

Changing World Technologies, Inc.

Brian Appel

Biofuels from New York Regional Waste

Moving from rhetoric to developers of renewable fuel oil

Biodiesel Workshop 2008

Brookhaven National Laboratory

May 2, 2008



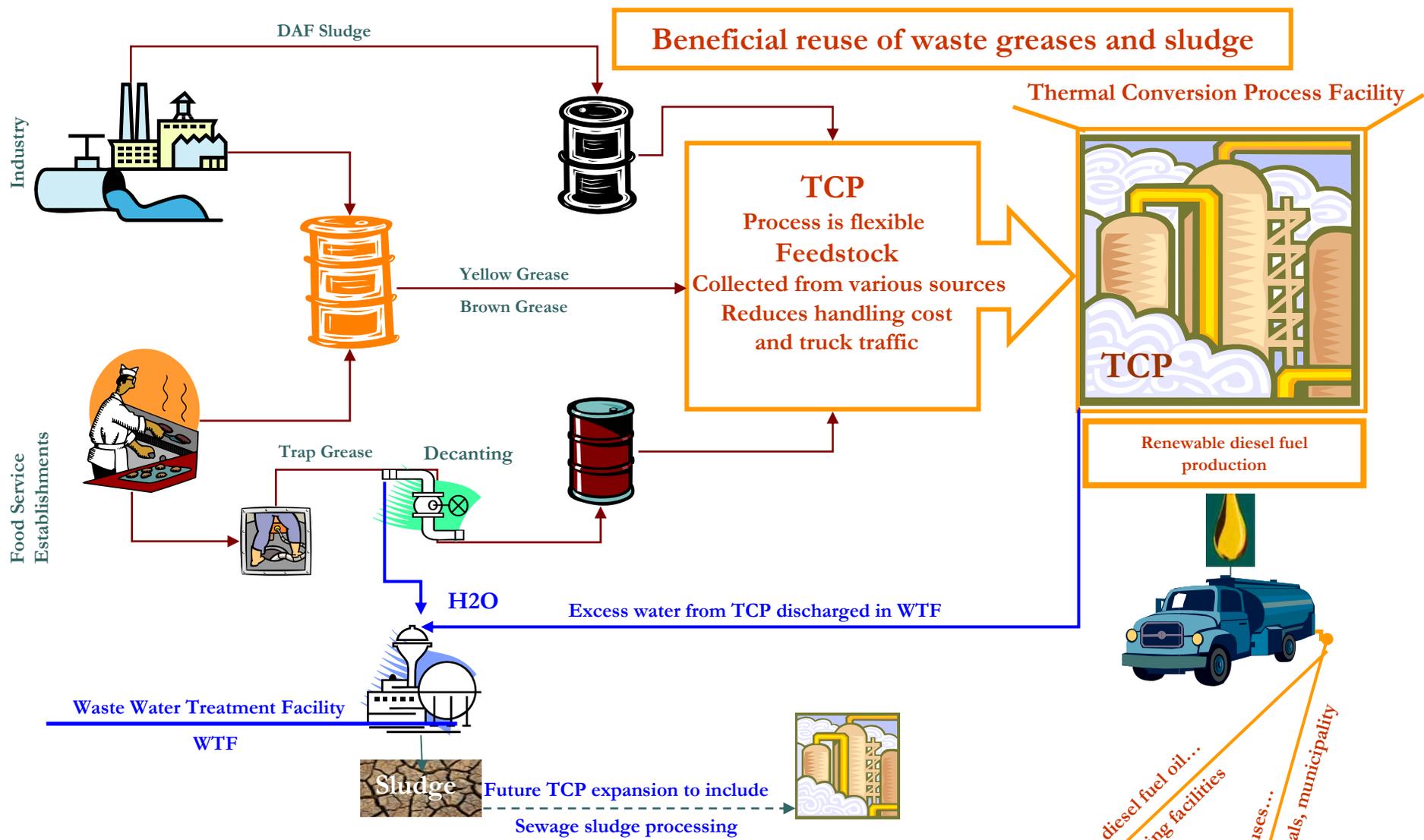
Our Program: Waste to Oil

- Our Platform: **Renewable** and Alternative
- Our Patented Technology: **Renewable** and Green
- Our Production: **Renewable** and Competitive
- Our Customer Proposition: **Renewable** and Compelling

What we do...



