Changing World Technologies, Inc

Renewable Diesel Production

"Waste to Fuel Oil"

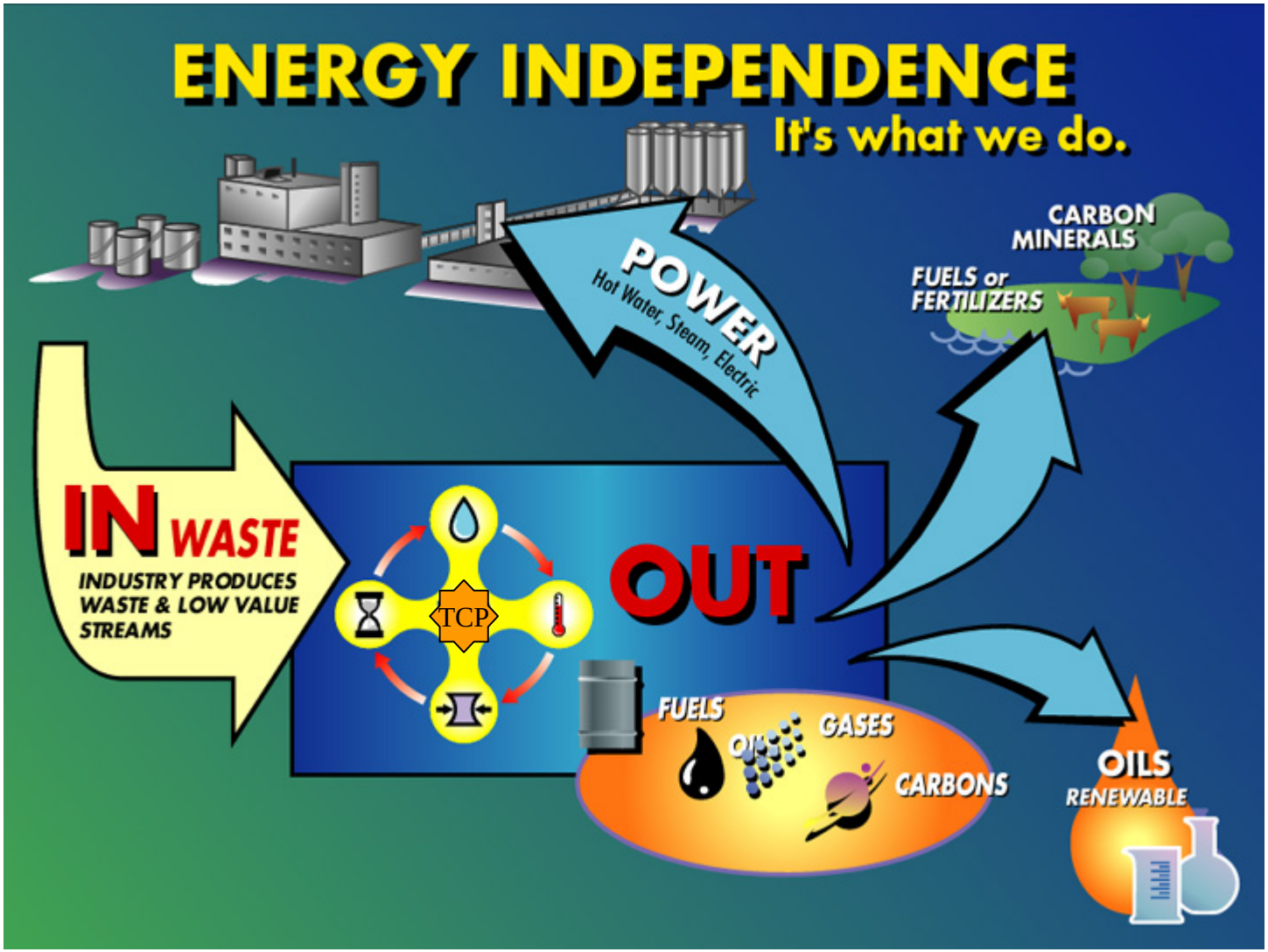
"Anything into oil"

May 21-24, 2007

Columbus, OH

Eliminate Waste
Produce Renewable Energy
Reduce Global Warming
Improve Quality of Life

Tapping into organic waste…



…using a Thermal Conversion Process to safely convert waste into fuels and industrial products

Changing World Technologies

- 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*

An immediate platform for a ready nation

- Renewable diesel production from waste
- Direct substitution for fossil fuels at competitive pricing
- Power and distribution from locally produced renewable diesel
- Strong strategic implications
  - Reduced logistic tail burden
  - Additional storage for critical assets – food and weapons
  - Ready to use fuel

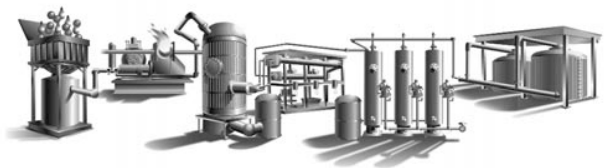
Mobile unit helps replenish fuel supply

Changing World Technologies

- Founded in 1997
- HQ (NY), R&D Center (PA), and Demonstration Facility (MO)
- Over $100M of Private Equity and Government Grant Financing
- Developer of the Thermal Conversion Process (TCP)
  - Also Know as Thermal Depolymerization Process

What is TCP?

