SMU POWER PLAYS CONFERENCE 2018
GEOTHERMAL STORAGE APPLICATIONS

♦ JANUARY 2018 ♦

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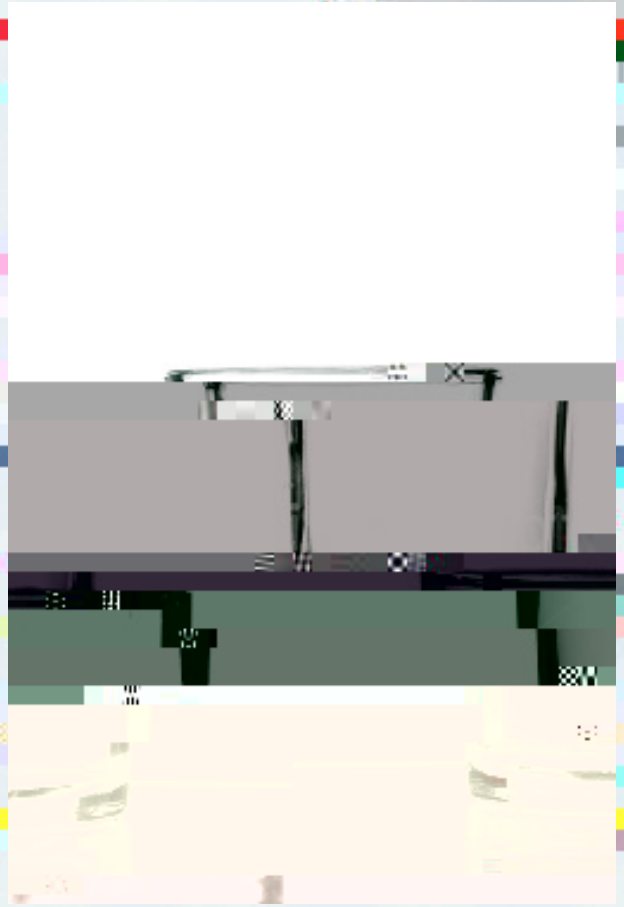
A GLASS OF WATER – AN ENGINEERS PERSPECTIVE



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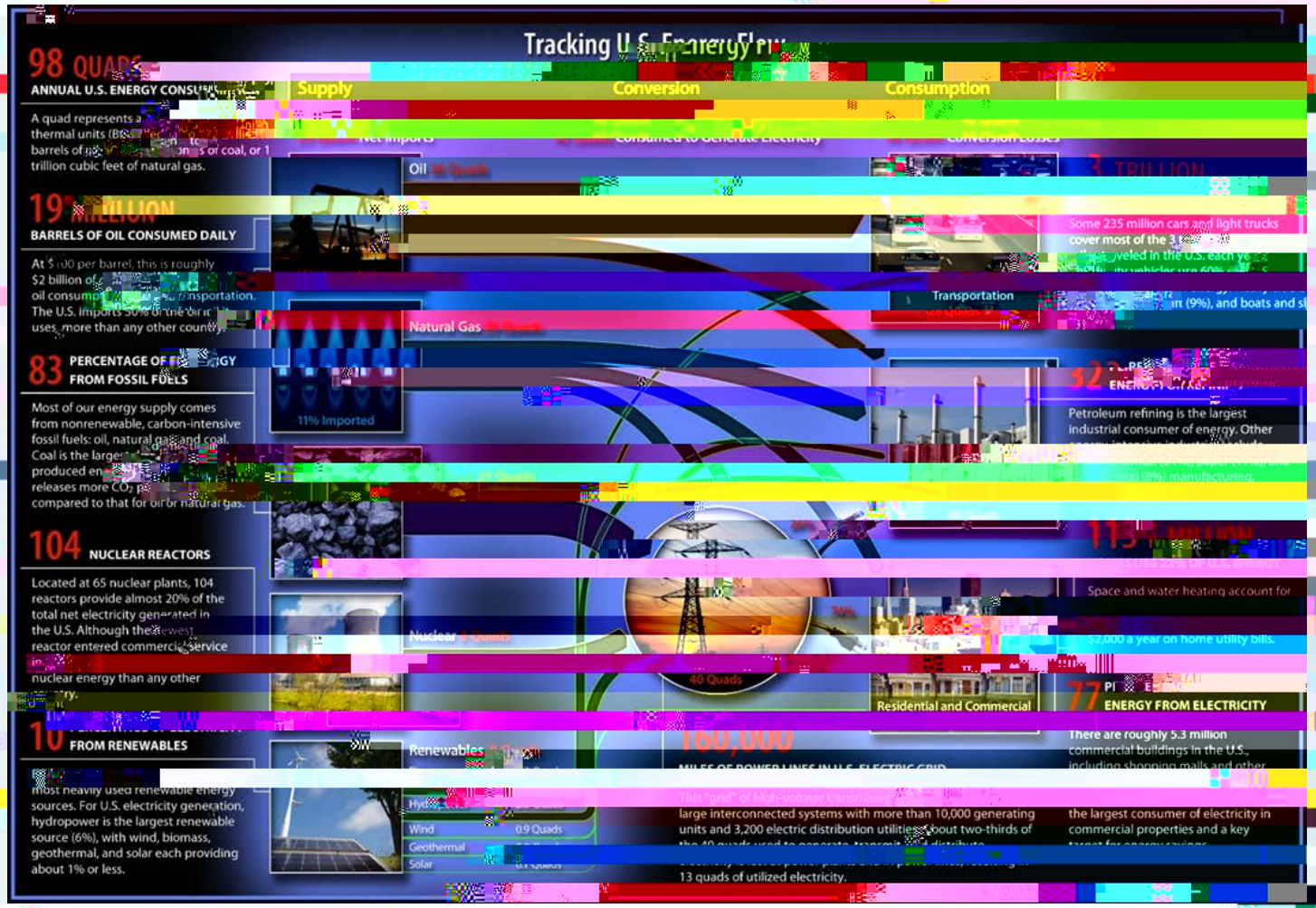
ENERGY TRACKING ON A NATIONAL SCALE



