

Municipal Solid Waste To Liquid Fuel and Bio Char



Public/Private Partnership



Executive Summary

Project Summary

- **Current Situation**

- 350,000 Wet Tons/Year of MSW

- **Proposed Approach**

- 110,000 Wet Tons of MSW
 - Diesel Fuel: **8,485,265 Gallons/Year**
 - Bio Char: **14,279 Tons/Year**



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The Team

- ALLIED Energy Services, LLC
 - *Developer and Operator*
- Soukos Environmental USA, Inc.
 - *MSW Feedstock Technology Provider*
 - *Energy Conversion Technology Provider*
- AMEC Foster Wheeler
 - *EPC (Engineering, Procurement and Construction)*



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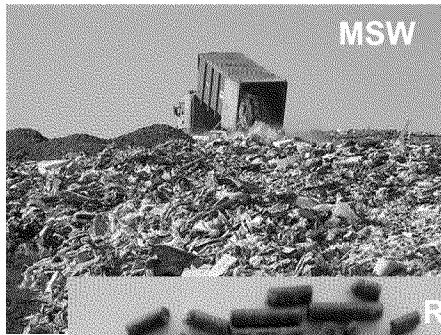


Project Overview

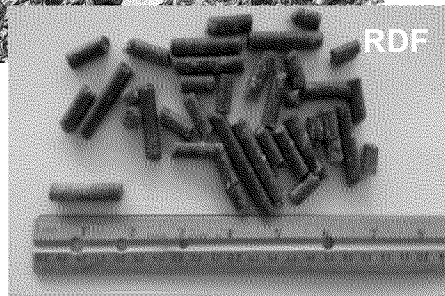
Soukos

AEOLUS & ARCHIMEDES

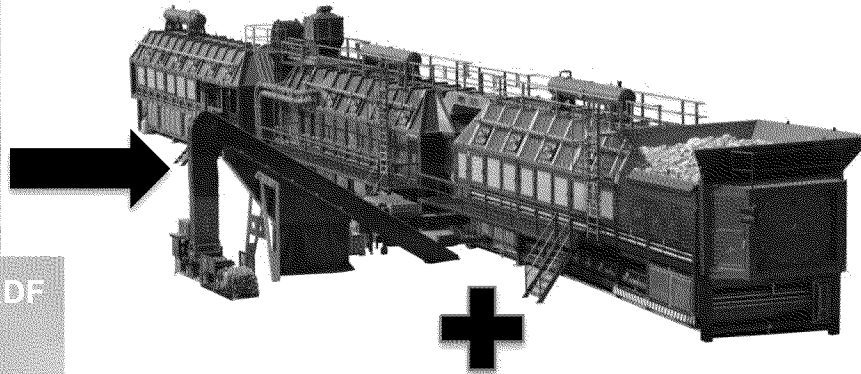
We take this..



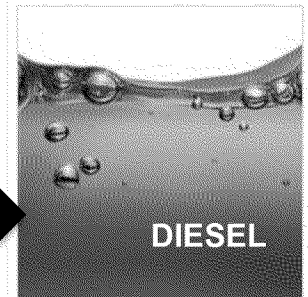
MSW



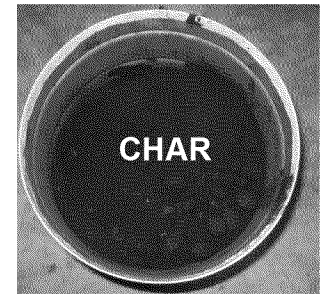
RDF



..and make this...