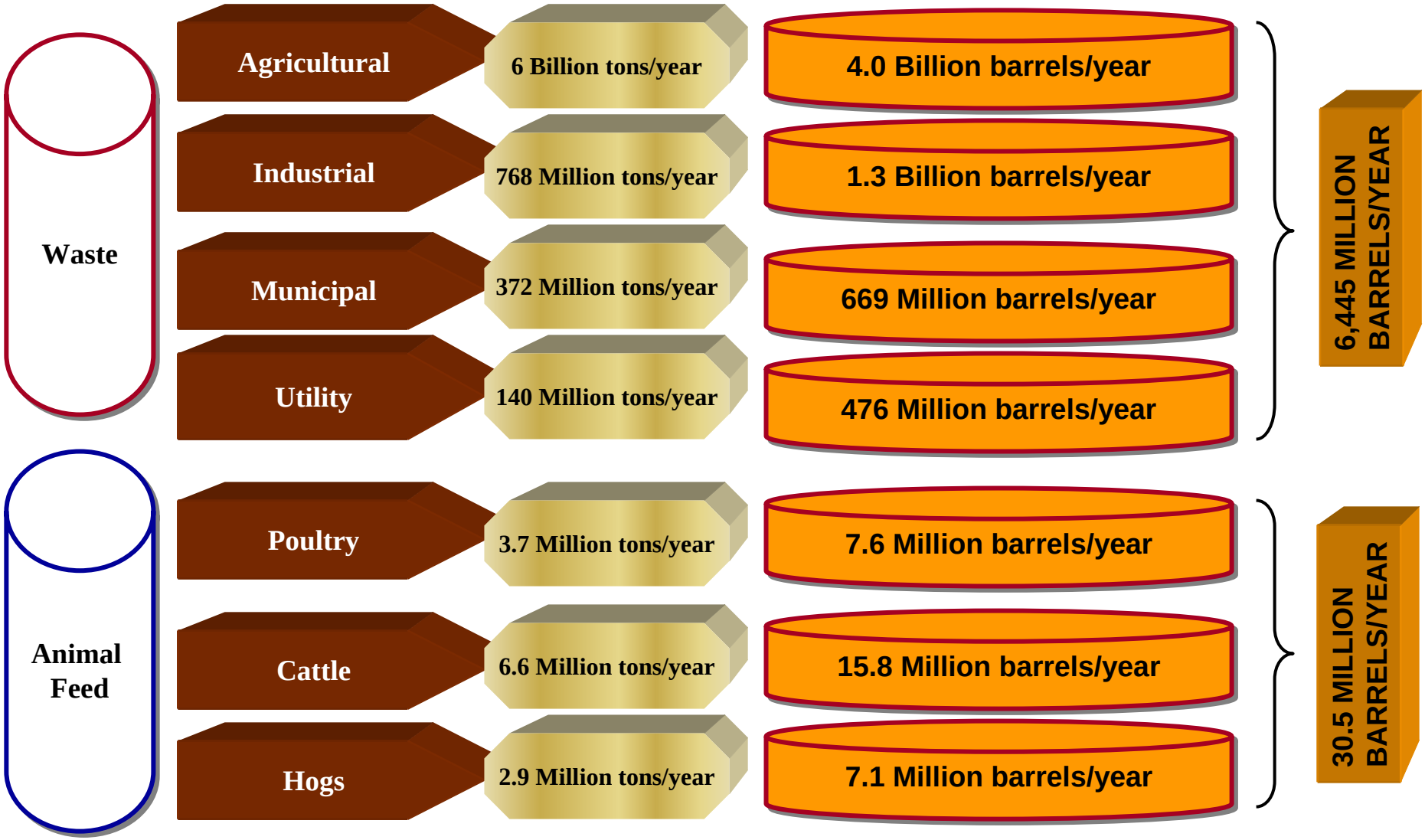
Thermal Conversion Process or (TCP) breaks down organic materials by using heat, pressure and water to produce oil and other co-products www.changingworldtech.com



CWT
Changing World Technologies, Inc.

The source that everyone is uncomfortable discussing

Potential renewable diesel production from waste



Establishing waste often a matter of perspective. Definitions blurred, i.e. sludge is often called “biosolid”, manures called nutrients and food waste is often animal feed

The refined oil markets in the United States…and worldwide

(000's barrels per day)
2002 statistics

U.S.

Fixed energy production market 6,576

1,248

Residential/ Commercial

- **Distillate fuel 657**
- Kerosene 36
- LPG 505
- Gasoline 20
- Residual fuel 30

4,926

Industrial

- **Distillate fuel 603**
- Kerosene 7
- LPG 1,648
- Gasoline 159
- Residual fuel 87
- Petroleum coke 398
- Other petroleum 1,435
- Lubricants 78
- Asphalt 513

402

Electrical power

- **Distillate fuel 51**
- Petroleum coke 61
- Residual fuel oil 291

Transportation fuel market 13,089

10,475

On Road

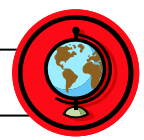
- Motor gasoline 8,355
- Fuel additives* 310
- **Distillate fuel 1,800**
- LPG 10