Out of the 98 apples a year; 42 apples are consumed and 56 apples are thrown away!

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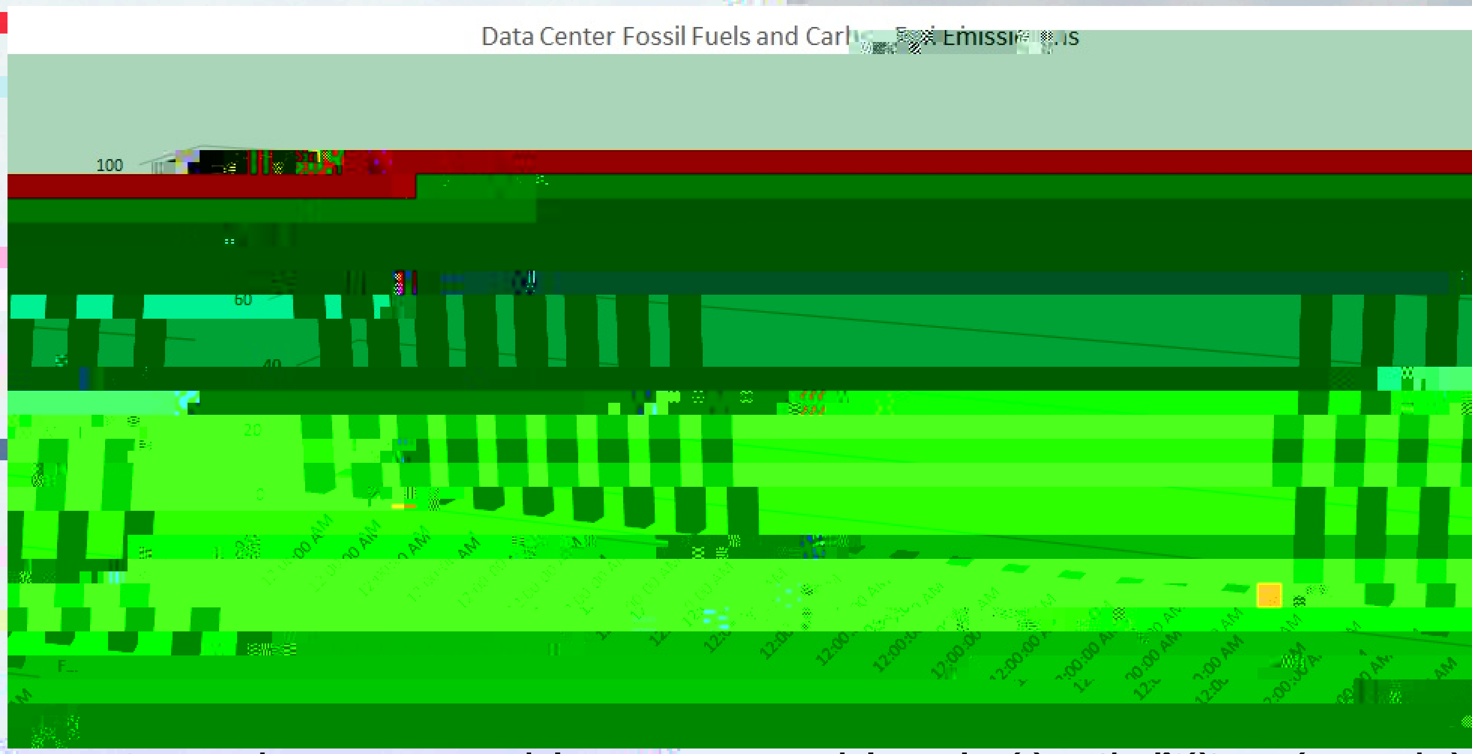
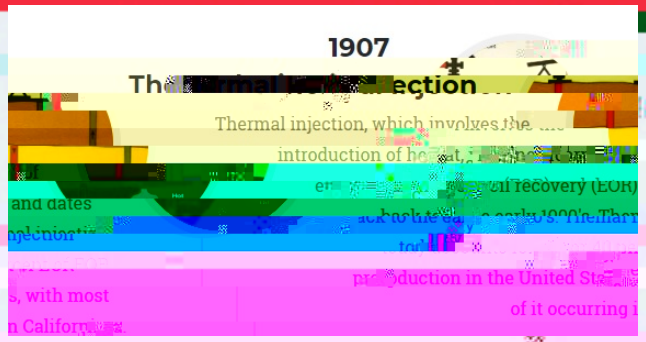
ENERGY TRACKING ON A NATIONAL SCALE

