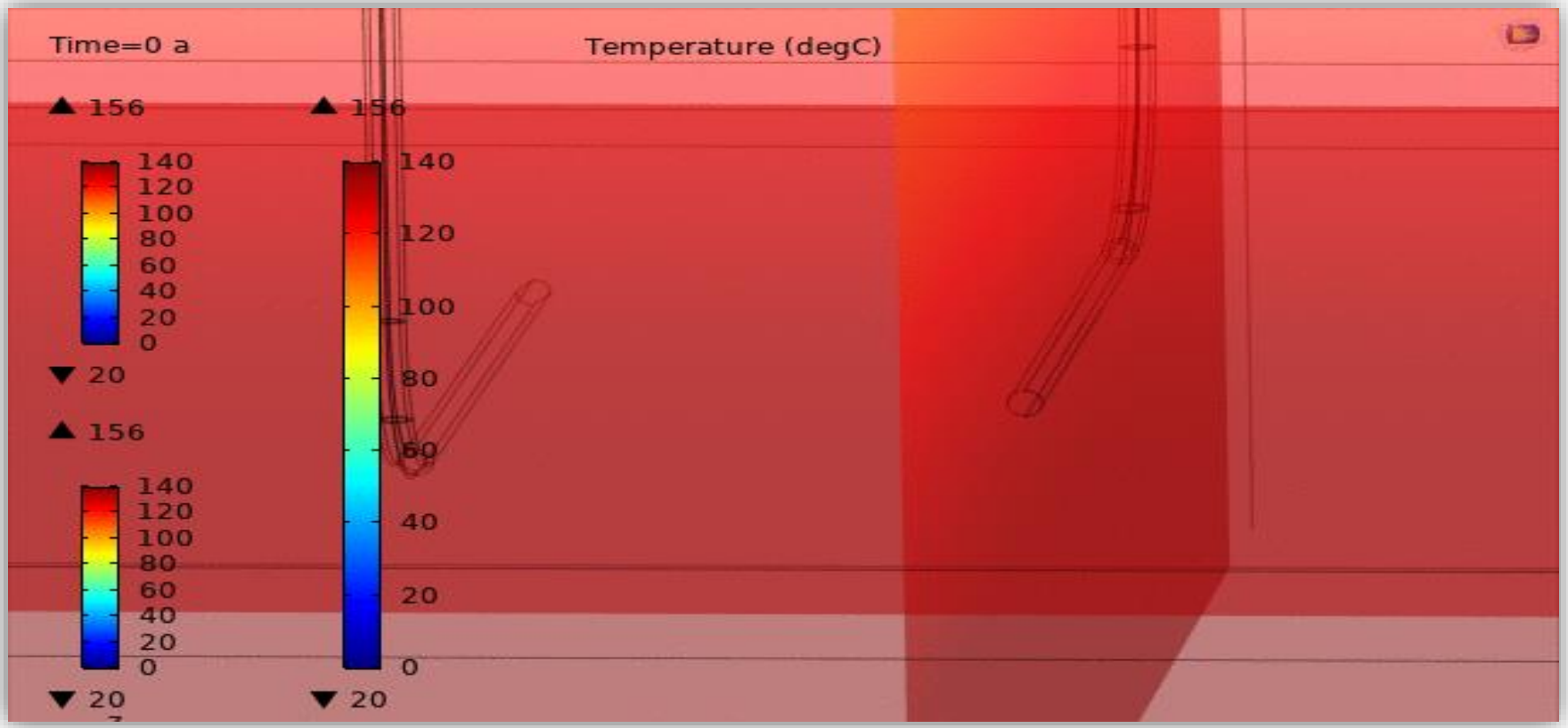
Known Aquifers exist below Oil and Gas fields

GenaSys™ - Induced Convective Recharge



GenaSys Convective Recharge Drives Long

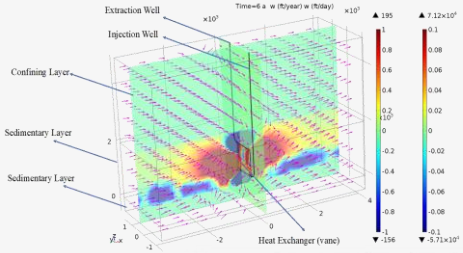
GenaSys™ - Induced Convective Recharge

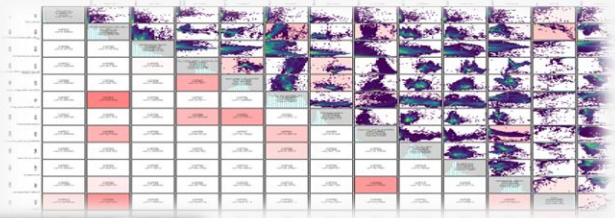


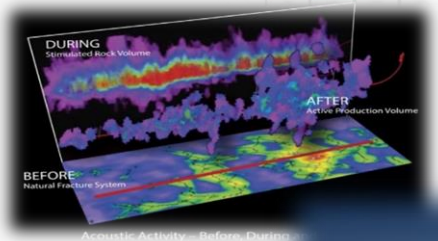
GenaSys Convective Recharge Drives Longe