2,614

Off Road

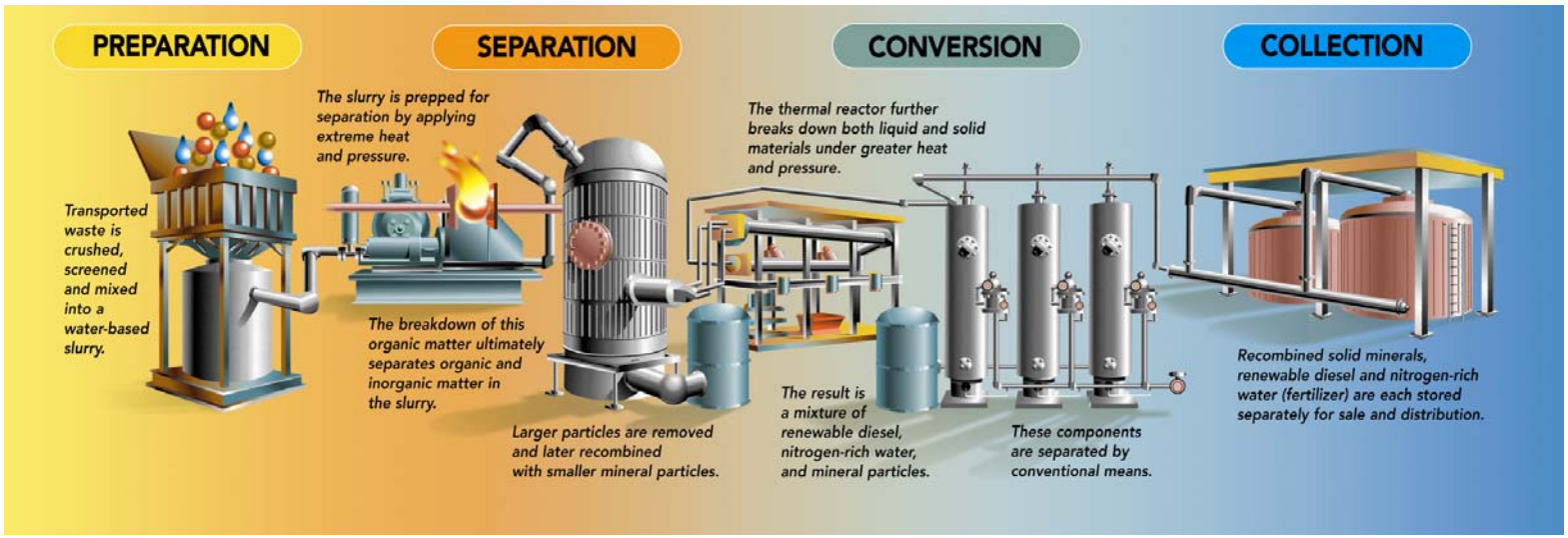
- **Distillate fuel 665**
- Kerosene 1,608
- Aviation gasoline 18
- Residual fuel oil 250
- Lubricants 73

Daily Total: 19.5 million barrels in US / 75million worldwide



Thermal Conversion Process (TCP)

Four step process for conversion of organic waste into renewable diesel

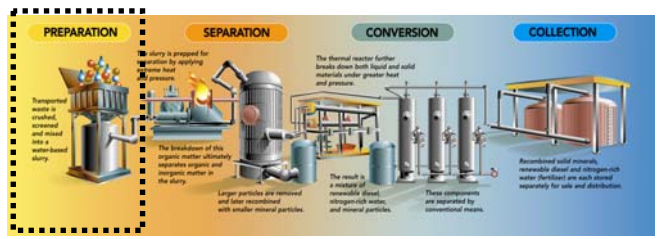


Non-Combustion
Conventional Equipment
Feedstock Variability
Scalability and Adaptable
No Catalysts or Chemicals

Relative Permitting Ease
Small Footprint
Energy Efficient
Environmentally Friendly
Valuable Products

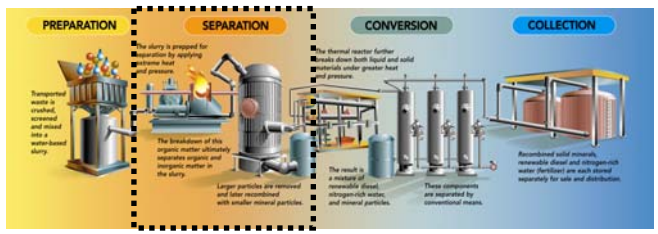
Step 1: Preparation

Waste is prepared and mixed into a slurry



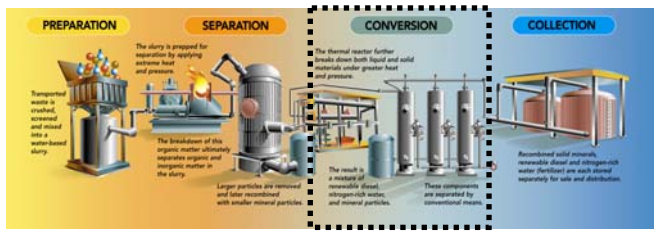
Step 2: Separation

Heat and pressure are applied, separating organic and inorganic materials in the process



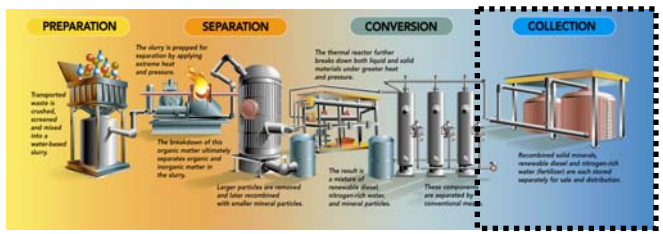
Step 3: Conversion

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



Step 4: Collection

End-products stored separately until sale and distribution



Waste and low value streams

Preparation and Receiving of Material

Solids

Depolymerization

Fuel or Fertilizer

Liquids

Hydrolysis

Oil

Oil Options
Power or Transportation

Commercial and Industrial Customer

Oleo chemicals

Refining

Renewable Diesel

Liquid Oil Extraction
Option to enter retail and wholesale fuel markets

Two Concurrent Paths

Developing;

- **RAPID DIESEL DEPLOYMENT PLATFORM**

  UNITED STATES DEPARTMENT OF DEFENSE

Utilization;

- **RENEWABLE DIESEL –** **Biobased synthetic fuel from waste**

What waste can be consolidated and utilized ?