DIESEL



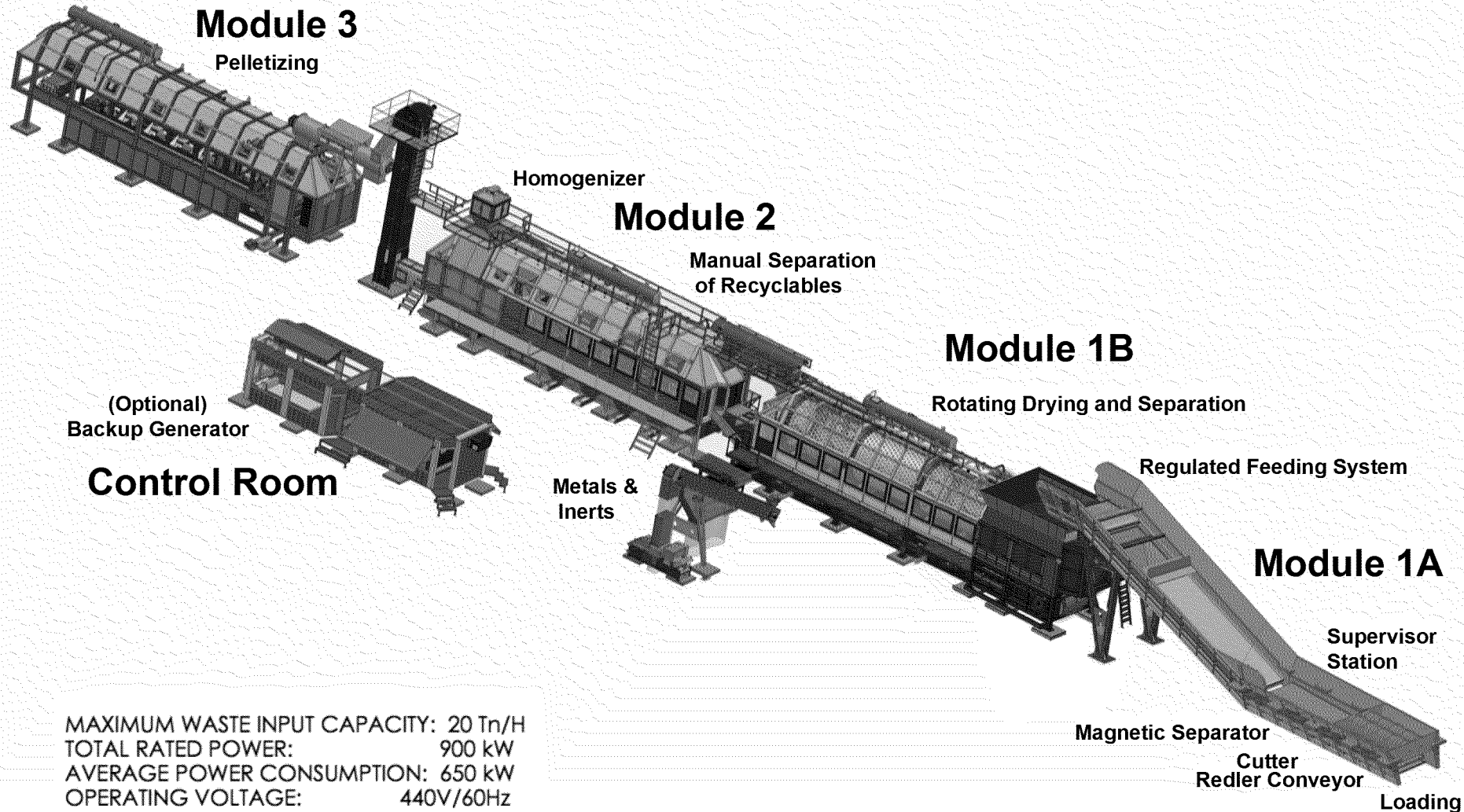
CHAR



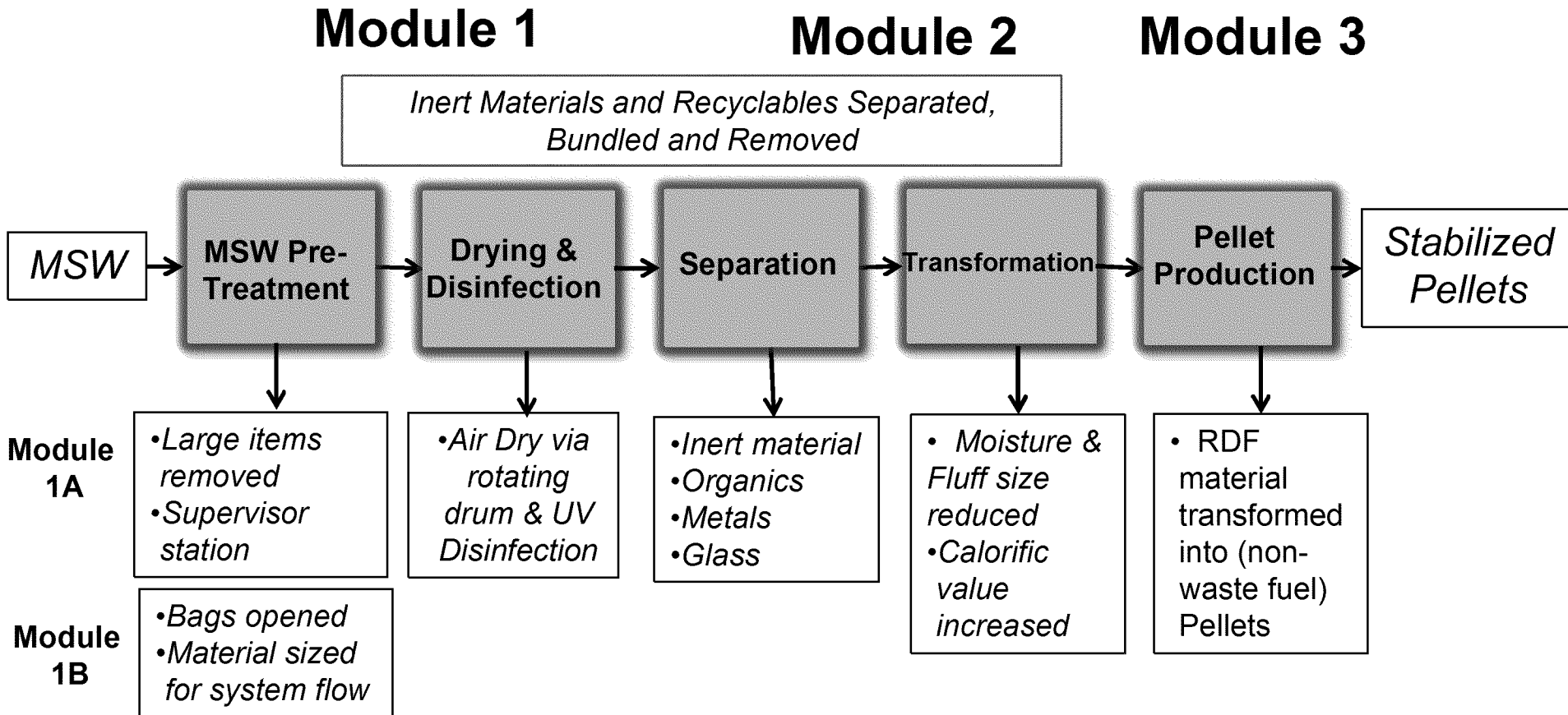
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Soukos Environmental Aeolus MSW to RDF Conversion