Elements of GTI Technologies

- Forward Modeling the Physics & Optimizing Longevity
- Machine Learning Aided Target Site Identification
- Advanced Subsurface Geophysical Imaging
- State-of-the-Art Drilling, Completion and Monitoring Technology
- Electrical Power Generation Capability via **Organic Rankine Cycle**

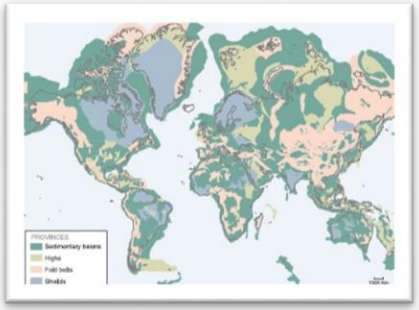






GenaSys Scalability

Globally

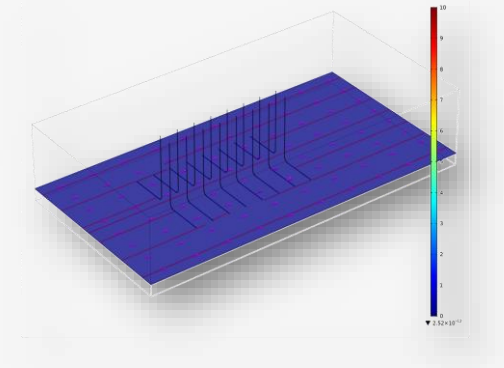


Sedimentary Basins are Globally Abundant - Onshore and Offshore