- Military waste to renewable diesel
  - Wet waste
    - Food scrapes, sludge and grease
  - Organic rich waste
    - Mixed plastics; PET, PVC, HDPE
      - Medical waste; bandages, infectious, sharps
    - Spent fuels, energetics
    - Maintenance oils, lubricants, solvents
    - Rubber and tires

The more people, the more waste

A liquid fuel concern…

Feedstock vulnerabilities
Natural gas cost
Commodities – Food versus Energy
Logistical restrictions
Railroad track wash-out

Jet ~72%, Ground ~18%, Marine ~8%

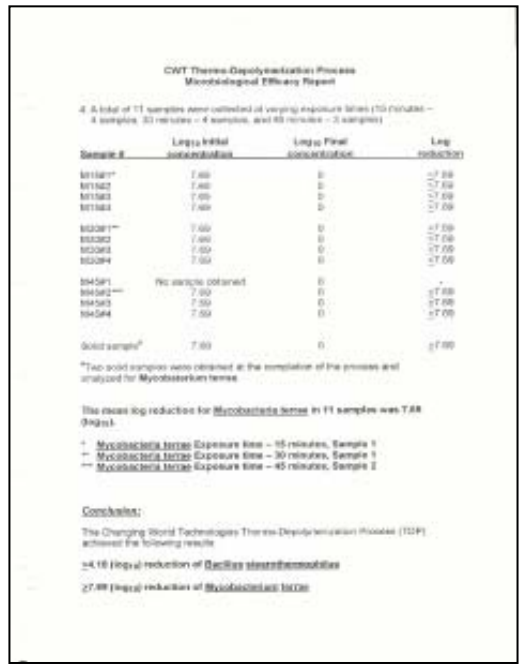
- Decentralized TCP facilities could provide alternative fuel
  - Diesel production – proportionately distributed with population
  - Distributed diesel fuel facilities translates into less vulnerabilities
- Existing equipment runs on liquids (many more years)
- Power generation moving toward using high class fuels
  - JP-8 and JP-5 compatible (why add additional jet fuel demand)
  - Older technology more flexible in fuel use
- Competition from developing nations and airline industry
- Efficiencies and alternative sources will play role
  - And x-factor; the next big thing

Defense; will get their fuel, others will have to ration (save grease in WW)

THE TCP PROCESS

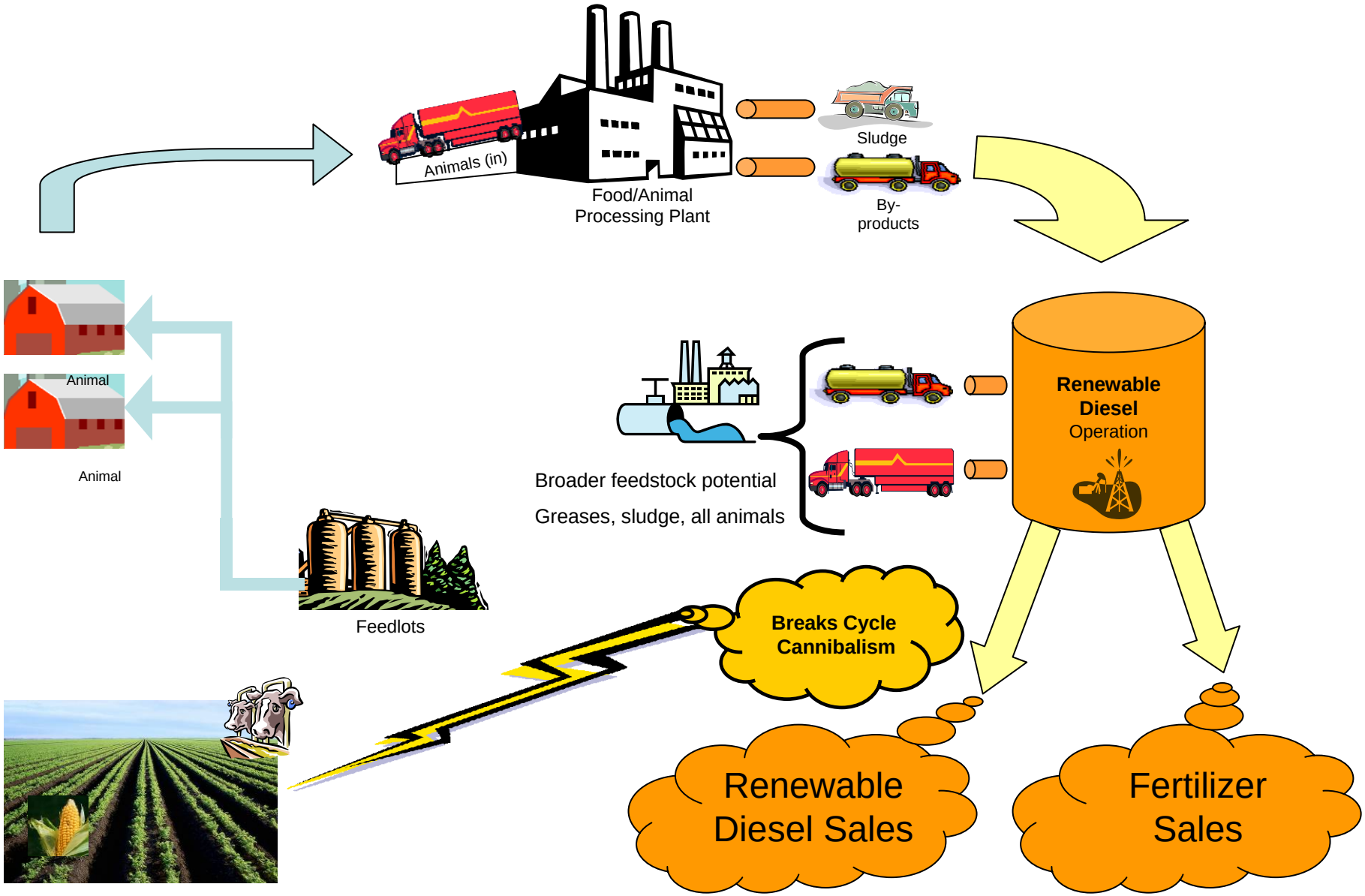
Major difference to other methods – is the TCP use of water and the multiple separation steps. The process preserves "C" as hydrocarbons versus the termination of "C" as CO2/Char for other destructive methods

New York State Medical Waste
Approval; Sharps, pathological, laboratory Process approved vs. apparatus approval



- Thermal Conversion Process - TCP
  - Utilization of water – slurry, heat transfer, solvent
  - Multiple steps, mixed materials - Depolymerization
  - High temperatures and pressures – Hydrolysis
- Scientific evidence supports pathogen destruction….

