# **USED MOTOR OIL TO** TYPE-B ULTRA-LOW SULPHUR DIESEL EcoFuel Solutions



## UNIVERSITY OF CALGARY

# **PROJECT DRIVERS**

#### Wide availability and growing resource:

Around 73.3 million liters of used motor oil (UMO) was recovered in Alberta in 2020 – 2021 alone. This

number is expected to grow as more adopt internal combustion machines.

#### A variety of industries:

Waste oil originates from many sectors including automotive, railway, marine and aviation, mining and forestry, and agriculture. Our process is not limited by the constraints of one market.

# **PROFITABILITY ANALYSIS**

The **H.J Lang Factorial methodology** was used to calculate the total capital costs for the plant.

Economic Indicator	Value
Total Equipment Cost (\$M)	8.3
Total Capital Investment (\$M)	47.3
Annual Operating Costs (\$M)	19.7
Annual Revenue (\$M)	40.7
Net Present Value (\$M)	46.9
Payback Period (years)	5.2
Return on Investment (%)	29.2
Net Return (\$M)	6.3
Discounted Cash Flow Rate (%)	30.5

#### **Opportunity for Innovation:**

Only 40% of the UMO created is recycled and 86% of this is burned as industrial fuel producing significant emissions





### **OPTIMIZATIONS**

Reactor volume increased to achieve target

# **PROCESS SUMMARY**

- **1. Desalter** 
  - Remove salts and prevent fouling downstream.
- **Thermal Cracker** 2.
  - Increase fraction of diesel.

# 3. Separation

- Separate Diesel and Lights from Heavies.
- Use Heavies to pre-heat feed.

# 4. Hydrogen Desulfurization

- Remove sulfur in Diesel by reaction with H<sub>2</sub> to produce  $H_2S$ .
- Sulfur levels need to be below 15ppm
- 5.  $H_2$  Recycle
  - Remove H<sub>2</sub>S and H<sub>2</sub> from Diesel and send it for recycling.



- sulfur levels (<15ppm).
- Stainless steel incorporation to prevent corrosion due to presence of sulfur.

# Heat Integration.



# **ENVIRONMENTAL IMPACT**

#### Problems

- "One gallon of UMO can contaminate up to 1 million gallons of fresh water" – EPA
- Toxic metals and carcinogens including PAHs (polycyclic aromatics) are 50 - 150x higher in UMO
- Oil acts as a visible pollutant preventing sunlight and oxygen from penetrating the water harming aquatic life
- Combustion of fuel containing sulfur results in the formation of particulates that contribute to air pollution and acid rain

#### Designed to minimize environmental impact

- Produced heavy hydrocarbons will be sold and used to make products such as plastics, rubber and paints
- Resulting light hydrocarbons will be used as a fuel source for the system
- Effluent streams such as flue gas will be reused in the process as heat integration
- Process water that cannot be treated will be stored and protected by a shielded salt disposal well preventing groundwater

seepage

#### **Our Solution**

- Creating an alternative solution for recycling oil contributes to a circular economy, eliminating waste and minimizing pollution
- Converted diesel fuel has a much lower carbon footprint than traditional diesel