Regionally

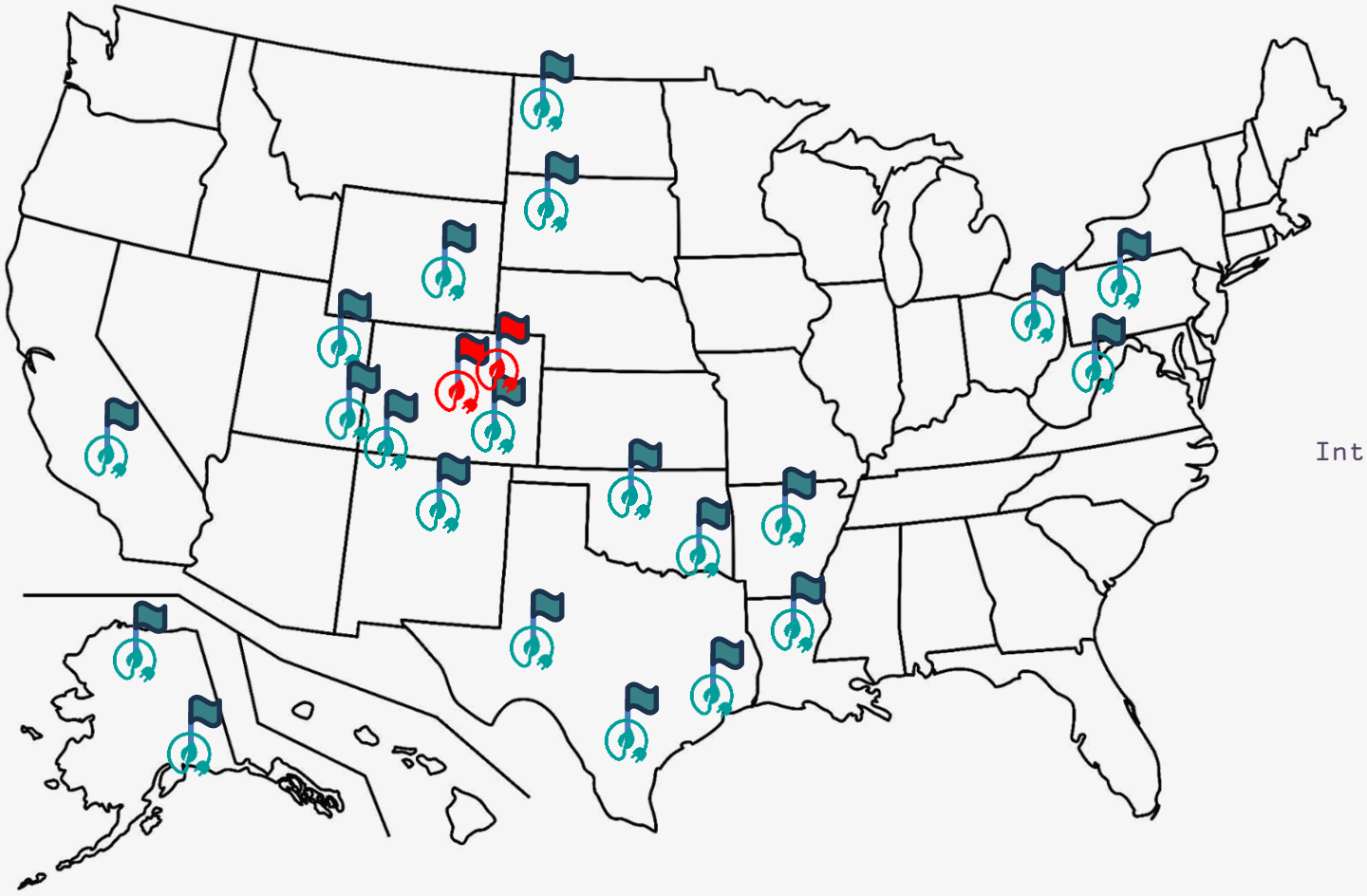
USA: GenaSys Targets

Locally



GenaSys Systems can be stacked to achieve higher power outputs

GenaSys Development Targets



Levelized Cost of Electricity (LCOE)

Calculated Values (40 years):

Cost of Plant (net capital cost + interest)
$30,276,069

Variable Costs (operating)
$69,398,328

Total Costs $99,674,398

Plant Output (MWh)
1,835,935

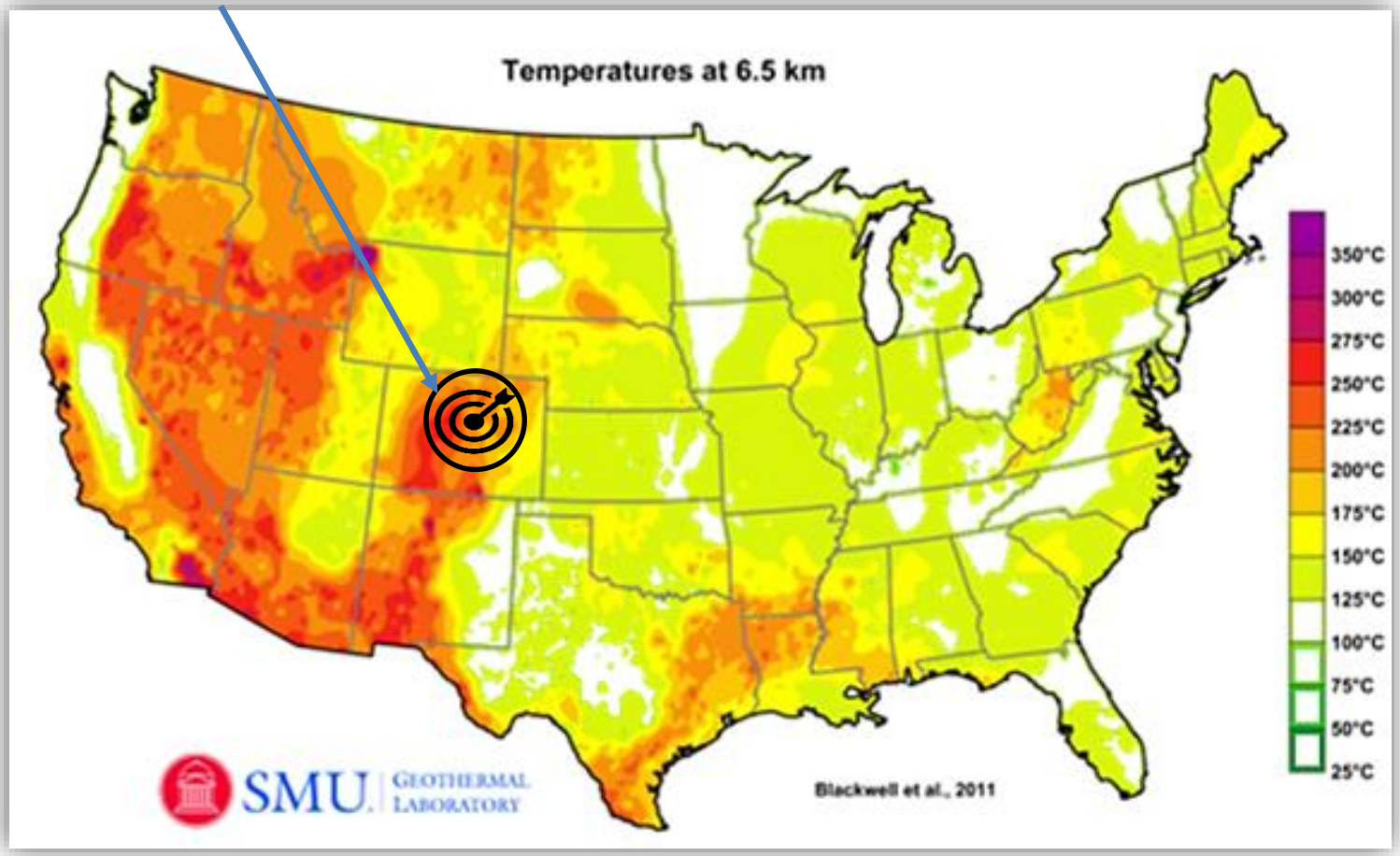
Cost of Energy - 40 years ($/kWh) =
$0.054