Feedstock sources and diverting waste from re-entry into food chain



TCP Addresses Contaminants

Animal Waste Contamination

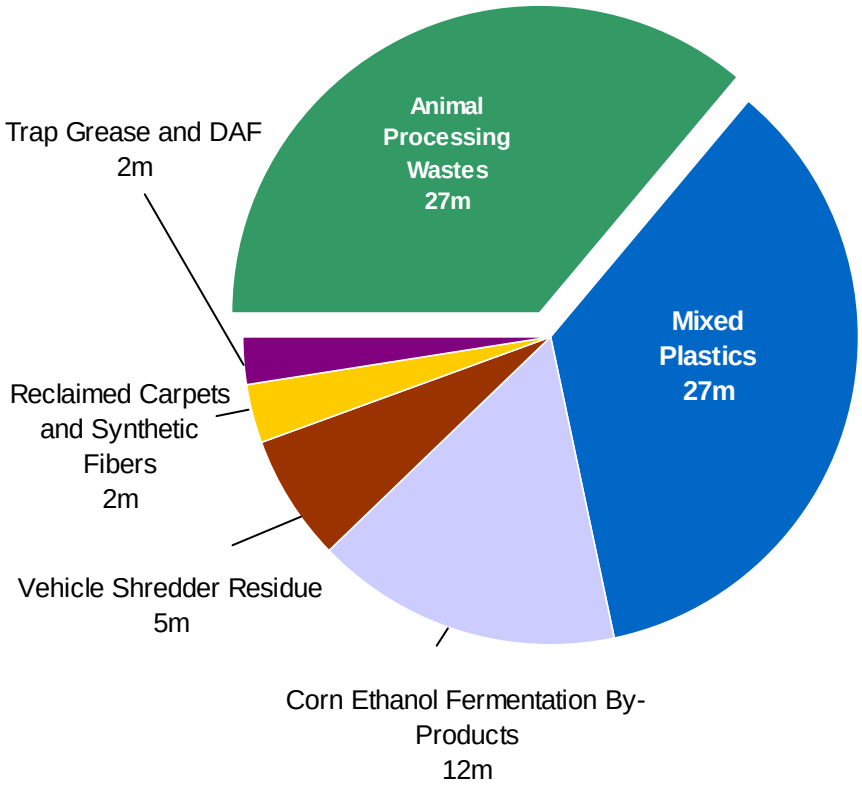
- 27 million tons per year of animal processing waste in US
  - Processed by traditional renderers
  - Used in livestock feed, pet foods, soaps and other chemicals
- Feeding livestock animal waste identified as a potential cause for the spread of BSE or “mad cow” and other diseases
- TCP can safely destroy pathogens that cause diseases such as “mad cow”

Inorganic Hazardous Materials

- 34 million tons of mixed plastic, rubbers, synthetic carpet and foam waste generated in the United States are often land filled
- TCP safely eliminates PCBs and other potentially hazardous inorganic compounds from these waste streams

