TO: JIM BURKE, BENTON COUNTY FLEET MANAGER,
JOSH WHEELER, BENTON COUNTY PUBLIC WORKS DIRECTOR

FROM: BENTON COUNTY ENVIRONMENTAL ISSUES ADVISORY COMMITTEE

SUBJECT: RENEWABLE DIESEL FOR THE COUNTY FLEET

DATE: FEB. 21, 2017

CC: BENTON COUNTY BOARD OF COMMISIONNERS

Introduction

In February 2016, Benton County Fleet Manager Jim Burke asked the EIAC to voice an opinion on the appropriateness of using Renewable Diesel. He explained that the fleet had switched from petroleum diesel to a biodiesel blend a few years ago as a way to reduce carbon emissions, but was not entirely happy with its performance. He had learned about a new product called "Renewable Diesel" (RD or R99) from his counterpart at EWEB in Lane County and felt it might be a better alternative. After a brief investigation, EIAC voted to endorse the switch for a one-year trial period, while we continued our investigation.

EIAC has now concluded its investigation of the carbon attributes of RD. This memo summarizes our findings, and offers our recommendations regarding its use for fueling the County fleet.

Executive Summary

Despite its high price per gallon, Renewable Diesel (RD) affords relatively clean, efficient combustion. Benefits include lower particulate emissions, improved cold-flow properties and reduced fleet maintenance costs, compared to biodiesel blends. The fuel now being used by Benton County is presumed to be made from a blend of feedstocks, including palm oil. However, palm oil based biofuels do not meet the Federal Renewable Fuel Standard (RFS) performance threshold of 20% lifecycle greenhouse gas (GHG) reduction (EPA 2011). To determine if this (or any) fuel formulation meets the RFS definition of a "low-carbon fuel", the manufacturer must calculate the GHG reduction by the EPA method. This is done through a lifecycle analysis of all the fuel's carbon impacts from feedstock production (including land-use change), fuel production, distribution modes, transportation distances, and point-of-use emissions. In order to register with the Oregon Clean Fuels Program (OCFP), the analysis on each product must be submitted to ODEQ for review and assignment of a "carbon intensity" value (CI). At this time, GHG impact data from the manufacturer of Benton County's current fuel supply is undisclosed and no OCFP application has been made. Without knowing the CI, Benton County cannot know if the fuel is sustainably sourced, nor measure the magnitude of their reduction or addition to atmospheric carbon.

Renewable Diesel vs. Biodiesel

Biodiesel is made from vegetable oils and/or animal fats, using a process called "transesterification", which is a relatively simple, cost-effective process that can be done on a small scale with local feedstocks. However, this process introduces oxygen into the fuel, which leads to issues with freezing temperature, separation during storage, algae growth, and high particulate emissions. Biodiesel is, by law, blended with petroleum diesel at a minimum 5% ratio (B5). Higher blend ratios (B10, B20, B50, B99) are available.

Renewable Diesel (RD or R99) is made from the same feedstocks as biodiesel, but is chemically different from biodiesel. Renewable diesel is produced using a more energy-intensive, industrial process to hydrogenate the bio-oil feedstocks. Renewable diesel is more

expensive to make than biodiesel, and can only be produced efficiently at a facility on the scale of a petroleum refinery or major chemical manufacturing plant. Because it's hydrogenated, renewable diesel doesn't contain oxygen, so users don't encounter the challenges biodiesel presents relating to freezing temperature and storage. RD also burns cleaner than biodiesel because of the hydrogenation.

Key Findings

The EIAC conducted its investigation by studying reference reports and having discussions with regulators, users, and suppliers. The key findings and references that lead to our recommendations are summarized below. We are available to respond to questions and provide additional references for greater detail.