Current GTI Projects

- **GenaSys-1: Denver Julesburg Basin 20 MW Power Plant**
  - GenaSys System designed and optimized for longevity and economics
  - Development Consortium Established
  - Landowner Agreement Executed, Permits issued
  - Discussing Off-take/Power Purchase Agreements with grid/micro-grid operators
  - Starting with a 5+MW plant
- **GenaSys-2: Denver Julesburg Basin**
  - DOE funding application DE-FOA-0002826
  - GTI led consortium including H&P, Halliburton, NREL, Southwest Research Institute, Ormat and Coiled Tubing Specialists
  - Hotter, shallower but less permeable rock. Stimulation (fracking) a DOE RFP requirement.
  - Awaiting award announcement
- **New Ventures**
  - **Additional Colorado Basins (Piceance, Raton, San Juan, etc.)**
  - **Williston Basin (North Dakota)**
  - **San Joaquin Basin (California)**

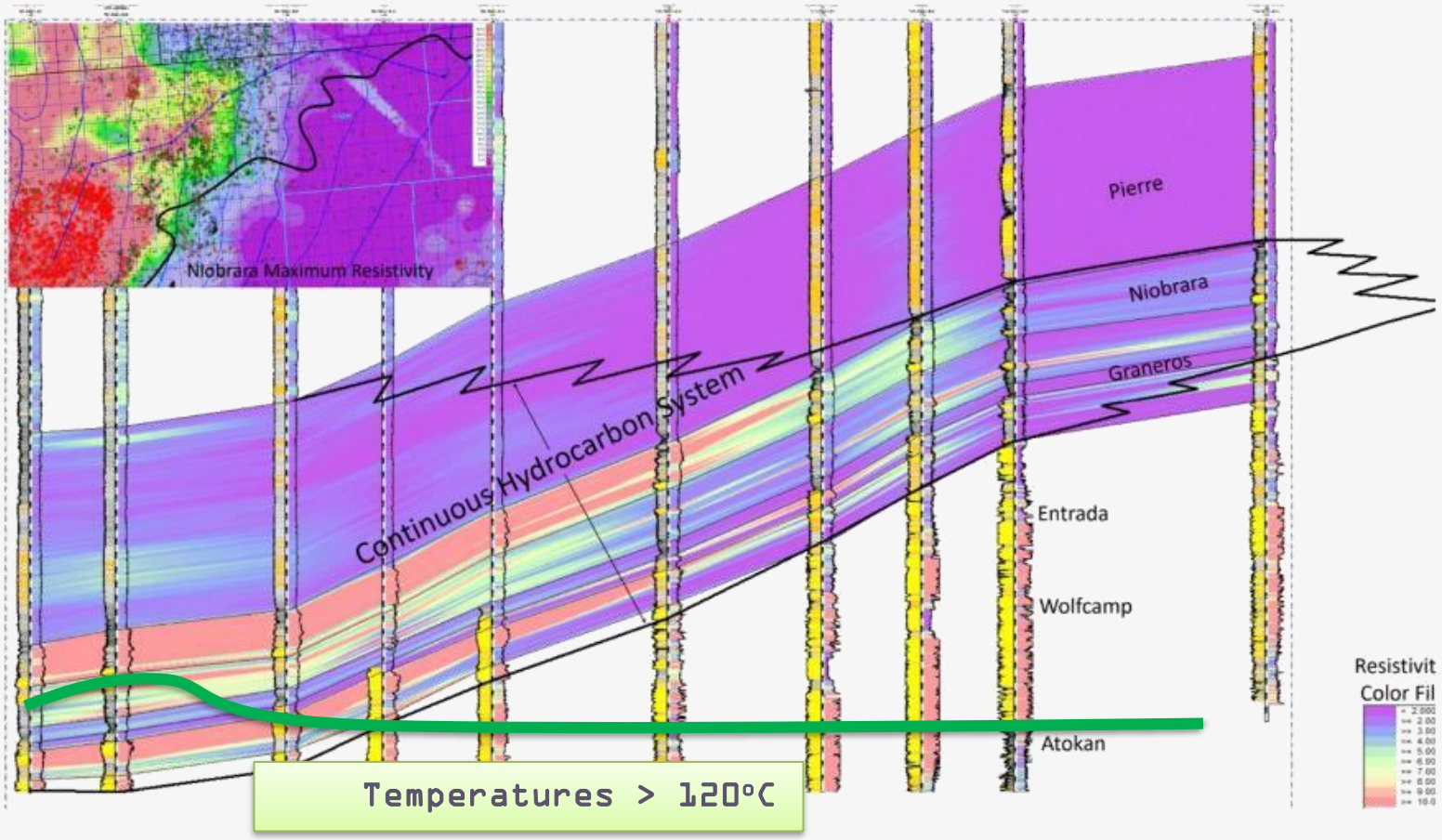
GenaSys Proto-type Location: Denver, CO USA