Feedstock Sources

U.S. Feedstock Market Size

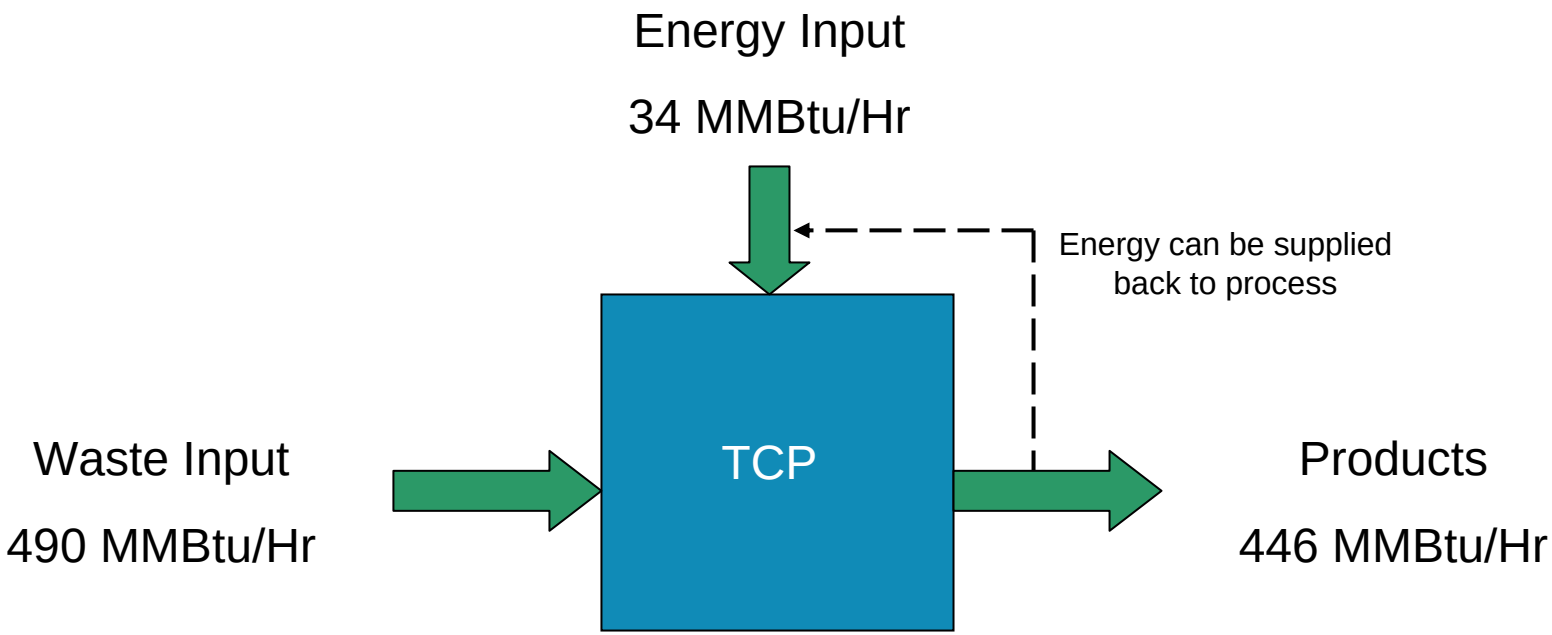


Total: 75 million tons / year

Validated by Highly Respected Independent Authorities

	**Performed Life Cycle Analysis**
KEYSPAN Climate is everything.™ 	**Funded Brookhaven study of TCP fuel in industrial boilers**
VEHICLE RECYCLING PARTNERSHIP DAIMLERCHRYSLER Ford GM	**Studied feasibility of converting vehicle shredder residue into renewable diesel**
 LACounty.gov	**Considering TCP for Municipal Solid Waste**
	**RDDP/Renewable Mandates/Fuel Security**
NEPA	**PA/MO/CO National Environmental Policy Act (NEPA) Assessments**
DOH STATE OF NEW YORK DEPARTMENT OF HEALTH	**Permitted TCP process to destroy medical infectious waste**

1,000 TPD Animal Plant Energy Balance



OVERALL ENERGY EFFICIENCY = 85%[1]

[1]*Calculated as Product Output /(Waste Input + Energy Input)*

Significant Advantages Relative to Other Alternative Fuels

- **Energy Efficient By Net Energy Balance[1]**

CWT Renewable Diesel	7.0
Ethanol	1.3
Conventional Biodiesel	3.2

- **Utilizes "Non-Prime" Feedstock**
  - Waste vs. corn vs. soybean vs. greases
- **Able to Process Multiple Feedstocks**
- **Logistically Simpler**
  - No rail / minimal transportation requirements
  - Co-location with waste source
  - Significantly smaller footprint
- **Low Production Cost**

[1]Net Energy Balance is the ratio of energy output over the fossil energy required to make the fuel

Food Composition

A mixed wet waste stream - provides opportunities

Complete Cooking Directions

BUTTERBALL®

Young Turkey

Nutrition Facts

Serving Size 4 oz. (112g)
Servings Per Container varied

Amount Per Serving	
Calories 170	Calories from Fat 90
	% Daily Value*
Total Fat 10g	15%
Saturated Fat 3.5g	18%
Cholesterol 70mg	23%
Sodium 320mg	13%
Total Carbohydrate 0g	0%
Dietary Fiber 0g	0%
Sugars 0g	
Protein 20g	40%
Vitamin A 0% • Vitamin C 0%	
Calcium 0% • Iron 4%	

*Percent Daily Values are based on a 2,000 calorie diet.

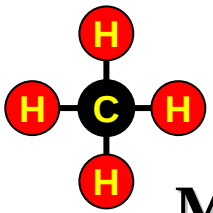
Fat ←

Carbs ←

Protein ←

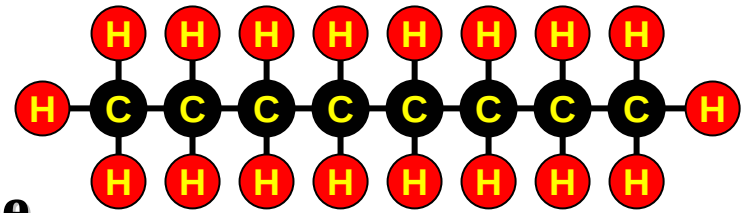
Hydrocarbon Fuels

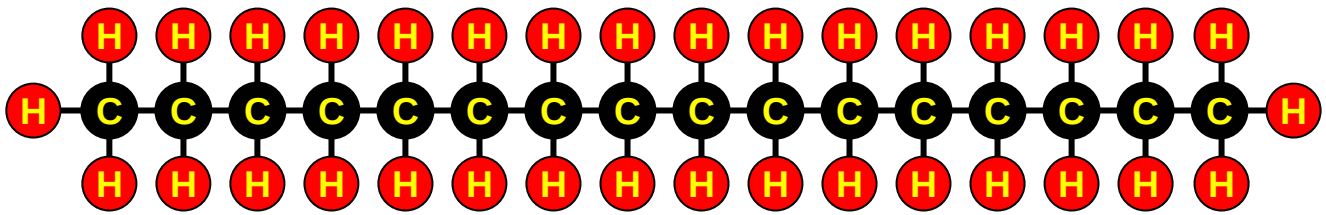
Hydrocarbons contain hydrogen and carbon