Beneficial reuse of waste greases and sludge



Value added proposition: Enhancement to existing programs

- Solves waste issues...reduces solids loading on WTF...reduces health risks
 - Reduces municipal expenses and public tax burden
- Locally produced renewable diesel fuel oil from waste
- Minimal new infrastructure required to utilize fuel oil



Renewable diesel fuel oil...
 ...used in existing facilities
 Expanded uses...
 ...schools, hospitals, municipality

The energy dilemma...

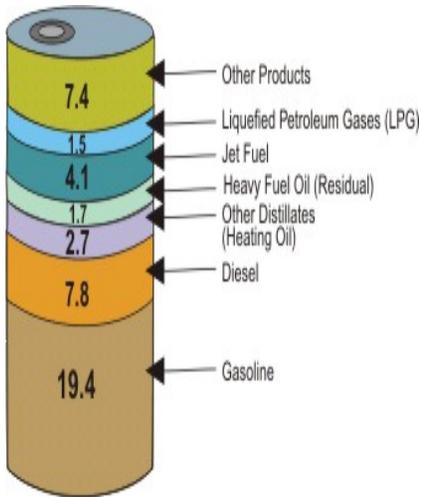


Fundamental business model for processing alternative feedstock and using existing oil refineries falls short; limited volumes, difficult logistical hurdles in aggregating feedstock, and competition with established markets for high value products including oleo chemical and food crops

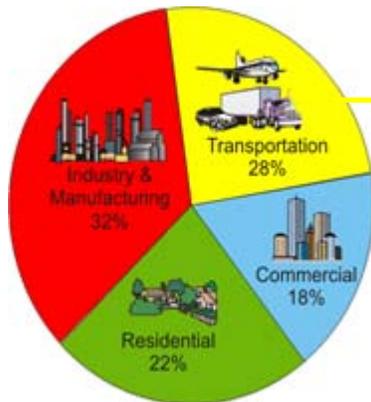
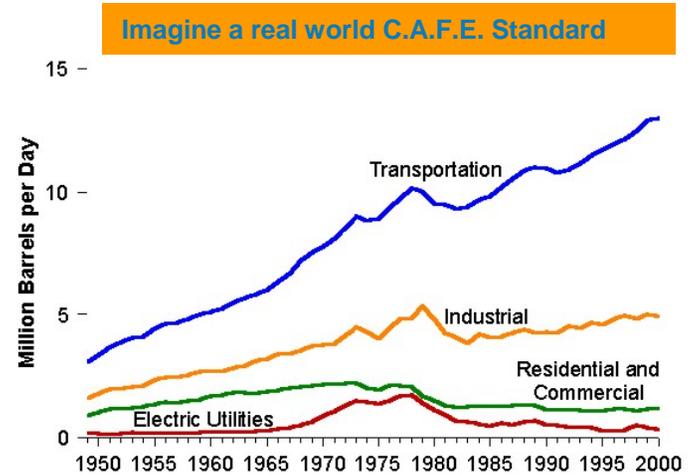
Why is this important?