GenaSys-1 Location



Temperatures >125°C are suitable for a GenaSys geothermal plant.

D-J Basin: Temperature > 120°C



DJ Basin: Permeable Sediments and Aquifers

Depth

Drinking Water

Hydrocarbons

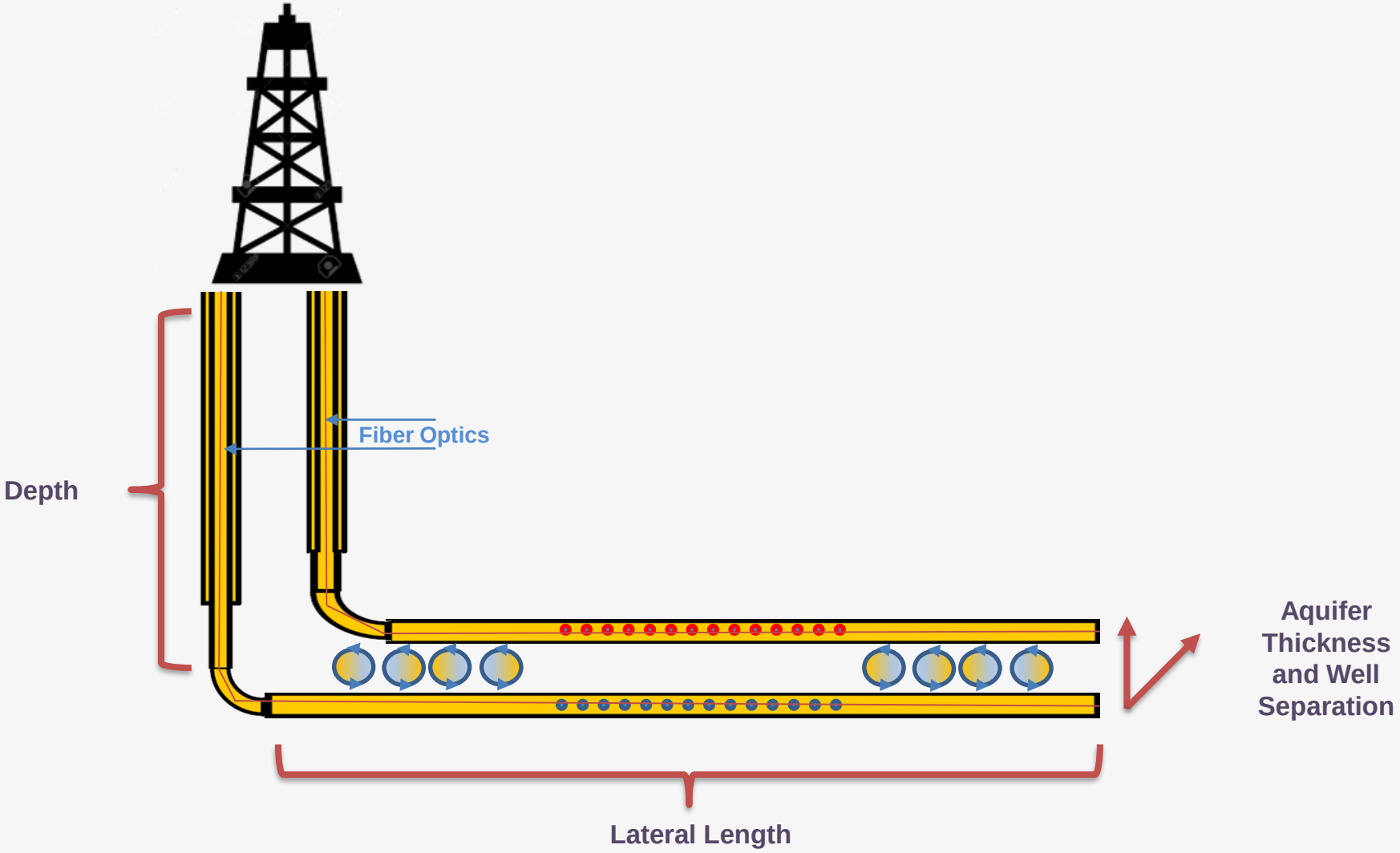
Geothermal Brine

Eon	Era	Period	Epoch	Formation		Rock Type	Thickness (m)
Phanerozoic	Cenozoic	Paleogene	Paleocene	Green Mountain Conglomerate		Conglomerate, Sandstone, Shale	198
	Mesozoic	Cretaceous	Upper	Denver Formation		Claystone, Siltstone, Sandstone, and Conglomerate	290
				Araphahoe Formation		Claystone, Siltstone, Sandstone, and Conglomerate	121
				Laramie Formation		Siltstone, Claystone, and Sandstone	168
				Fox Hills Sandstone		Shale and Sandstone	55
				Pierre Shale		Shale, some Sandstone beds	1890
				Niobrara Formation	Smoky Hill Shale	Shale and Limestone	43
					Fort Hayes Limestone	Limestone	43
				Carlisle Shale		Claystone, Siltstone, Calcarenite and Hard Limestone Beds	162
				Greenhorn Limestone			
				Graneros Shale			
			Lower	Dakota Group	South Platte Formation	Sandstone and Shale	91
					Lytle Formation	Sandstone and Conglomerate	
		Jurassic	Upper	Morrison Formation		Siltstone and Claystone	91
				Ralston Creek Formation		Sandstone and Siltstone	27
		Triassic	?	Lykins Formation		Shale, Limestone, and Siltstone	137
	Paleozoic	Permian		Lyons Formation			58
		Carbon.	Penn.	Fountain Formation		Sandstone and Conglomerate	502
Precambrian				Precambrian		Igneous and Metamorphic Rocks	