Methane

Octane

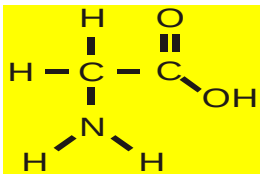




Cetane, a 16-carbon straight chain hydrocarbon

Fats, proteins, carbohydrates

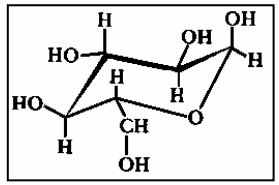
A resource of Hydrocarbons



Glycine

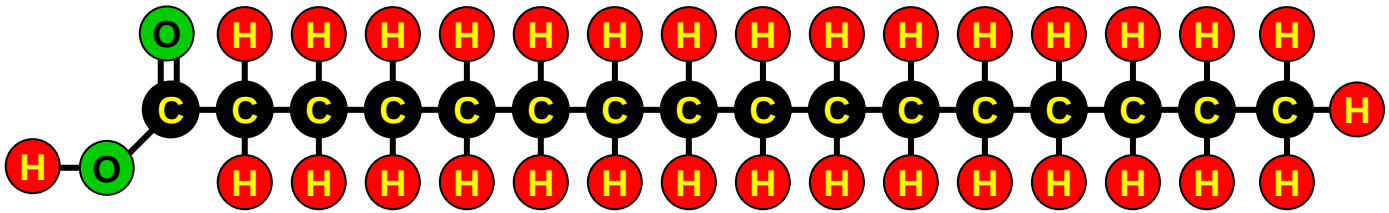
Amino Acids

Glucose



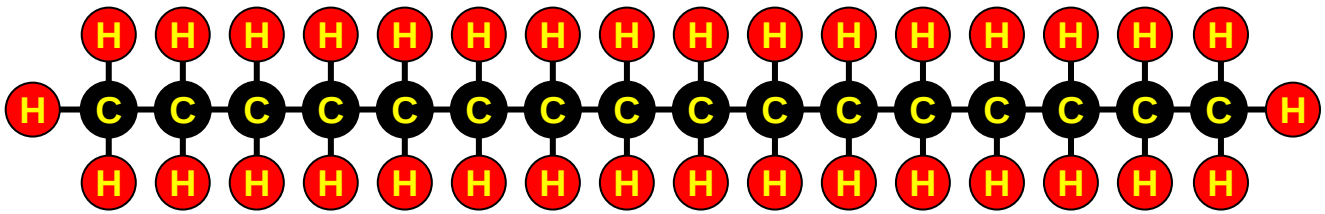
Carbohydrates

Palmitic Acid

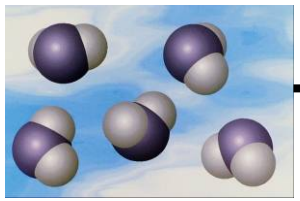


Carboxylic group -COOH

Cetane

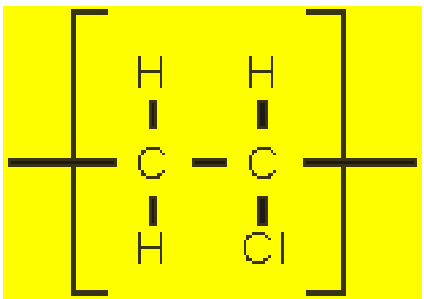


Processing Plastics



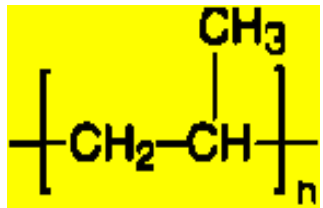
H_2O

Oxygen/chlorine bonds break during hydrolysis

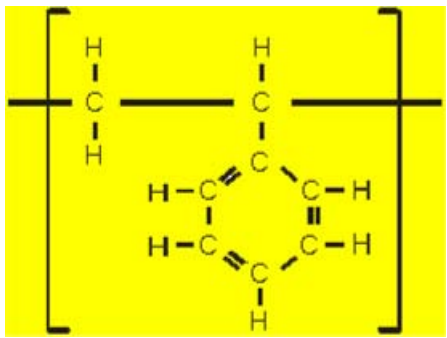


PVC

Carbon-carbon bonds break during depolymerization



Polypropylene



Polystyrene

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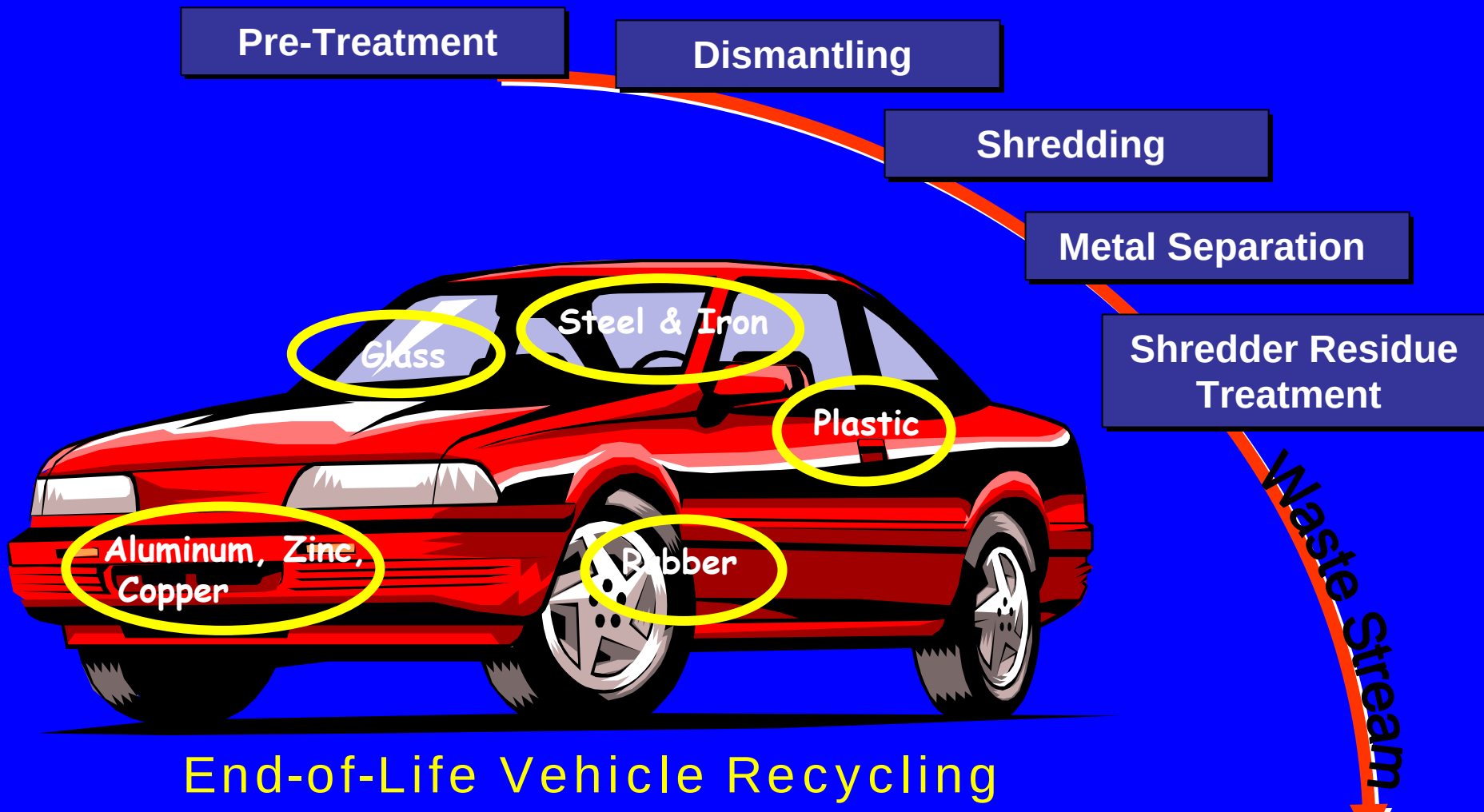
A Life Cycle Look at End of Life Vehicle Recycling




