

Kelp/Seaweed Feedstocks: Products and Processes

Marine BioEnergy, Inc.

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Biogas from kelp replaces diesel

- CR&R, Inc has issued a Letter of Intent to purchase kelp from Marine BioEnergy.
- CR&R is digesting garden cuttings, food waste, and soon kelp to make biogas. The biogas is replacing the diesel in their trash fleet.
- CR&R has one of the biggest digesters in the Western U.S. They pump biogas into the regional pipeline to fuel trucks at their other various fleet locations.



Biogas for the grid

- Once CR&R has plenty of kelp and excess gas, the gas will be available to all gas customers, including for the spinning generators that operate the grid on days of low wind or low sun. The generators are existing infrastructure and the biogas is much less expensive compared to grid-sized batteries.
- The balance of the digested biomass is chopped evenly and bagged up for commercial retailers for soil supplements. The balance of the liquid is sent back through the digester. Nothing goes to land fills or sewers.
- <https://crrwasteservices.com/sustainability/anaerobic-digestion/>



Organic bio-stimulants from kelp

- Primary Ocean is selling an organic bio-stimulant based on giant kelp to farmers that improves plant development.
- Primary Ocean has stated an interest in purchasing kelp from Marine BioEnergy.
- <https://bioaginnovations.com/product/organikelp/>



Liquid fuels from kelp

- Brown kelp (*Saccharina*) has been processed through HydroThermal Liquefaction (HTL) followed by CHG to make biocrude.
- Genifuel notes on their website that hydrothermal processing "Solves Three Problems At Once"[™]: (1) It cleanly disposes of the wet waste material; (2) It produces renewable fuel; and (3) It produces clean, clear, sterile water.
- Genifuel adds that their process works with almost any organic feedstock, converting more than 99% of the organic content to fuels or inert products.
- The biocrude can be processed through refineries.
- <http://genifuel.com/advantages.html>

Liquid fuels from kelp, modular

- For smaller applications, Bio2oil in Denmark is now marketing a modular HTL system, delivered in two shipping containers for €2.1M. More processing units can be stacked, if needed.
- <https://bio2oil.dk/wp-content/uploads/2019/12/Folder-Web.pdf>



Based on the market

Giant kelp is rich in various products that can be isolated from the kelp before the balance is processed into fuel. The decisions will be based on the cost of pre-processing and market demand. Options include:

- Protein
- Polysaccharides such as fucoidan and mannitol
- Potash, iodine and bromine

Mitigating methane in cattle

- The red algae *Asparagopsis taxiformis* has been shown to mitigate methane production in beef and dairy cattle.
- The seaweed requirement is ounces per day of cattle feed lightly laced with molasses so the cattle will eat it! With 41 million cows in the U.S., the market will require hundreds of tons of this specialty seaweed per month, year around.
- *A. taxiformis* needs to be tested on the depth-cycling system - with the goal of providing substantial organic feed to the livestock market.
- https://theconversation.com/feeding-cows-a-few-ounces-of-seaweed-daily-could-sharply-reduce-their-contribution-to-climate-change-157192?utm_med
- <https://www.blueoceanbarns.com/>

Photo credit: Maria



Seaweeds for food

- Popular seaweeds/kelps are grown for food. As sterile hybrids become available, Marine BioEnergy will test the hybrids on the depth-cycling system.
- The FAO reports worldwide production in 2018 at 32.4 million tonnes (USD \$13.3 billion).
- Production is dominated by China (57%) and Indonesia (29%), followed by the Philippines (5%) and South Korea (5%).
- FAO. 2020. *The State of World Fisheries and Aquaculture 2020. Sustainability in action.* Rome. <https://doi.org/10.4060/ca9229en>



Please contact us:

Cindy Wilcox, cindy.wilcox@marinebiomass.com

Brian Wilcox, brian.wilcox@marinebiomass.com

Please see other videos and slide decks at the Marine BioEnergy Innovation Summit booth, or see www.marinebiomass.com

Thank you!

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Kelp photos by Phillip Colla, Oceanlight.com