Soukos Subsystem Process Diagram



1. No Combustion Anywhere In The Soukos Subsystem
2. Stabilized Pellets Produced Are a Non-Waste Fuel



Soukos AEOLUS Non-Waste Fuel



Soukos RDF Pellet Heating Value

Gross Heating Value 13,281 BTU/lb, 30.89 MJ/kg

Net Heating Value 12,296 BTU/lb, 28.60 MJ/kg

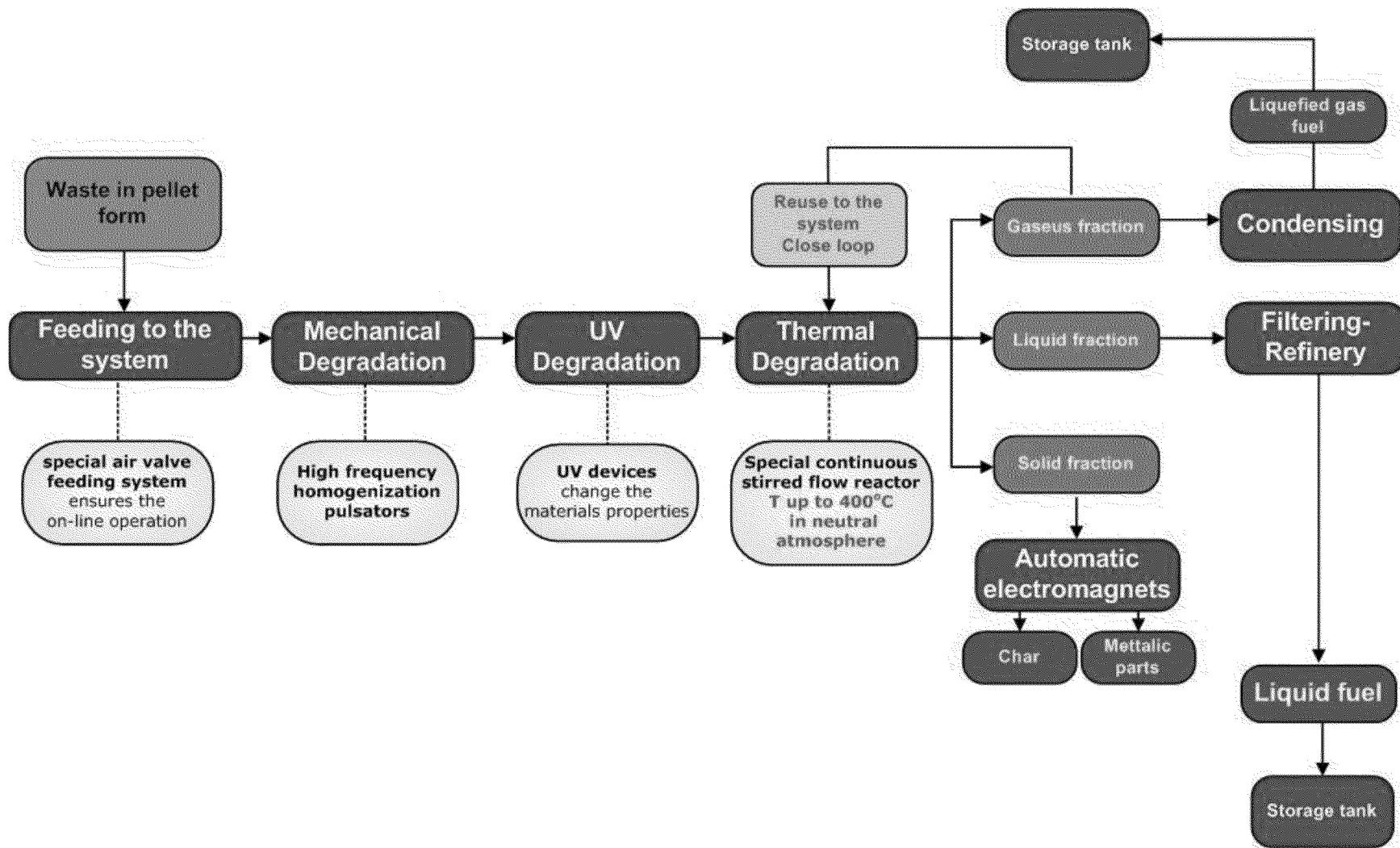
*Based on testing at PPI on 10/26/16

Soukos Environmental ARCHIMEDES - Technology

- RDF Pellet to Diesel Fuel System
 - Not a standard catalytic pyrolysis technology
 - Relatively low temperature process
 - MSW pellets with high plastics can be processed
 - This translates to high energy value fuel
 - No catalysts needed
 - No system shutdown to replace catalysts in reactor
 - High conversion rate
 - 60% MSW - pellet conversion
 - 45% by weight of diesel fuel produced with MSW pellets
 - 2 Modules plus Control Room