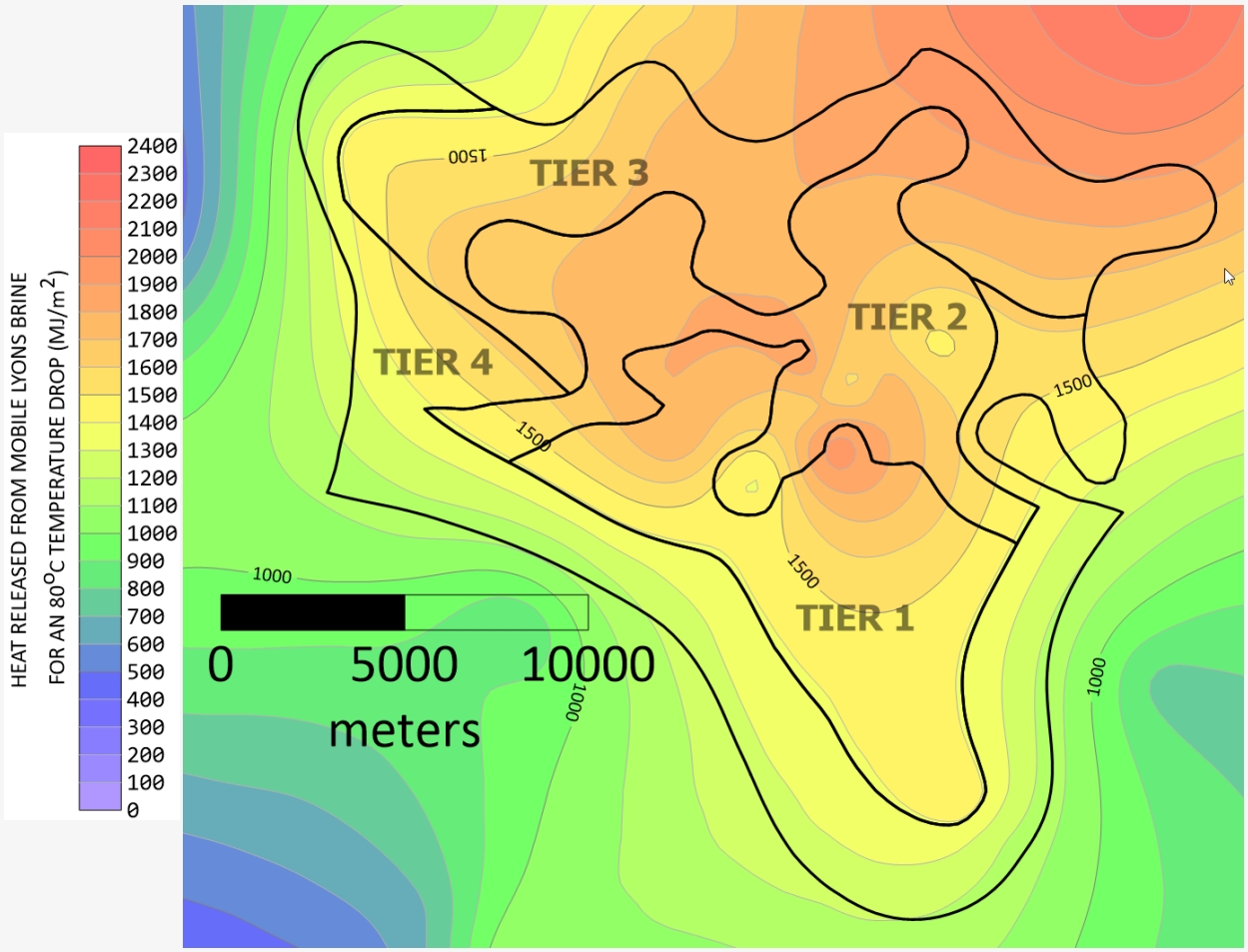
Lyons

Figure 4. Stratigraphic column of the Denver Basin for the Colorado Piedmont (Modified from Abbot and Noe, 2002).

