HARVESTING FOG

(Fats, Oils & Grease aka: Brown Grease)

Challenge:
Harvest FOG with
Economic Efficiency to Produce Fuel.
Four Point Analysis:
Vested Costs
Opinion
Opportunities
Methods

FUEL FACTS!

- Entire U.S. economic & societal structure is based on plentiful liquid automotive fuel (LAF).
- LAF extraction, refining, distribution, sale and use is the largest, longest lasting, industrial endeavor undertaken by human beings. Electricity is second.
- Exotic Alternative fuels requiring fundamental infrastructure change will go from experimental to obsolescense never seeing common usage.
- Only efforts “Infra-compatible” will succeed.

OVERFLOWS COST

- Sanitary Sewer overflows related to FOG cost over $24 Billion per year.
  - Includes:
    - Clean up
    - Collection System Repair
    - Damage to Receiving Waters Requiring Remediation
    - Economic Impacts from Closed Waters, Beaches, Fisheries

ENFORCEMENT COSTS

- FOG Pretreatment Enforcement is erratic, expensive and only marginally effective.
  - Strong Lobbying Opposition
    - National Restaurant Association second only to AARP
  - No Consensus:
    - Administrative Structure
    - Engineering
    - Abatement Performance
    - Funding
    - Orphan Pollutant suffering from neglect

OPINION

- Individual Opposition is pervasive throughout the restaurant industry, down to the person charged with cleaning the interceptor.
- Secondary Consideration Adminstratively
  - Industry: noxious overhead expense
  - Public: lacks public interest
  - Politically: unglamorous
  - Administratively: difficult

INFRASTRUCTURE

- Major Physical or Administrative Infrastructure Replacement is not an Option.
  - Must Have Confidence & Support of:
  - Industry:
    - Minimum Food Service Cost & Operation Impacts
    - Economic, aesthetic, convenient
    - Compatible with Energy Related Physical Infrastructure - Tankage, Distribution, Delivery
  - Must be Compatible With Institutional Infrastructure
    - Codes, Standards, Regulation, Tax, Funding, Jurisdiction,

OPPORTUNITY OF QUANTITY

- Yellow grease = 4 kilograms/year/person
  - (9 pounds/year/person)
- Intercept. grease = 7 kilograms/year/person
  - (16 pounds/year/person)
- Total waste grease 11kilograms/year/person
  (25 pounds/year/person)
- **“Interceptor Crude” = 4.8 Billion lbs. / yr. = 632 Million Gallons / yr. [@ 7.6 lbs./gal.]**

OPPORTUNITY OF LOGISTICS

- Production is widely dispersed proportional to population density - as is fuel consumption.
- Biomass Refining Requires Smaller Plants; Allowing Placement Near Bulk Fuel Blending Plants
- Lower Supply - Distribution Cost perPump/gal.

