

GREENFUELS OF OREGON: GEOTHERMAL ENERGY UTILIZATION IN BIODIESEL PRODUCTION

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INTRODUCTION

Greenfuels of Oregon is undertaking a new venture in the Klamath Basin to produce biodiesel using geothermal energy. The facility is currently under construction, but the production process is set up to make use of geothermal energy in the biodiesel process.

THE GEOTHERMAL RESOURCE AND DISTRIBUTION SYSTEM

The Greenfuels of Oregon biodiesel production facility is located on the “Liskey Ranch” (Figure 1), a Known Geothermal Resource Area (KGRA) that has seen a long history of geothermal energy usage since the 1970s. Current uses of geothermal energy on the Liskey Ranch include space heating, greenhouse heating, aquaculture pond heating, and now biodiesel production.

The geothermal resource has been described by Laskin (1978) and Lund (1994). The area is located near the northwest edge of the Basin and Range geological province, and thus the occurrence of geothermal water is controlled by geologic faults along the front of the Klamath Hills. These faults allow groundwater which has circulated to great depths to rise upward into shallower aquifers where it can be tapped by water wells. Groundwater temperatures available for utilization are on the order of 190 to 210°F, and wells on the property can produce geothermal water at several hundreds of gallons per minute.

THE GREENFUELS OF OREGON GEOTHERMAL SYSTEM

Greenfuels of Oregon makes extensive use of their geothermal resource for many heating purposes. Uses of geothermal energy include radiant floor space heating of the biodiesel production building, in addition to use in the pro-

duction of biodiesel itself. From the biodiesel facility, the geothermal water is cascaded to greenhouses when various organic vegetables are grown, and to an aquaculture operation.

WHAT IS BIODIESEL?

The Alternative Fuels Data Center of the U.S. Department of Energy defines biodiesel as a domestically produced, renewable fuel that can be manufactured from vegetable oils, animal fats, or recycled restaurant greases. Biodiesel is safe, biodegradable, and reduces air pollutants such as particulates, carbon monoxide, hydrocarbons, and air toxins. Blends of 20% biodiesel with 80% petroleum diesel (B20) can generally be used in unmodified diesel engines; however, users should consult their OEM (Original Equipment Manufacturer) and engine warranty statement. Biodiesel can also be used in its pure form (B100), but it may require certain engine modifications to avoid maintenance and performance problems and may not be suitable for wintertime use.

THE BIODIESEL PRODUCTION PROCESS

The general formula for making biodiesel is:

alcohol + vegetable oil or fat + heat + lye catalyst → biodiesel

The production process to be used by Greenfuels of Oregon is shown schematically in Figure 2. The process starts with some type of feedstock for the organic oil. Greenfuels of Oregon is currently set up for processing canola or soy beans with equipment shown in Figure 3 and 4.

The next stage of the process is to mix the organic vegetable oil with methanol and a sodium monoxide catalyst in the reactor, which is a 600-gallon tank. Heat is also added to the reactor through geothermal water at approximately 180°F

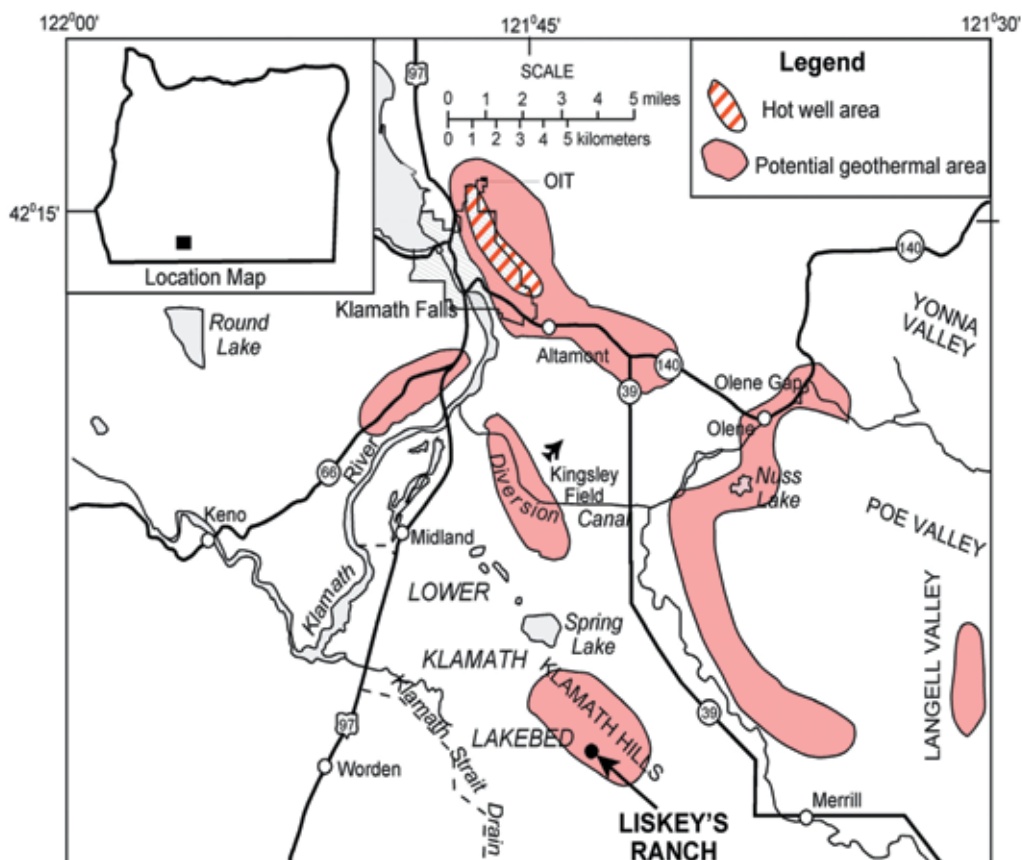


Figure 1. Location map of "Liskey Ranch".