GenaSys-1 Schematic

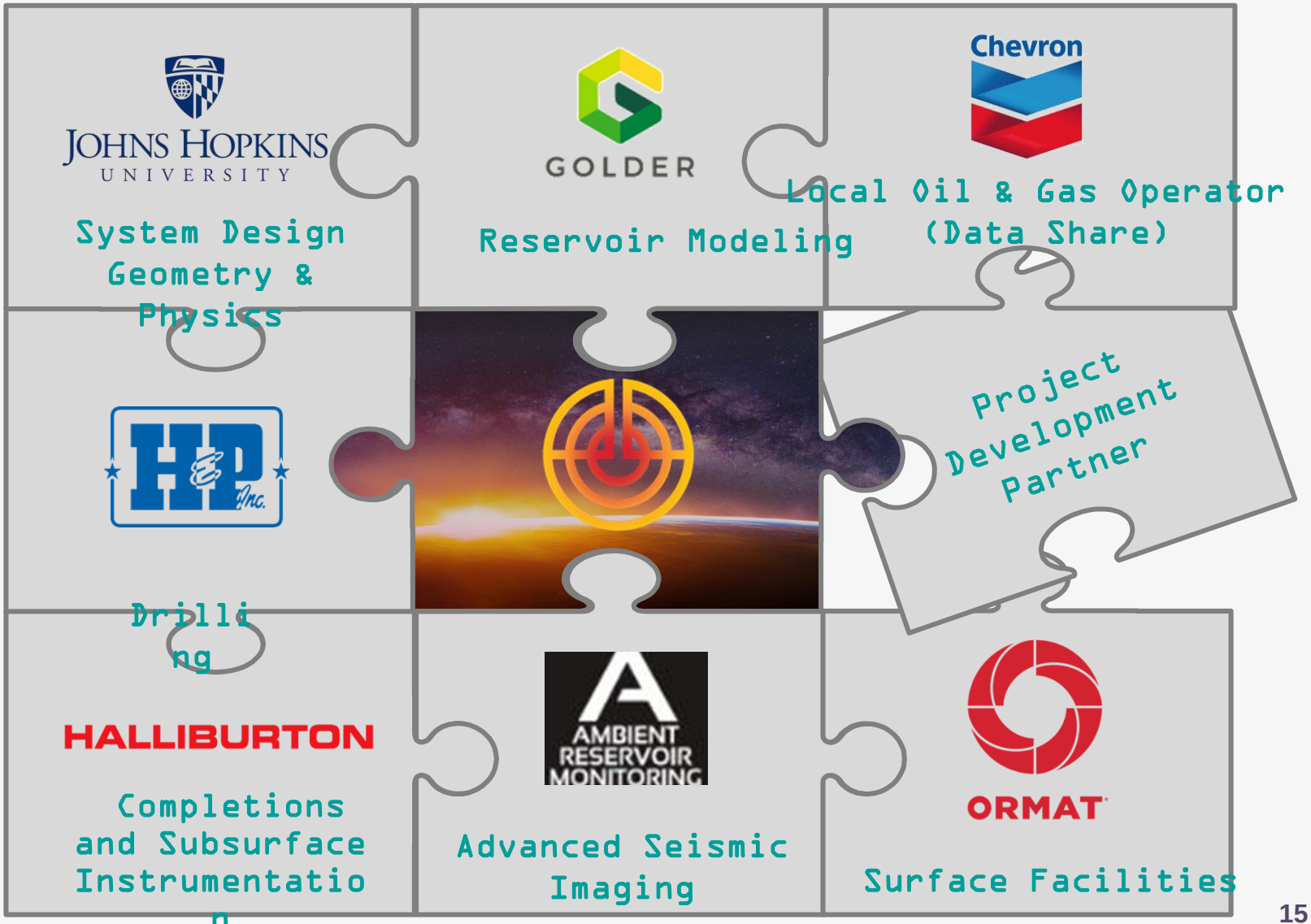


DJ Basin Prospect Map: GenaSys 1



~300MW for 30 years

GenaSys Demonstration Development Team

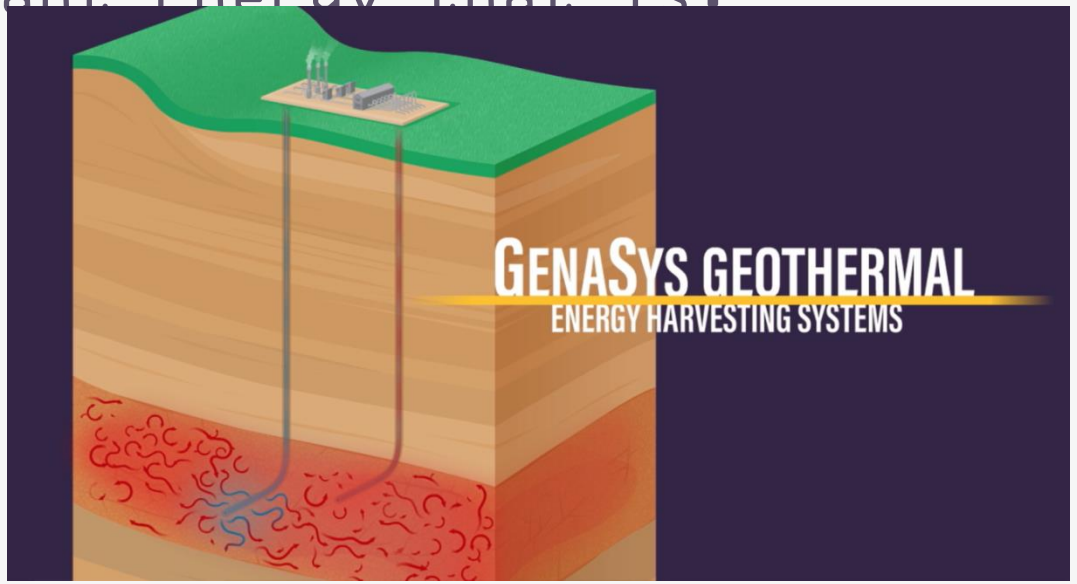


GTI's Solution: Scalable Green Energy

Our **GenaSys™ Geothermal Energy Systems** will revolutionize how we harness renewable energy.

Globally Abundant Energy that is:

- Clean
- Renewable
- Low-cost
- Baseload



A video describing the GenaSys Geothermal System, as well as additional relevant information, can be viewed on our website: https://geothermal.tech/


GEOTHERMAL
TECHNOLOGIES
Addressing the need for
abundant, clean, renewable,
baseload energy