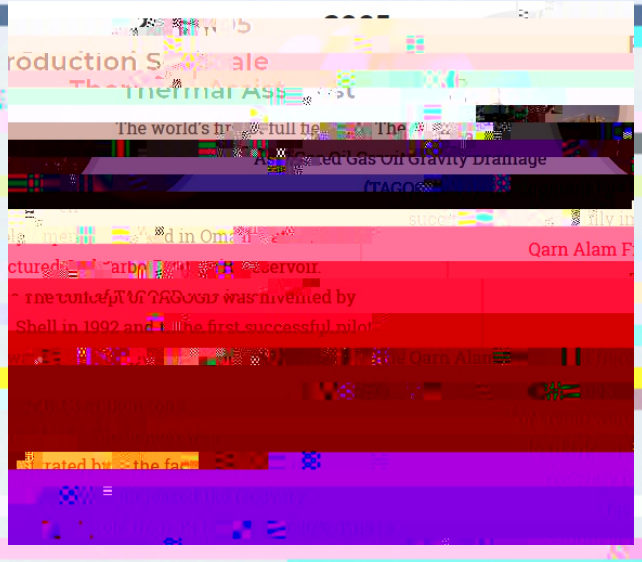
…and increased carbon emissions.

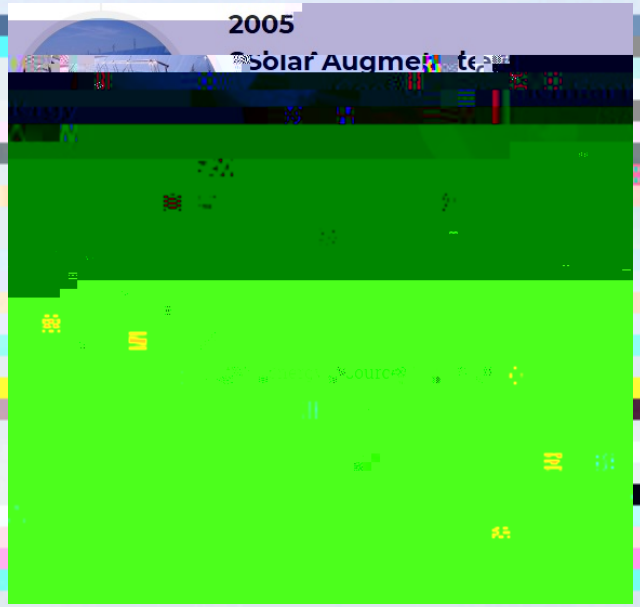


So, today's renewable energy problem is