Displacement of Fossil Fuels

Despite the hype, it is not only about transportation fuels

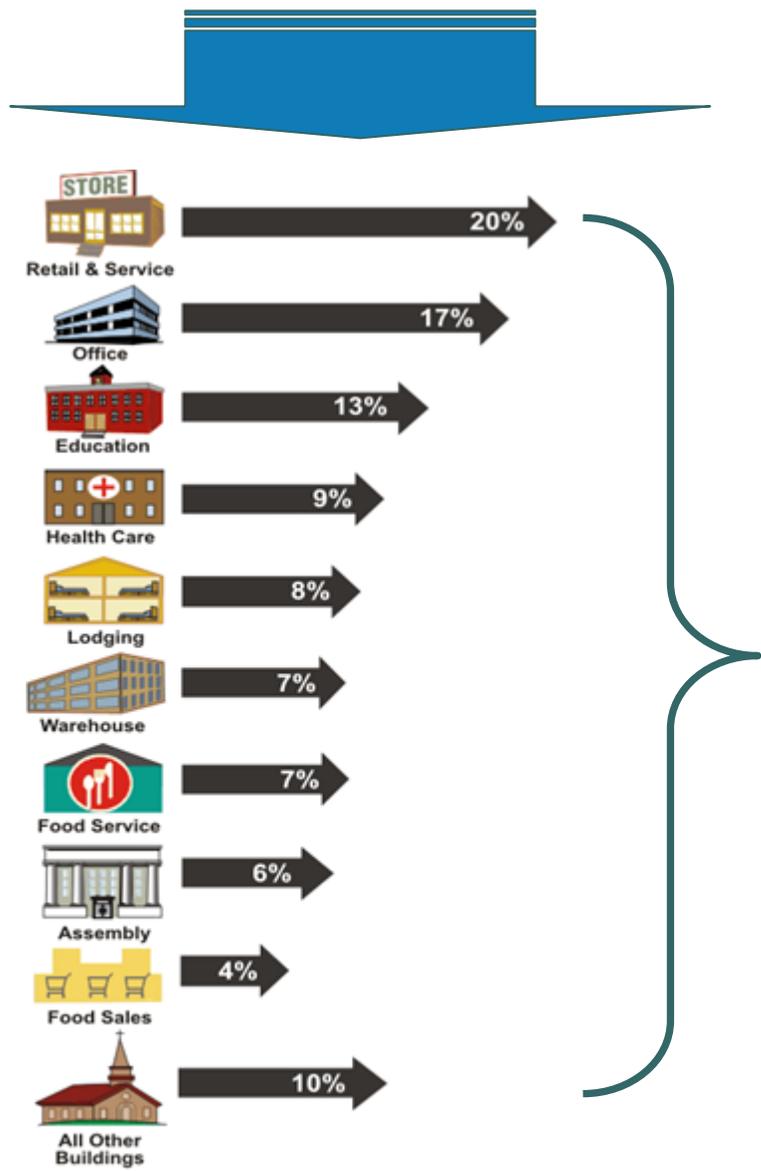


U.S. energy use for the non-transportation sectors is close to three-quarters of total market



Transportation market demand expected to decrease as C.A.F.E. standards increase, introduction of plug-in-electric hybrids and mass transit systems re-built and utilized

Fixed Energy is Important...