1. **The Oregon Clean Fuels Program (OCFP).** The Oregon Clean Fuels Program (OCFP) was created in 2015 by the Oregon DEQ in response to legislative action (Senate Bill 324) as a mechanism for reducing carbon emissions from transportation fuels. The program is focused on *suppliers* of transportation fuels and does not apply to fuel *consumers*, including governmental agencies or citizens. Benton County has no legal obligations to adhere to the OCFP, but the County's Sustainability policy guides the Public Works Department's decision to strive to exceed the program's goal of a 10% reduction in fuel carbon intensity by 2025.
2. **Calculating Carbon Intensity**. The OCFP is constructed around the same parameters as a similar California State program. Both use a Federally-approved Life Cycle Assessment model called GREET to estimate the "Carbon Intensity" (CI) of various transportation fuels. GREET takes into account all factors associated with sourcing the feedstock, converting it to fuel, delivering, and using it. The obligation for generating the model inputs and running the calculations falls on the fuel producer. The State agencies review the data and ultimately assign CI values for each "Fuel Pathway". They then compile the findings in a table of registered "Fuel Pathway Codes" (FPC). The CI values for various FPCs range from about 10 gCO_2e/MJ to over 120. Petroleum diesel is usually around 100. Some alternative fuels, such as biodiesel, have CI values well under 50, which means their net carbon impact is less than half that, per unit of energy, as petroleum diesel. Alternative fuel users, such as Benton County, can use the CI/FPC table to select fuels and calculate carbon emission changes.
3. **Palm Oil Considerations.** One of the world's major sources of feedstock for making RD is palm oil grown on tropical plantations, mainly in SE Asia. Palm oil is also widely used in food and cosmetics. Several years ago, the US EPA conducted a general assessment of palm oil–based RD using the GREET model. It found that, primarily because of land-use changes associated with converting tropical rain forest to plantations, palm oil-based RD did not qualify as a "low-carbon fuel" because its CI was too high (EPA, 2011). Clearing tropical forests to establish palm plantations, as well as the energy-intensive industrial production process, have high carbon impacts. Carbon dioxide release is especially great when establishing palm plantations on peat soils. Life cycle analysis estimates the time required to reach a break-even point of carbon savings vs. emissions at 86 years for non-peat soil tropical forests and 423 years for peat soil forests (Fargione et al. 2008). The conversion of forests to palm plantations also creates other ecological and socioeconomic impacts. A summary of these is provided in the attached ICCT report Executive Summary (Petrenko et al. 2016).
4. **Benton County's current supply**. The RD currently being used by Benton County was manufactured by Neste, Inc. at its refinery in Singapore, and supplied through a chain of importers and distributors. Our investigation has verified that it was made from a mix of feedstocks, and has not been modeled or registered for FPC/CI with either the Oregon

or California Clean Fuels Programs. ODEQ tells us they are quite certain that this fuel is partially palm oil-based. Neste-Singapore has registered several fuels through the State programs, but none are palm oil-based, and none are currently available to Benton County. However, efforts are under way to bring registered supplies of RD to Oregon.

5. **What benefit?** Since the RD being used by Benton County is not registered with the Oregon Clean Fuels program, we have no basis for calculating reductions in carbon emissions from its use. Agency personnel at ODEQ and ODOE tell us they are working with Neste on a palm oil-based RD registration, but the process is moving slowly, and focused mainly on the non-edible "waste" from the refinery.
6. **Other sources?** There is a limited amount of US-based production of RD that doesn't use palm oil and is FPC/CI registered with the Oregon program. Our cursory investigation indicates these registered RD fuels are about $1.50/gallon more expensive than petroleum diesel. Some believe that continued use of non-registered RD demonstrates demand, which would lead to improved supply options.
7. **Other impacts**. Any expansion of domestic production of RD will compete with biodiesel for feedstock. Since the supply of sustainable feedstocks is limited, higher demand could lead to higher prices for feedstocks like animal tallow, waste cooking oil, and virgin edible oils.

<u>Recommendations</u>

The EIAC investigation has led to consensus agreement of Committee members that Benton County Public Works should:

1. Buy and use only OCFP-registered alternative fuels with CI values less than 85 gCO_2e/MJ, to the extent affordable. This CI value is slightly higher than the EPA definition of "low-carbon fuel" to allow the use of propane (CI = 83).
2. Balance the County's goal of reducing its carbon impacts with the need for fiscal control by deciding how much of its fuel budget should be allocated to more-expensive low-carbon alternative fuels.
3. Avoid all fuels made from palm oil feedstocks, including "industrial waste" palm oil, except "post-consumer" waste palm oil like used cooking oil.

References Cited

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Petrenko, C., J. Paltseva and S. Searle. 2016. Ecological impacts of palm oil expansion in Indonesia. International Council on Clean Transportation White Paper, July 2016. See: http://www.theicct.org/ecological-impacts-of-palm-oil-expansion-indonesia

Oregon Clean Fuels Program See: http://www.oregon.gov/deq/aq/programs/Pages/Clean-Fuels.aspx

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Reprinted from:
Ecological Impacts of Palm Oil Expansion
Chelsea Petrenko, Julia Paltseva, and Stephanie Searle
July, 2016

EXECUTIVE SUMMARY

The high yields, low cost, and stability of palm oil makes it the most widely used vegetable oil in the world, and global production of the commodity is steadily rising in response to population growth and policies that promote the use of palm and other oils in biofuels. Indonesia is the world's leading producer of palm oil, supplying approximately half of the commodity globally, and is itself driving increased palm oil consumption through a domestic biofuel policy. While the oil palm is a highly efficient crop, there are severe environmental and social consequences of the rapidly expanding industry.