Soukos Environmental ARCHIMEDES – Technology Flow Chart



ARCHIMEDES - Technology

- Internal Unit Operations

- Electromagnetic Energy Size Reduction of Pellets

- High frequency energy applied to pellets

- UV Degradation of Pellets

- 170nm to 400nm wavelength breaks down chemical structure of organics
 - Imparts change of polymer molecular weights

- Thermal Reactor

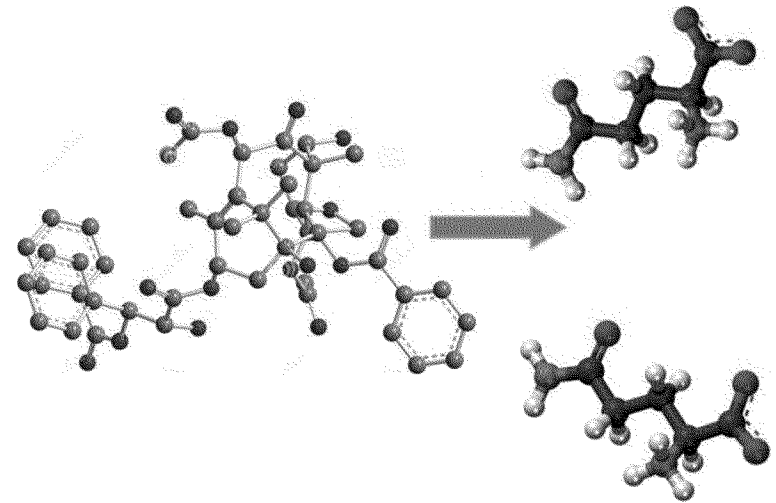
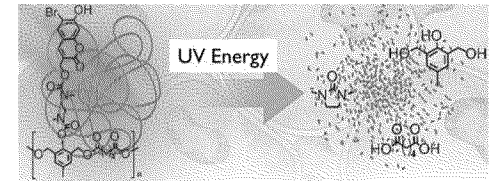
- Continuous reactor
 - Neutral atmosphere
 - 250°C – 400°C
 - No catalysts

- Condenser

- Recovery of liquefied gas

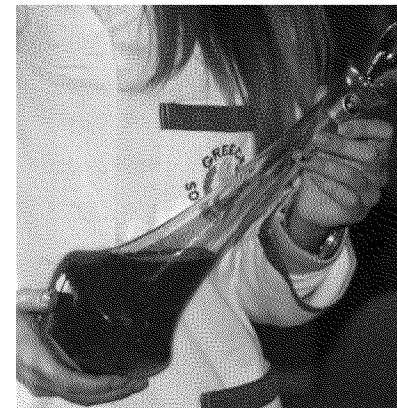
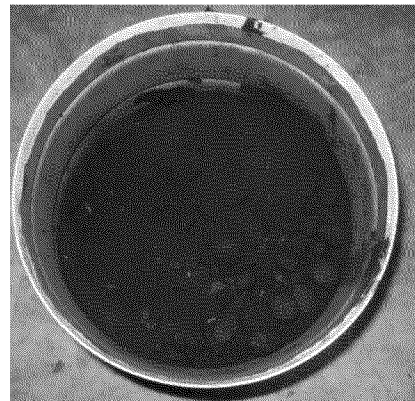
- Refining