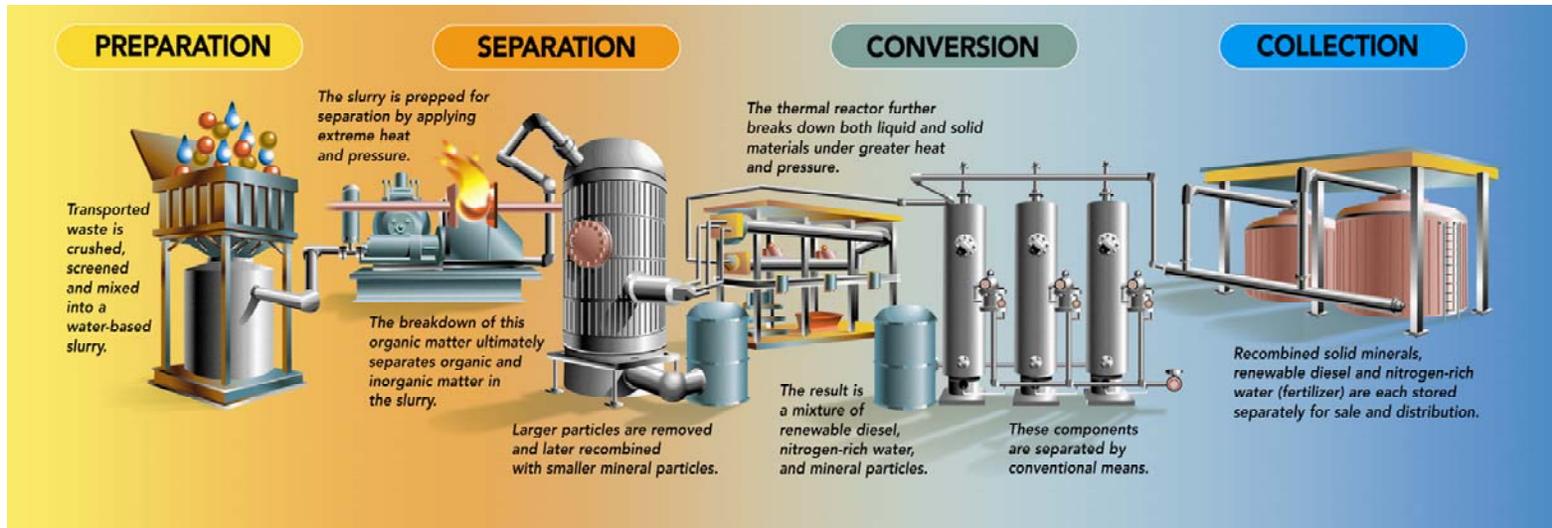
Due to rounding, Percentages may not add to exactly 100 percent.

Fixed energy applications are easier to integrate new alternative fuels

Large market for developing new fuels...



The process of converting waste to fuel oil



Patented Process
Scalable and Adaptable
Conventional Equipment
Conventional Materials
Non-Combustion
No Catalysts

Relative Permitting Ease
Feedstock Variability
Small Footprint
Energy Efficient [85%]
Environmentally Friendly
Valuable Products

Thermal Conversion Process (TCP)

Step 1: Preparation

Waste is crushed and mixed into a slurry



Step 2: Separation

Heat and pressure are applied to separate organic and inorganic materials



Step 3: Conversion



Higher heat and pressure are applied, generating renewable diesel and co-products