THE HISTORY OF SOLAR GEOTHERMAL FROM AN OIL PRODUCTION PERSPECTIVE







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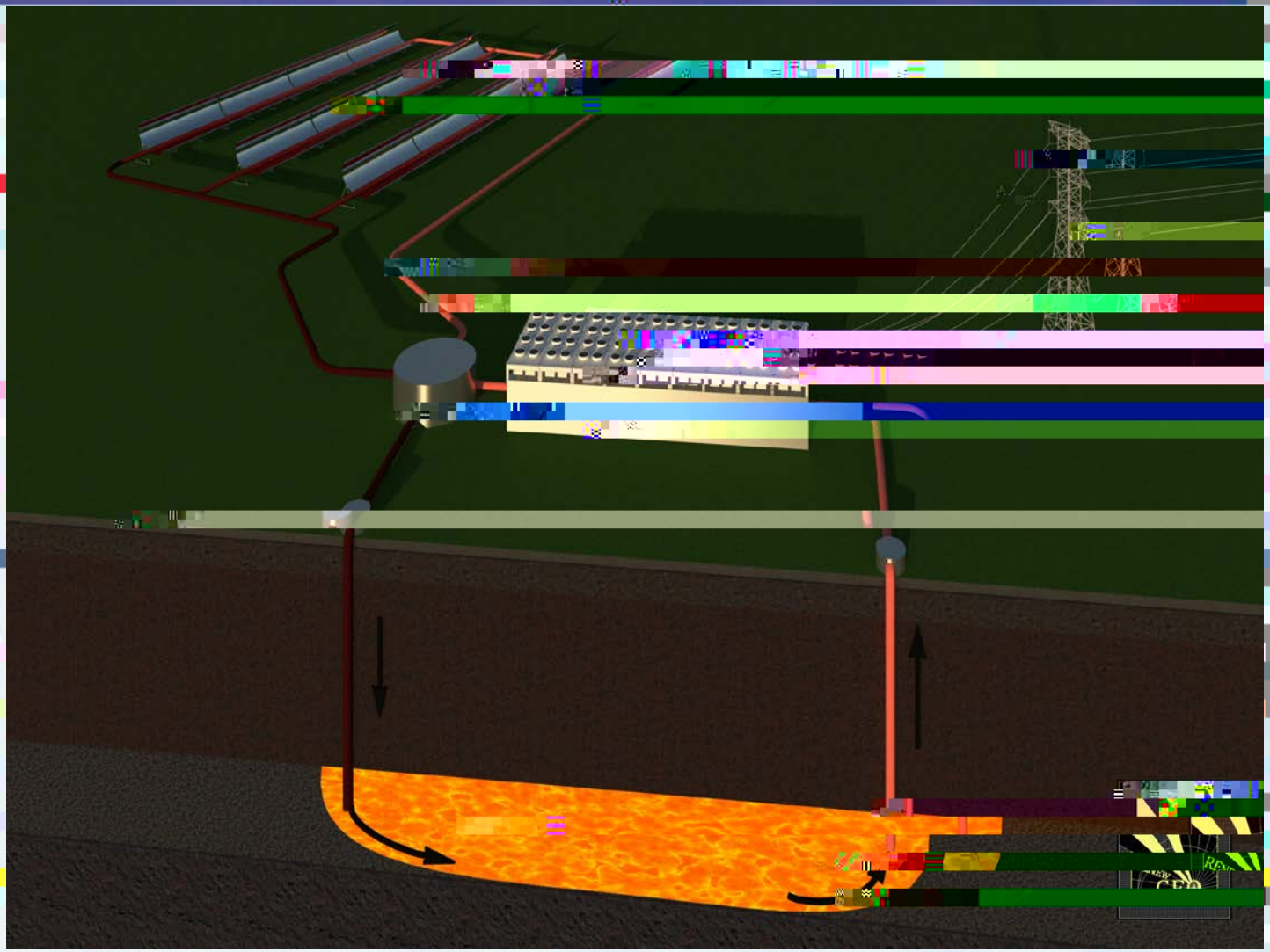