Shredder


Shredder Residue


Mixed Plastics


Foam


Fibers


Metals


Rubber


Wood

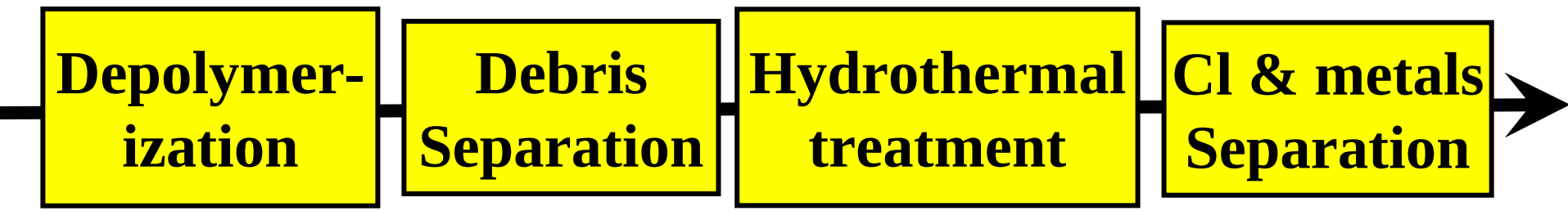
Ex., Material Composition of SR

SR Composition	1	2
Hydrocarbon Polymers	62,7%	76,59%
Condensation Polymers	4,3%	0,73%
Chlorinated Polymers	6,2%	3,68%
Ligno-cellulosics	0,8%	3,58%
Tires	14,0%	0,00%
PCB's	0,01%	0,00%
Insoluble	1,99%	5,42%
Water	10,00%	10,00%

Distillation Cut	Industrial Uses	Temperature Range
Light Distillate	**Gasoline; motor fuel**	**122-302F**
Middle Distillate	**Kerosene; jet fuel**	**302-482F**
Diesel	**Diesel fuel; heating oil**	**482-644F**
Heavy Fuel Oil	**Lubrication oil; industrial fuel**	**644-676F**

TCP for Shredder Residue

- Two thermal processes for clean intermediate oil
  - Depolymerization
  - Medium temperature hydrothermal treatment
- Cl, metals, debris separated from oil
  - PCB's destroyed
  - Mechanical separation for debris
  - Hydrothermal separation for Cl & metals
- Clean hydrocarbon for use or upgrading
  - Oil can be upgraded in-house or at refinery



Big Picture

Waste to energy and reduction in landfill costs

SR
Autos
White Goods
E-waste
Lubricants
Oils

Organic material
30%

Organic Material
Other
35%

Inorganic
Material
24%

Water Disposal
11%

Oil & Gas

Energy

Smelter or landfill

Sewer

Output fractions of SR Only (1-ton)

Organic to oil and gas	30%	600 lbs
Organic - fixed carbon	35%	700 lbs
Scrap metals and dirt fines	20%	400 lbs
Inorganic - metals,wood	4%	80 lbs
Water	11%	220 lbs

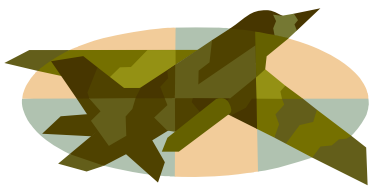




These are estimates that depend on input. Use of output site specific
Does not include motor oil

How to achieve military objectives and change…

- Supporting commercial ready technologies through cost sharing or pre-construction agreements
- Building smaller independent facilities
  - Avoid “Hub” mentality to limit vulnerability (Henry Hub, Trans-Alaska pipeline)
  - Limit supplies from hostile and unstable nations
- Helping develop appropriate construction modules for bases, with eye on mission support
- Storing and distributing synthetic fuels through normal logistical channels and expanding services
- Bridging the gap with renewable fuel suppliers and “refineries”
  - Procurement contracts in place
  - Local market quality guarantees – blends, performance and environmental



Ground Zero

Irrespective of energy advances
we must still deal with waste

Waste to Fuel

A Paradigm Shift

- Eliminate waste
- Produce meaningful amounts of renewable diesel
- Reduce global warming dangers by reducing fossil fuel use
- Improve quality of life for military personnel

U.S Department of Defense; The Power to Achieve Energy Independence

Thank you

“Anything into oil”

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www.changingworldtech.com