Step 4: Collection

End-products stored separately for distribution and sale



Utilization of Existing Infrastructure Commercial Demonstration Facility



Practical Approach

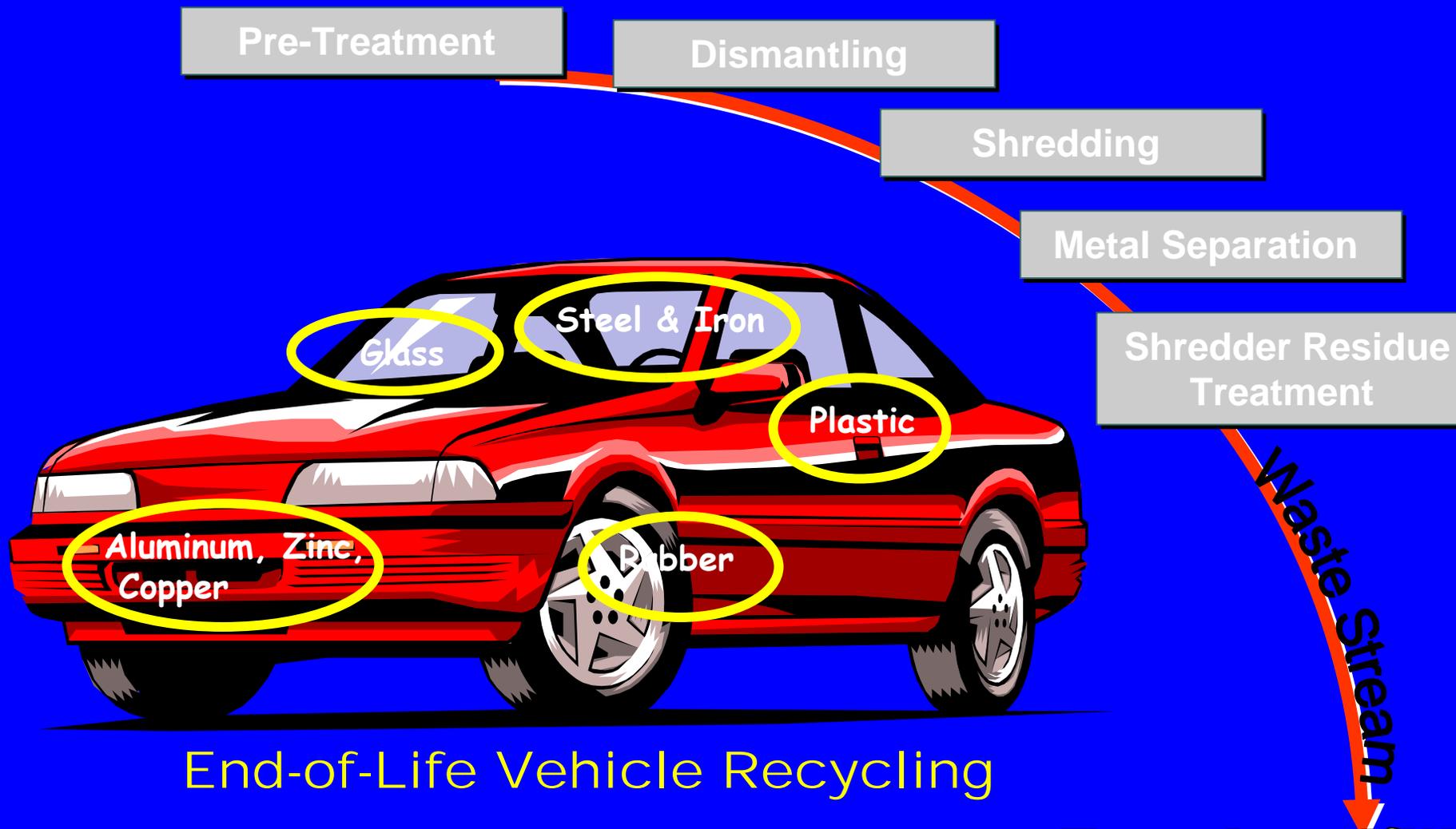
**Smaller distributed bio-refinery concept.
Collect waste and utilize fuel locally**

**Avoids the need for building new
expensive infrastructure**

**No distribution bottlenecks for accessing
renewable fuel oil**

Future Applications...

Shredder Residue and Mixed Plastics





Shredder



Shredder Residue



Mixed Plastics



Foam



Fibers



Metals



Rubber



Wood

Validated by Highly Respected Independent Authorities



Performed Life Cycle Analysis



Funded Brookhaven study of TCP fuel in industrial boilers

VEHICLE RECYCLING PARTNERSHIP

Studied feasibility of converting vehicle shredder residue into renewable diesel

DAIMLERCHRYSLER



LACounty.gov

TCP for Municipal Solid Waste



RDDP/Renewable Mandates/Fuel Security

NEPA

PA/MO/CO National Environmental Policy Act (NEPA) Assessments



Permitted TCP process to destroy medical infectious waste

Commercial and industrial applications

An easier and larger market to penetrate



- For industrial boiler use in local markets [**Schools, Hospitals, Municipal Facilities**]
- At BTU parity prices; competitive with oil or gas [**~\$1.60 - \$1.80**]
 - **#2 Oil = 138,500 btu's**
 - **RDO = 125,500 btu's**
- With low conversion costs that can be done immediately
- Eligible for renewable energy credits
- Where learning curve for new fuel application is more manageable and less risky

2005 Bids \$1.97- \$2.13 for 500k/gallons Quogue/General

Proposed Facility Highlights

- Investment of approximately \$20 million dollars
- 30 high paying technical jobs
- Small footprint estimated at less than 5 acres with proper setbacks
- Initial capacity of 120 tons per day
- Initial production of 20,000 gallons per day of renewable diesel fuel oil
- Potential expansion capability to over 50,000 gallons per day
- Fuel pricing at parity with fossil fuel oil
- Future incentives for displacement of fossil fuels [CO₂ benefit]