Solar Augmented Geothermal

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THE HISTORY OF SOLAR GEOTHERMAL FROM A GEOTHERMAL PERSPECTIVE

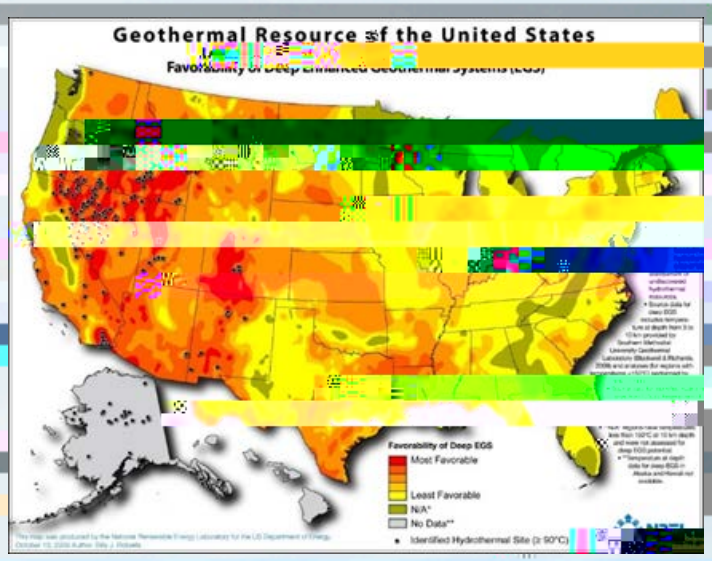
Most of the history of geothermal exploration and development in the US has been built around finding easily assessible high temperature resources.

NOT A FIX TO WELL ISSUES

Solar Geothermal as presented here is not about adding solar heat to compensate for poor well performance conditions. The result is improved plant performance only during solar hours.

THIS IS NOT EGS

"A naturally occurring geothermal system, known as a hydrothermal system, is defined by three key elements: heat, fluid, and permeability at depth. An Enhanced Geothermal System (EGS) is a man-made reservoir, created where there is hot rock but insufficient or little natural permeability or fluid saturation."



RENEWGEO IS BASED ON NEW CONDITIONS

By creating a synthetic resource, there is one degree of complexity removed from the evaluation of potential sites. Because this technology needs only certain geological conditions and an abundance of solar, this technology can be deployed in many more locations than traditional geothermal.

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THE SOLAR CHARGED GEOTHERMAL TECHNOLOGY

Moving forward, what does this look like.

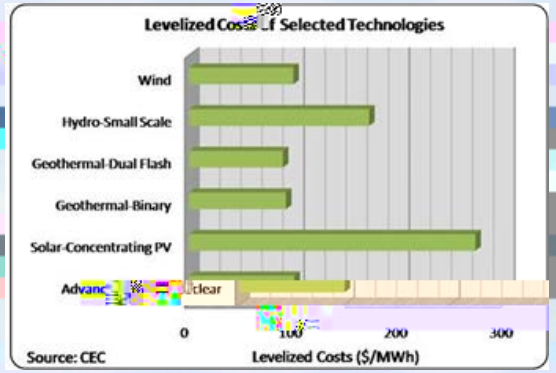
CAREFUL TESTING AND PLACEMENT

As much knowledge as we have about pumping water into the ground and retrieving that water with heat added from nature, we know very little about the injection and retrieval of solar heated water. There are modeling challenges to predict the flow from injection / extraction points, but using the same injection / production techniques that the oil industry has developed, it should be possible to control the reservoir temperature and flow to create useable thermal storage.

COSTING

The levelized cost of this technology is between conventional geothermal and solar concentrated salt (Crescent Dunes). Throw out disingenuous solar PV and it's cost point and problems, solar renewable geothermal has much promise.

Keep in mind this is not just power generation, but power generation with storage that is carbon free renewable. And unlike conventional geothermal is not limited to what mother nature can provide.



OTHER THOUGHTS

- Small footprint - 5 MW with good solar conditions require 40 acres.
- Since site selection is open to un-traditional locations, this should be deployed more in a microgrid fashion in the 1- 10 MW range.
- Onsite generation for data centers. (easier to connect fiber, reduced reliance on PPA's)
- Begins to look like direct use geothermal (and all of its possible applications)

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Questions