- Removal of high viscosity materials
 - Filtering of impurities



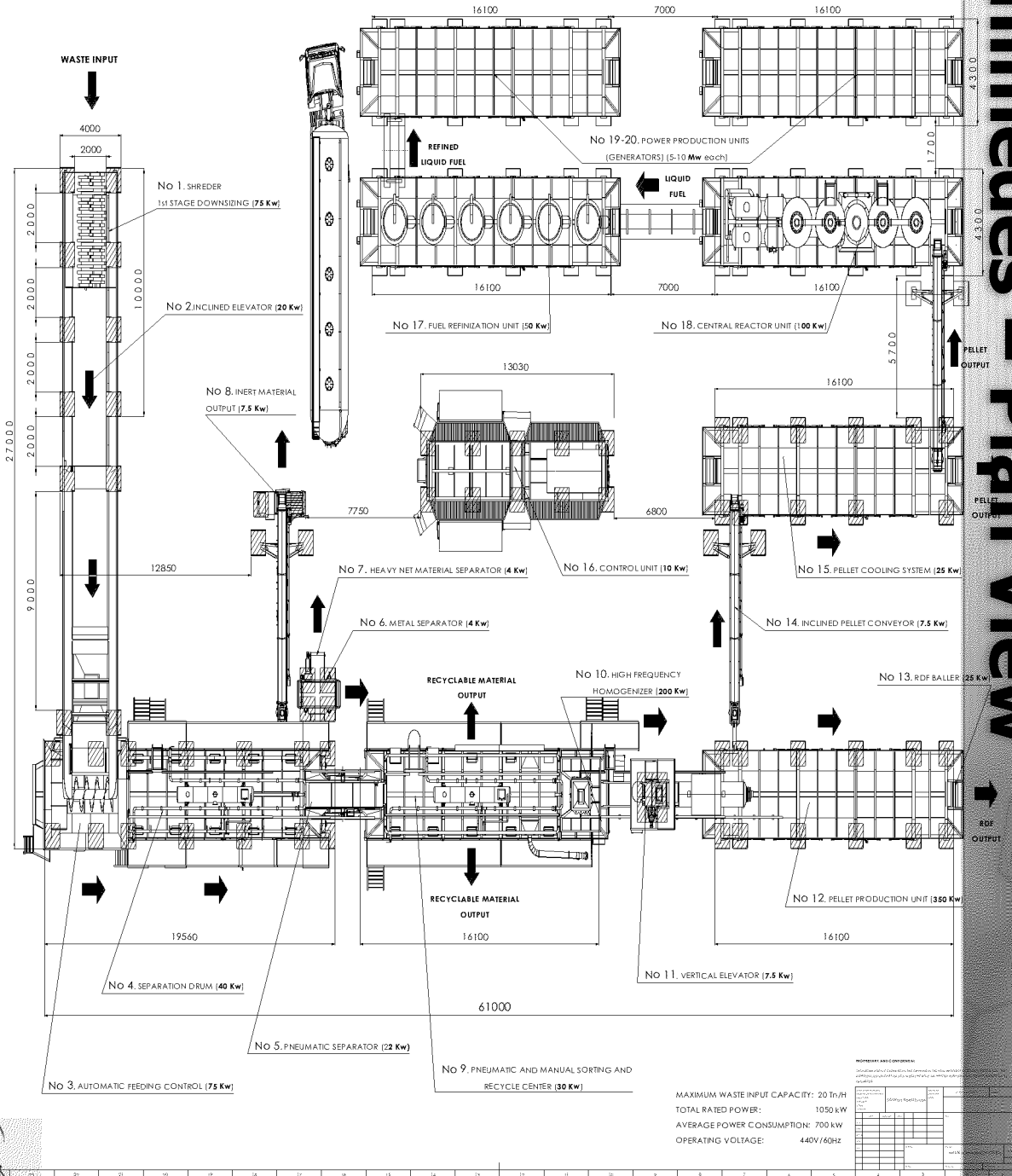
Soukos Environmental ARCHIMEDES - Operations & Output

- Has operated in Burgas, Bulgaria for more than 4 years
- Syngas from process can be used to fuel reactor
- Continuous operations with minimal maintenance required
- 4 Operators & 1 Technician
- Diesel Fuel energy value of approximately 9,000 BTU/lb with MSW pellets
 - Diesel produced from biomass pellets will have a slightly lower energy value due to the lack of polymer materials
- Diesel Fuel produced in Bulgaria has been tested to ASTM D975 standards
- Char with commercial value