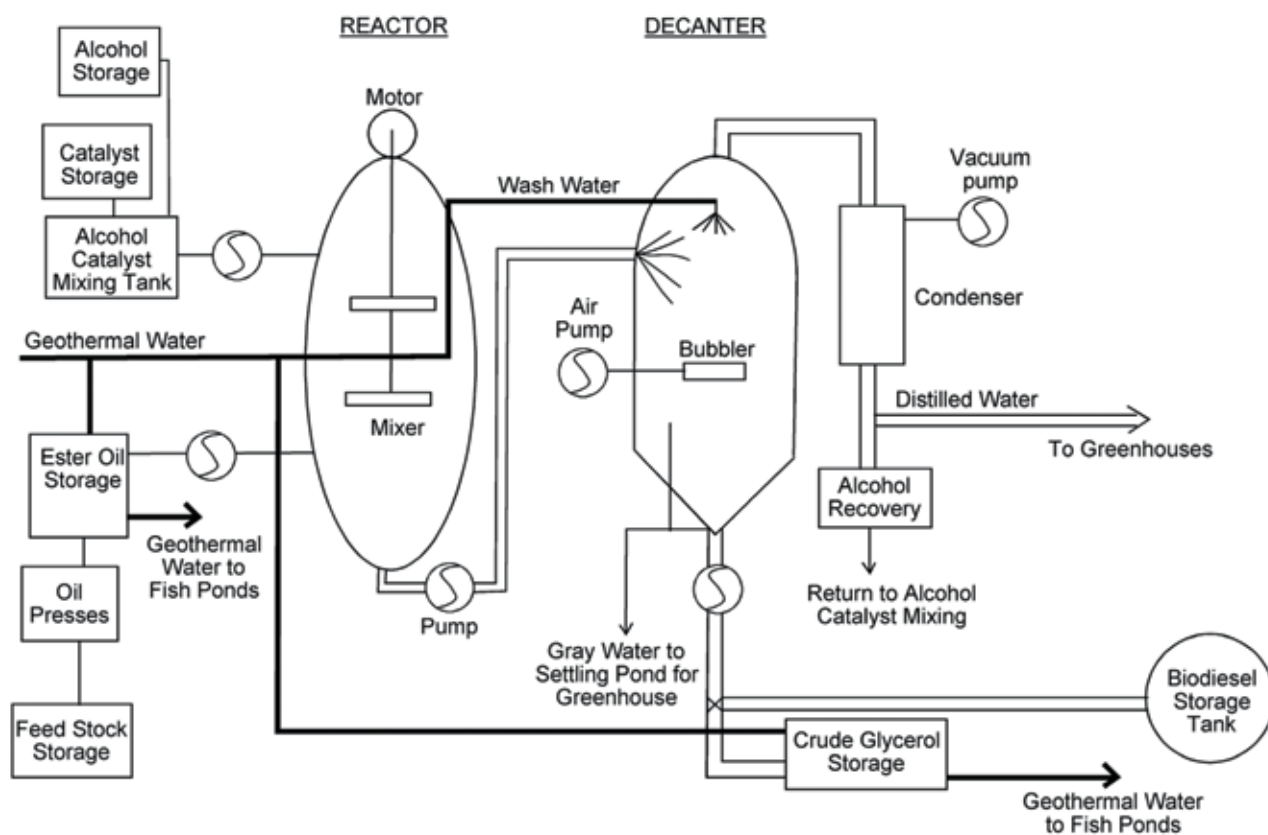


Figure 2. Schematic drawing of the biodiesel production process at Greenfuels of Oregon.

This process is formally called “transesterification” and occurs for approximately 30 minutes.

The mixture is then pumped to the decanter where geothermal water is used to “wash” and separate the finished biodiesel product from other materials. Distilled water and alcohol are recovered by vacuum pumping the decanter and then recondensing the vapors.

Geothermal gray-water is routed to settling ponds and then used in the greenhouses. Crude glycerol is a byproduct of the process. A photograph of the biodiesel production equipment is shown in Figure 5.

The biodiesel production target for Greenfuels of Oregon is about 1,500 gallons per day, but the actual production will depend upon feedstock availability. Most of the biodiesel is planned to be sold locally.



Figure 3. Feedstock grain storage silos.



Figure 4. Photograph of equipment for feedstock grinding.

CONCLUDING SUMMARY

Greenfuels of Oregon is undertaking a new use of geothermal energy in the Klamath Basin: production of biodiesel. In addition, geothermal energy will also be used for space heating of the building, and the geothermal water will be cascaded for use in greenhouse and aquaculture pond heating.



Figure 5. Photograph of the biodiesel production equipment.

There is on-going controversy in scientific literature about the energy balance of biodiesel production. In other words, there is a recurring question of whether it takes more energy to produce biodiesel than the energy that the biodiesel fuel produces. The Greenfuels of Oregon project in the Klamath Basin certainly requires a further examination of this question, and this will be the subject of future bulletin articles.

ACKNOWLEDGEMENTS

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