Technology Advantages

- Renewable diesel fuel oil produced from waste and sold locally
 - No new infrastructure required to use renewable fuel oil (rail, barges, pipelines)
 - Practical solution to waste disposal
- Renewable fuel is cost competitive
 - BTU parity pricing
 - Low switching cost and quick implementation of equipment
 - Availability of green premiums (carbon credits)
- Process destroys pathogens and diverts waste from food chain, landfills and incinerators
- Process does not involve the burning or combustion of waste feedstock
- Process is over 85% energy efficient
 - Allows for distributed generation planning
- Process does not place a burden on other natural resources
 - Water, land or heavy use of fossil fuels to produce

Waste Grease

- Represents a large national resource
 - estimated 3.8 billion lbs produced annually in the US
 - equivalent to 495 million gallons of renewable diesel with good yield
- A waste disposal problem



Help our industries stay competitive by reducing waste disposal cost

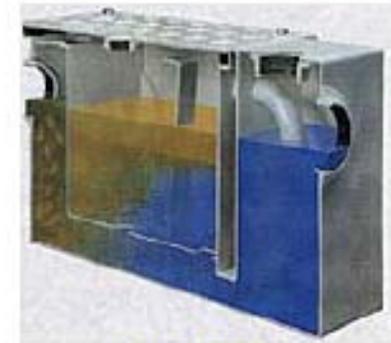
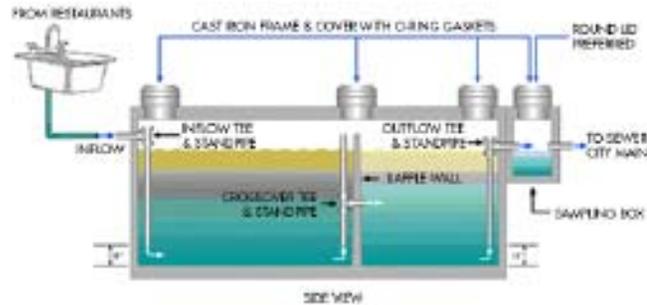
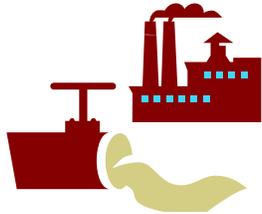
The Feedstock

Locally sourced



Grease Traps

DAF Sludge -Industry



Grease Trap

Oils and greases



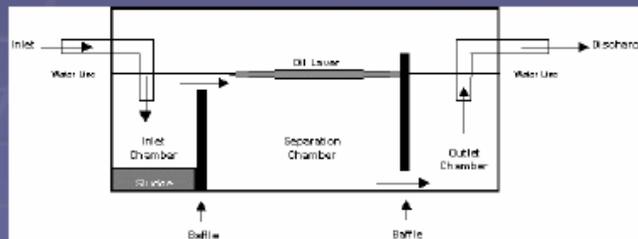
•A grease trap works by slowing down the flow of warm/hot greasy water and allowing it to cool. As the water cools, the grease and oil separate and float to the top of the grease trap. The cooler water (less grease) continues to flow down the pipe to the sewer. The grease is actually trapped by baffles, which cover the inlet and outlet of the tank, preventing grease from flowing out of the trap.

Skimming's from Treatment Plants



FOG recovery at the Waste Water Treatment Plant

FOGs are of a lower density than water are collected with the skimming at the inlet.

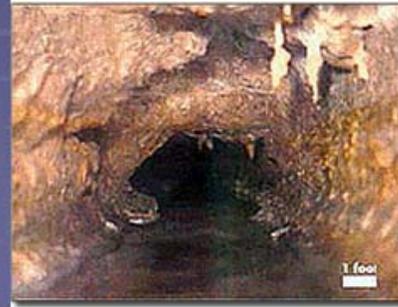


Solve a problem – Create Energy

WHY REGULATE?