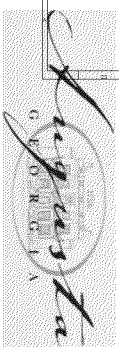
Soukos Environmental Aeolus & Archimedes - Plan View

SOUKOS ROBOTS USA WASTE MANAGEMENT SYSTEM



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Soukos Environmental USA, Inc. Proprietary



The City of Augusta Waste to Synthetic Fuel Facility



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Total Site View



Project Benefits

- **Jobs**
- **Environmental**
- **Environmental Services Operation**
- **Sustainability Objectives**
- **Education**
- **Economic**
- **Financial**



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Project Benefits

- **Jobs**

- **65 Full Time Jobs/50 Indirect Jobs**
 - Interns
 - Entry Level
 - Skill Labor
 - Engineers
 - Management



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Project Benefits

- **Environmental**
 - **Water Quality (Spirit Creek)**
 - **Air Quality (Non-Attainment Compliance)**
 - **Carbon Footprint**



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Project Benefits

- **Environmental Services Operation**
 - **Landfill Reduction**
 - **110,000 Tons/Year**
 - **Air Space**
 - **Recycling Program**
 - **Landfill Gas for Electricity**
 - **Truck Washing and Dust Control**
 - **3,468,960 Gallons/Year**



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Project Benefits

- **Sustainability Objectives**
 - Air Quality
 - Solid Waste
 - Renewable Energy



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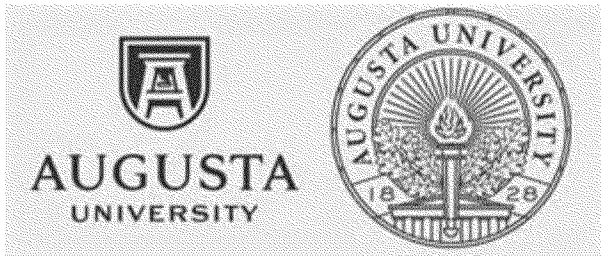


Project Benefits

• Education



- Skills Training – Quick Start
- Field Experience/Learning
- Certifications
- Internship
- Graduates



- Research
- Field Experience/Learning
- Internship
- Graduates



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Questions?



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Backup

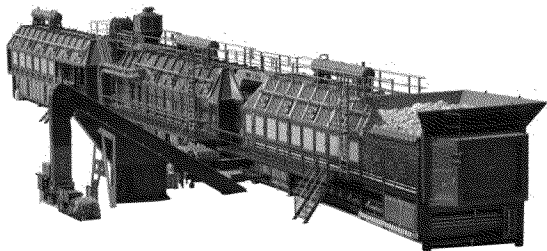


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Soukos Aeolus, Knossos & Archimedes MSW to Diesel Fuel and MSW to Products

Soukos Aeolus System



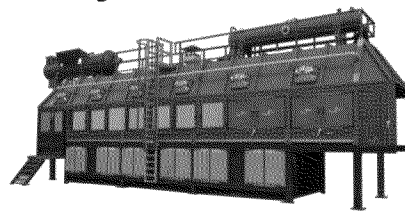
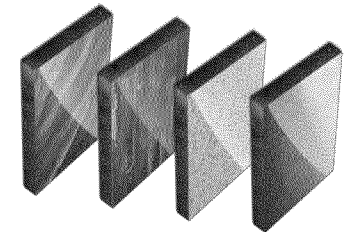
Municipality Landfill (MSW)



Output is
RDF Pellets

Soukos Knossos System

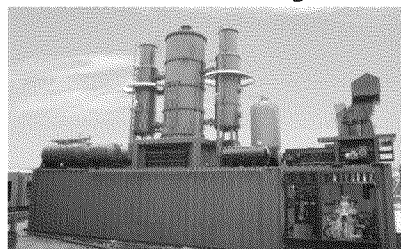
Output is
Building
Products



Soukos Archimedes System

Output is Diesel
Fuel & Char

Oil Refinery



Soukos RDF
Gross Heating Val
Net Heating Valu
*Based on t

Net Heating Value
281 BTU/lb, 30.89 MJ/kg
96 BTU/lb, 28.60 MJ/kg
at PPI on 10/26/16