Given that global land area for agriculture is limited, increasing demand for palm oil leads to expansion of this industry onto other cropland, secondary forests already logged for timber, and native tropical forests. Business-as-usual oil palm expansion, which increasingly replaces tropical forests with monoculture crop systems, depletes biodiversity, destroys old growth rainforest, and causes air pollution. Furthermore, much of the rainforest in Indonesia grows on carbon-rich peatland, the destruction of which adversely affects both biodiversity and the climate.

Southeast Asia overlaps with four of the world's distinct "biodiversity hotspots," each of which has unique geological history and biota. Unfortunately, tropical forests in Southeast Asia are being destroyed at a faster pace than other regions in the world. Indonesia lost an estimated 0.84 Mha of primary forest per year from 2000 to 2012, totaling over 6.02 Mha, and significantly outpacing deforestation rates in Brazil; half of this forest loss has been attributed to oil palm expansion. The consequences of this loss to biodiversity are devastating, as a single hectare of tropical rainforest in Indonesia harbors over 200 plant species. Furthermore, more than 60% of Indonesian rainforest species are endemic to that region. Iconic species such as the orangutan, found only on Sumatra and Borneo, are rapidly declining in numbers due to forest loss. Unique fishes living in peat swamp forests are also as risk from habitat degradation. Additionally, pests and alien species such as rats tend to thrive in plantation environments. Although not all biodiversity loss in the region is directly attributable to oil palm plantations, palm production has been found to reduce biodiversity more than other type of crop plantations.

Land-use change in the tropics accounts for 10-20% of total global greenhouse gas (GHG) emissions, making it the second largest GHG source in the world. The carbon footprint of the palm oil industry has two components: emissions from deforestation, and emissions from the processing of palm oil. Converting forests to oil palm plantations results in the loss of large amounts of carbon from biomass and from the disturbed soil. In particular, drainage of peat swamps for oil palm establishment is associated with extremely high CO2 emissions when organic matter that has accumulated over millennia is allowed to decompose. Because of the extensive emissions associated with palm oil expansion, the carbon savings are far outweighed by the losses. It is estimated that it would take between 75 and 600 years for the carbon savings of petroleum displacement by palm oil biofuel to balance the carbon lost during the growth and manufacturing of the product.

Wildfire smoke is a major source of air pollution that adversely affects human health and productivity in Southeast Asia. Despite regulations against land-clearing fires, "slash and burn" agriculture is a common occurrence in the dry season. In Katapang, Indonesia, fire was the cause of 90% of deforestation between 1989 and 2008, and 20% of wildfires across Indonesia can be attributed directly to oil palm plantation practices. Wildfire smoke can cause respiratory and cardiovascular disease and even death. In addition to devastating health effects, wildfires have adverse economic effects. Closed businesses, schools, and limited transportation can bring economies to a halt, and the effects of fires spread far beyond the geographic region where they originate.

Pollutants from agrochemicals associated with palm oil production (fertilizers, pesticides, and rodenticides) have harmful impacts on terrestrial and aquatic ecosystems. Palm oil mill effluent, which is microbially digested in open ponds, often overflows into waterways during heavy rains. The use of dangerous herbicides and pesticides also directly affects the health of workers who handle these chemicals.

Some stakeholders experience significant gains from the burgeoning global palm oil trade (growers, investors, and employees), but other groups, such as traditional landowners, experience land losses and restrictions on land use rights. Native Customary Rights are often ignored when plantations are established, leading to conflicts between indigenous peoples and palm oil companies and sometimes serious human rights abuses.

It is clear that business-as-usual expansion of the Indonesian palm oil industry will come at a great environmental cost. In order to meet Indonesia's greenhouse gas reduction goals, protect biodiversity, and reduce air and water pollution, stricter law enforcement is needed and new development must be diverted from primary and secondary forests. New oil palm plantations sited on degraded or Imperata grasslands could realize significant carbon savings with low biodiversity impacts. However, the limited area of these land types will not support all future growth of the palm oil industry if demand continues to increase in line with expectations. Policies that continue to promote growing for the use of palm and other oils in biofuel will thus likely exceed the capacity of the industry to expand sustainably. The use of available palm and other agricultural residues in biofuel are more effective solutions for meeting climate and other environmental goals.

The foregoing Executive Summary was produced by:
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Washington Berlin Beijing Brussels San Francisco
www.theicct.org
Full document available:
http://www.theicct.org/ecological-impacts-of-palm-oil-expansion-indonesia