FOG discharge into the sewers:

- Negative impacts on wastewater collection and treatment systems
- System blockages: spills, manhole overflows, or sewage backups into homes and businesses = health hazards
- Feedstock for biofuel not recovered

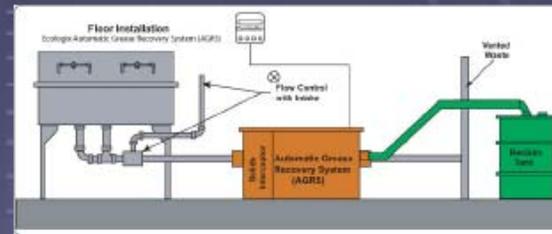


It will save on maintenance cost

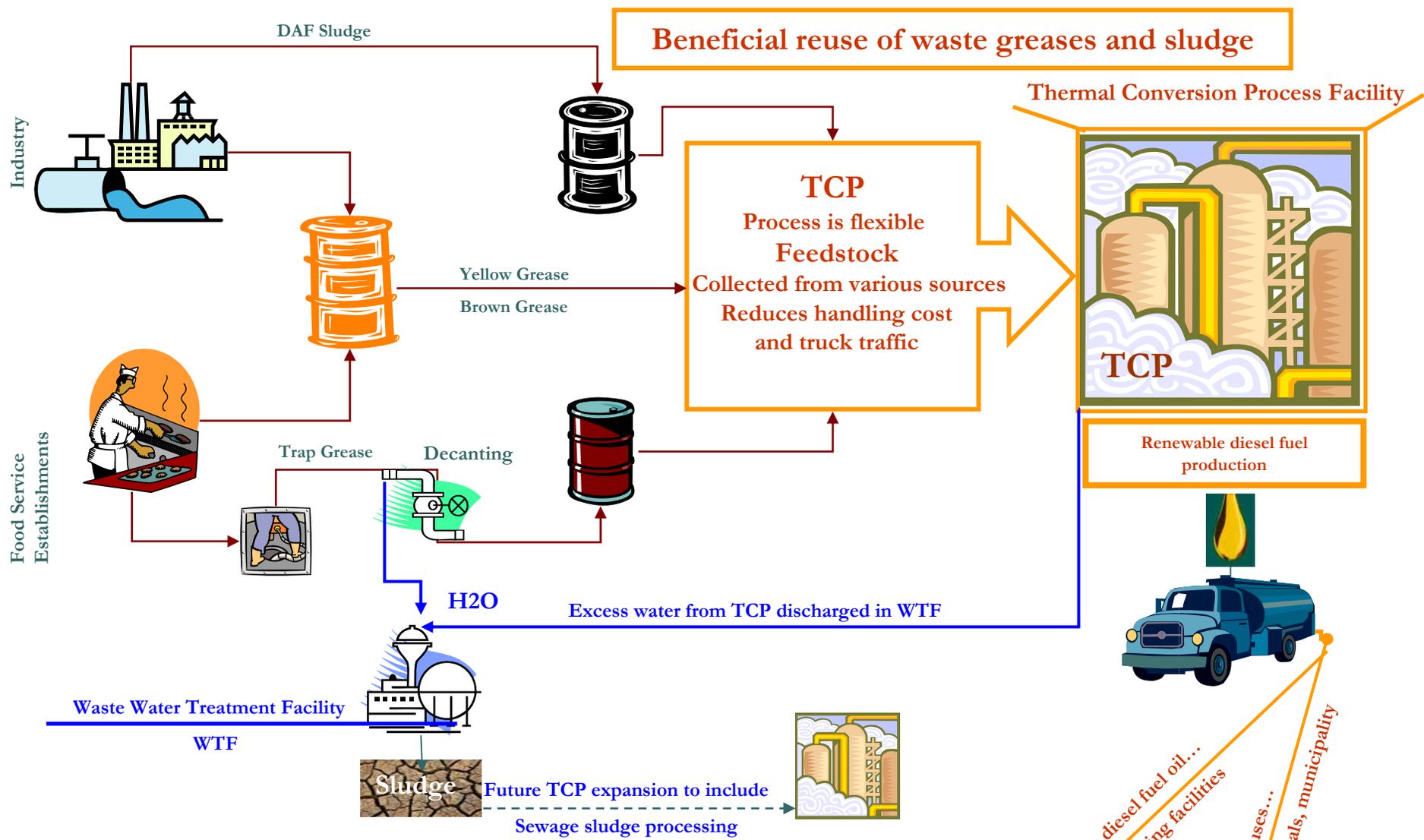
The Enforcement Issue

Two levels:

- Enforcement of the placement of traps
- Enforcement of the collection of the greases
- Different approaches on how to handle the enforcement



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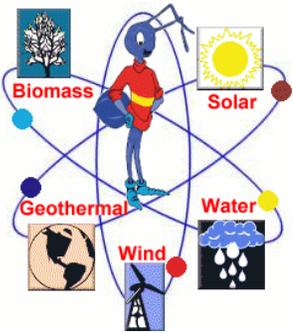