OPPORTUNITY OF ADAPTABILITY

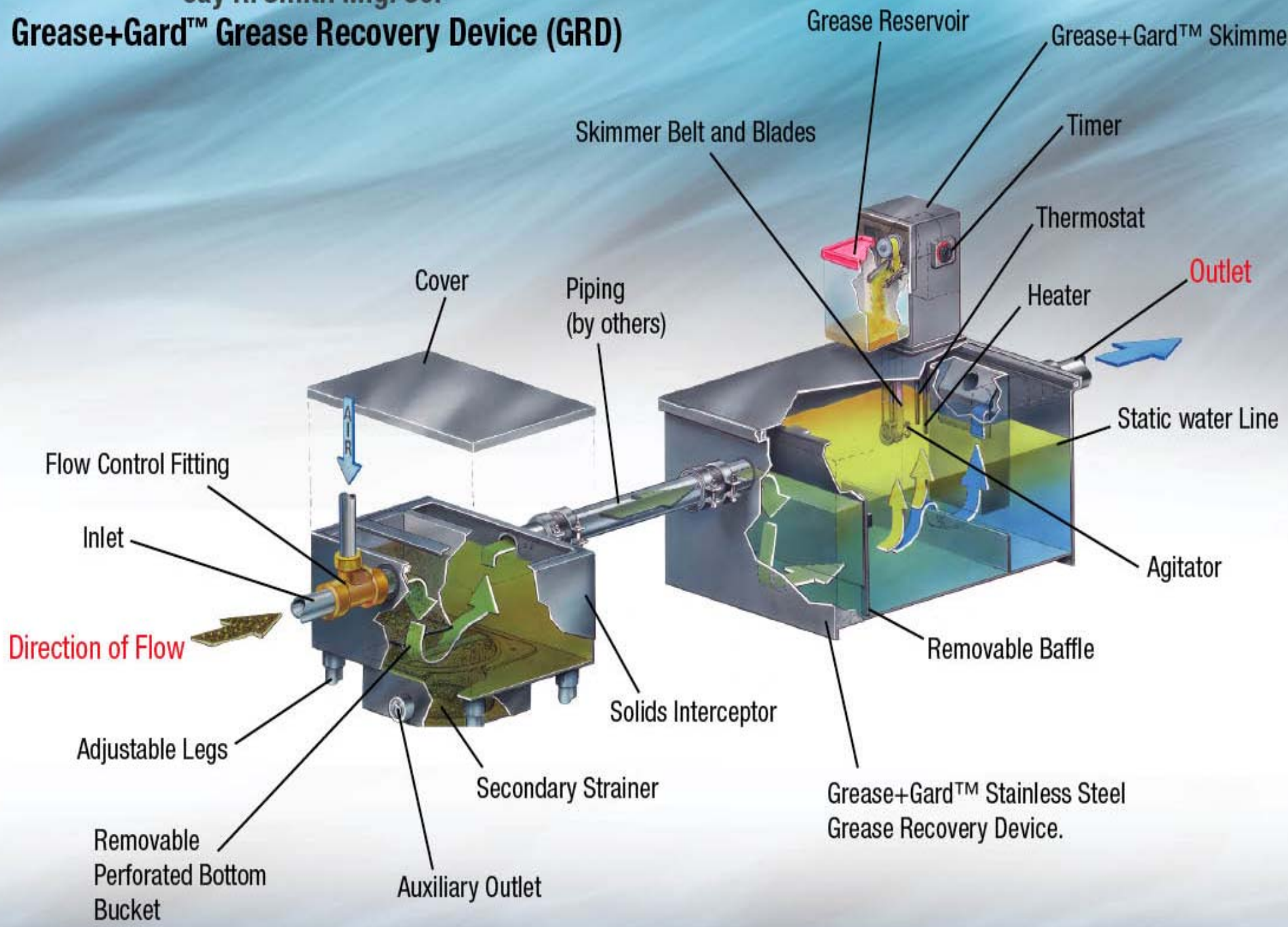
- Production:
  - Biomass Refining Product Adaptable to Fuel Blending Process - Diesel or Gasoline
  - Biomass Refining Utilizes Variable Carbons Such as Food Waste, Woody Waste
- Distribution:
  - Use Existing Transportation, Storage, Distribution
  - No Engine changes required
  - No Institutional changes required
  - Promotion and Marketing Advantages
  - Public Behavior Change Unneccessary