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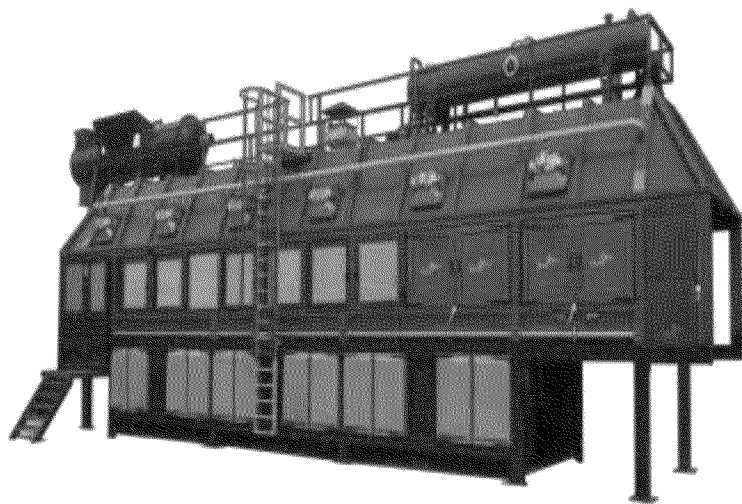
Soukos Environmental USA, Inc. Proprietary



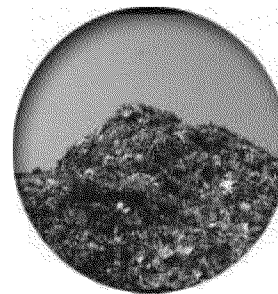
Knossos (RDF to Products)

The “KNOSSOS” System is a mobile Unit, which utilizes the generated RDF material derived from the innovative Mobile MSW Treatment Systems “AEOLUS” of SOUKOS ROBOTS.

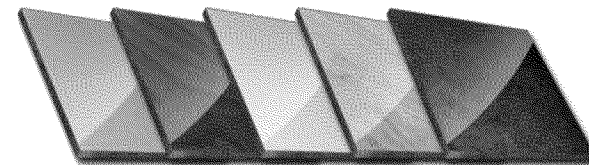
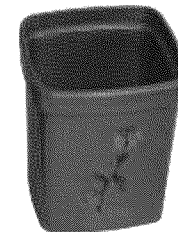
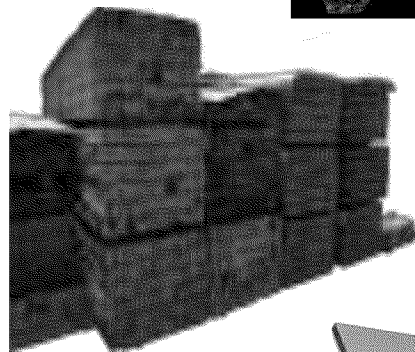
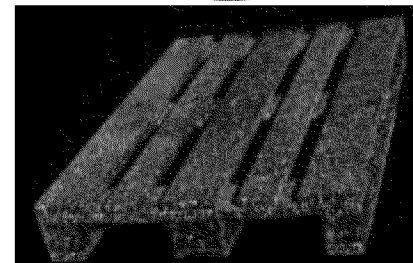
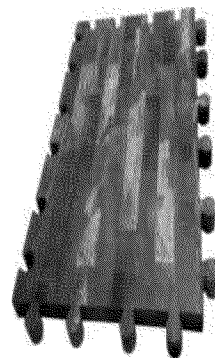
The system’s capacity is maximum 10 ton/hr of incoming RDF materials



INPUT
Material RDF



OUTPUT



Soukos Aeolus & Archimedes MSW to Diesel Fuel (Bulgarian Operation)