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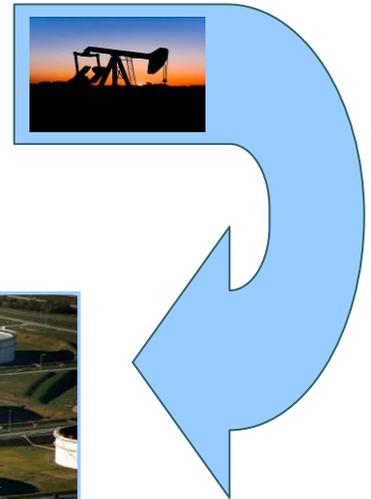
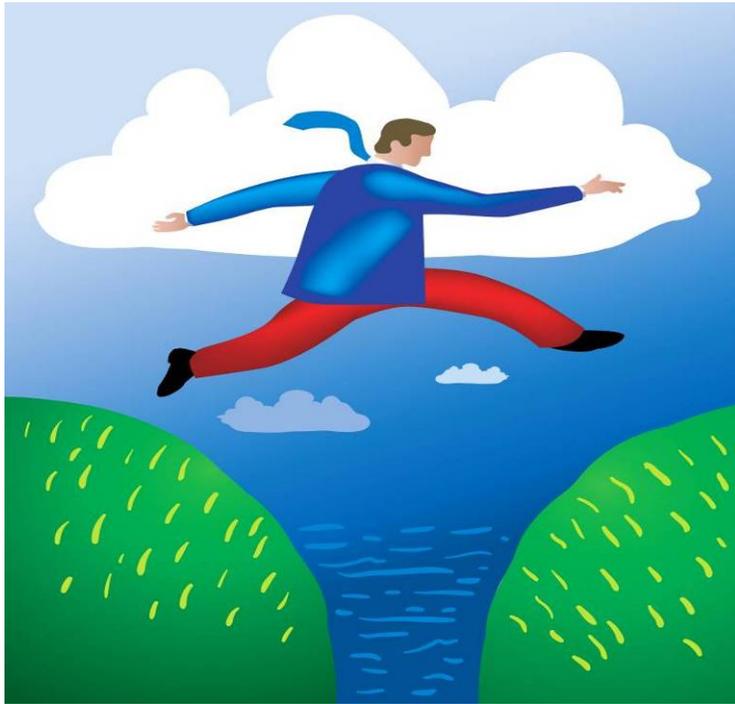


Next Steps for affecting change...

- Reaffirm process capabilities
- Confirm feedstock availability
 - Trap greases, oils, industrial DAF and sludge
- Determine off-take arrangements
 - Power Purchase Agreements
 - Schools, hospitals, municipal facilities
 - Green Attributes
 - How to monetize
- Development of financial models
 - County Participation
- Identification of the best location
- Timeline



CWT, Thinking differently about municipal waste and energy independence...



A truly advanced biofuel...