HARVESTING METHODS

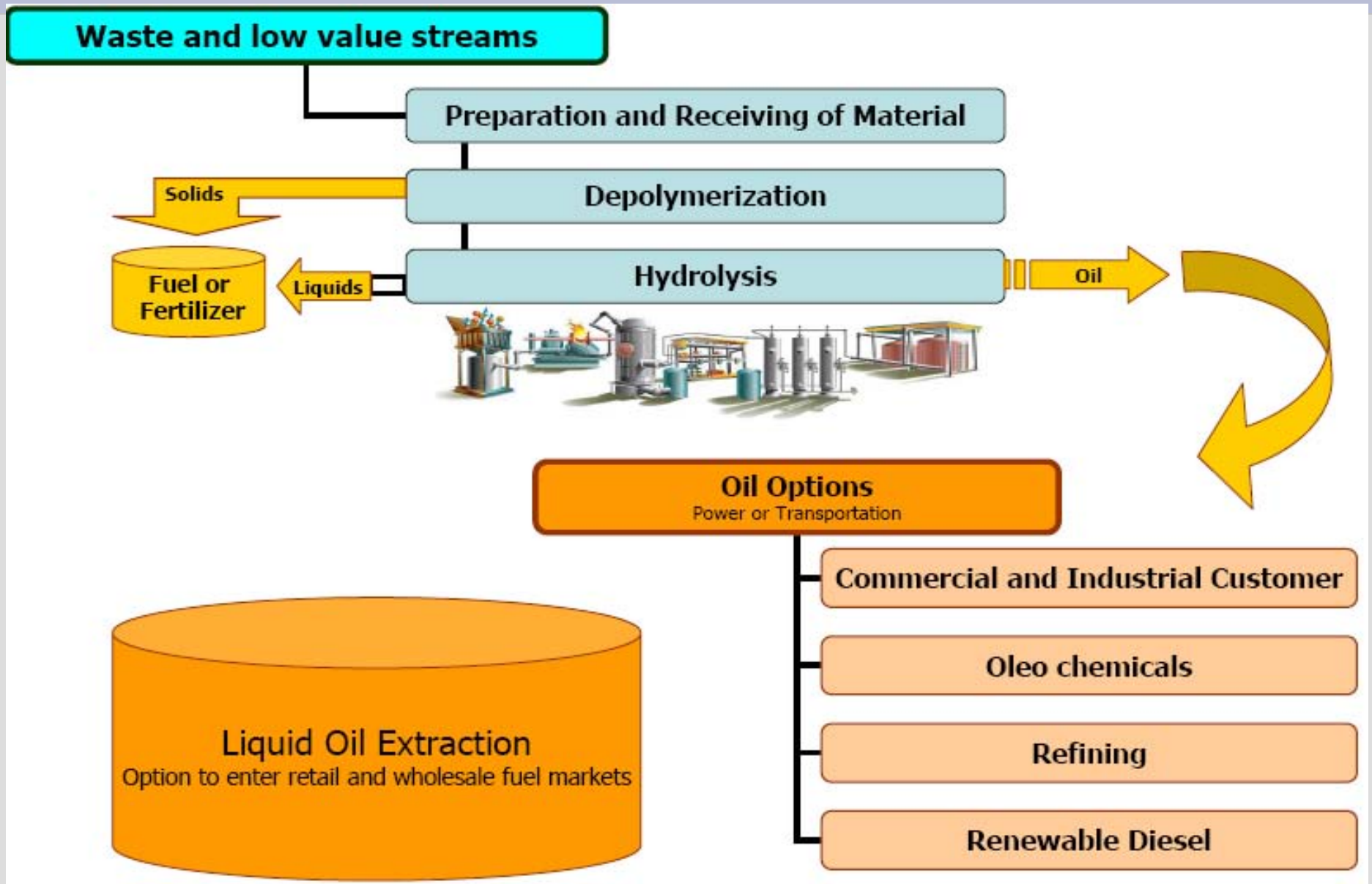
- Fresh Interceptor Crude = Higher Fuel Yield
  - FOG Molecule Susceptible to Degradation & Contamination
- Grease Interceptors:
  - Hydromechanical & Gravity
  - Ease of Cleaning & Frequency Key to Production
  - GRD (Grease Removal Device) Advantages:
    - Ensures Freshest FOG
    - Requires Little Operator Interaction
    - Suitable to More Installations
    - Adaptable to Both Interceptor Types
    - Requires No Infrastructure Change

Jay R. Smith Mfg. Co.

Grease+Gard™ Grease Recovery Device (GRD)



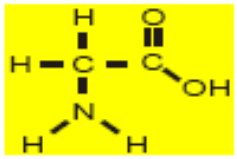
PRODUCT FLOW



MOLECULAR STRUCTURE

Fats, proteins, carbohydrates

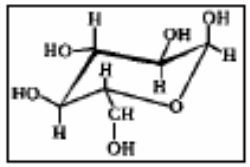
A resource of Hydrocarbons



Glycine

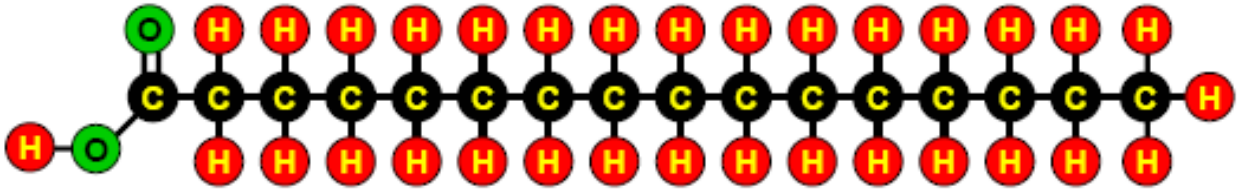
Amino Acids

Glucose



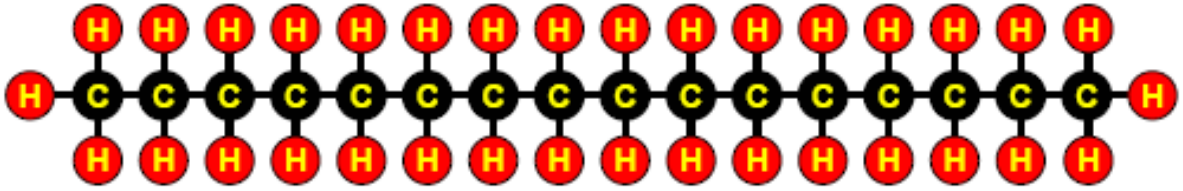
Carbohydrates

Palmitic Acid



Carboxylic group -COOH

Cetane



REFINING METHODS

- Methane “Biogas”
  - Anaerobic Digester at Plant can accept all organics
  - Energy out / Tons in = Moderate Yield
  - Most Suitable to Onsite Electrical and Heat Gen.
  - Water Byproduct Requires Treatment
  - With Further Processing, Can be Liquified
- Hydrogenation
  - High Temperature, High Pressure in presence of Hydrogen and a Catalyst
  - Product very Similar to Crude Oil
  - Inclusive of Other Carbonaceous Materials
  - Highly Adaptable to Existing Petro-Infrastructure
  - Most Suitable where Waste Heat & Particulate Available

REFINING METHODS CONT.

- Depolymerization
  - Uses Superheated Water, Pressure
  - Suitable for complex, poisonous compounds, Oxidizes Heavy Metals
  - Does Not Require Prior Water Removal
  - Produces Petro-Infrastructure Compatible Crude
- Pyrolisis
  - Heating Biomass in the Absence of Oxygen
  - Produces a Liquid Bio-Oil
  - Highly Adaptable to Existing Petro-Infrastructure
  - Suitable for a Variety of Feedstocks - Cellulosic

METHODS NEARING COMMERCIALIZATION

- Hydrogenation-Derived Renewable Diesel
  - Close to Full Commercialization
  - Produced by refining fats or vegetable oils alone or blended with petroleum
  - Using existing refinery infrastructure
- UOP/Eni Ecofining™ Process for Green Diesel Fuel
  - Ecofining process units are in development today
  - Converts natural oils and wastes to green diesel fuel

CONCLUSIONS

- Sufficient Quantities Provide Feasibility
- Infrastructure Compatibility
- Operator Support - Reduced Costs
- Public Incentives:
  - Cleaner Environmental Methods
  - Politically Compatible
- Significant Budgetary Incentives:
  - Savings from Overflow Reductions
  - Reduced Enforcement Costs
  - Every Increment = Profit Center