Energeon International LLC.

ECO Systems
WTE & Complete MSW Treatment System
Unique Bio Mass & Solar Thermal Power Plants – BOT projects

2015 European METHANOL POLICY FORUM
13 & 14 October / Stanhope Hotel. Brussels

WASTE to DME
Separation at the source has its problems!
1. Is not working 100%.
2. Plastic recycling has many problems.
3. Many residence refuse to work for the municipality
4. Costly collection and operation.

ALL recycled materials need secondary sorting!!!

Paper and Plastic have impurities and cannot be used 100%

Diapers and milk cartons are not recycled.

Landfills are filling up fast and cause many environmental problems.

Current MSW management is expensive and cumbersome.

“ZERO-WASTE” becomes the standard!!!
Energeon International LLC.

Types of Conversion Systems

- Biomass & Waste Conversion
  - Biological
    - Combustion
  - Thermochemical
    - Gasification
    - Pyrolysis
Types of Gasification Systems

- Indirectly Heated
  - External Fuel (Many approaches)
  - Media Heating (allothermal)
  - Plasma (electric-based)

- Directly Heated
  - Air-Blown
  - Oxygen-Blown
Direct Gasification Reactors

- Directly Heated
  - Fluidized Media Bed
    - Bubbling Fluidized Bed (PMFreeGas®)
    - Circulating Fluidized Bed (TarFreeGas®)
  - Transport Reactor
  - Fixed Bed
    - Updraft
    - Downdraft
Frontline PMFreeGas® Gasification System
Ultra Low PM, Low Alkali, Low Chloride Syngas
Frontline PMFreeGas® Gasifier Technology


- Bubbling fluidized bed reactor
- Pressure up to 6 bara demonstrated; pressure to 9 bara in development
- Scalable – single reactor up to 1000 tpd
- Fuel flexible
  - Experience with dozens of feedstocks
- Air or oxygen/steam gasification
- Very stable operation
- Minimal footprint
- Excellent turndown capability
  - Stable operation at 10-20% of nameplate capacity
- Ideal for repowering existing plants

Since 2005, Frontline has been developing and demonstrating scalable, pressurized gasification and advanced gas conditioning technologies
Energeon International LLC.

Potential Feedstocks?

- Refuse-derived fuel (RDF) from sorted municipal solid waste (MSW)
- Bagasse from sugarcane processing
- Empty Fruit Bunch (EFB) from palm oil extraction
- Peanut shells
- Sunflower hulls
- Wood chips – eucalyptus whole tree
- Wood chips – poplar whole tree
- Urban wood waste
- Waste wood chips – dunnage, pallets, crates
- Wood pellets
- Wood derived from construction and demolition (C&D) waste
- Sawdust
- Crude glycerin from biodiesel production
- Waste paper
- Paper sludge
- Switchgrass
- Corn cobs
- Corn Stover
- Corn grain, including discard seed corn
- Corn hulls
- Obsolete seed soybeans
- Dried distiller’s grains and soluble (DDGS)
- Poultry litter
- Cow manure
- Meat and bone meal from animal rendering operations
- Low rank coal (lignite)

“If we can feed it, we can gasify it!”

- Able to process feedstocks with high alkali, high ash content, feedstocks that are difficult to grind

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Frontline’s PMFreeGas® Cleanup Technology
High Efficiency - Hot Gas Filtration

- Commercially proven at CVEC
- Patent issued – US 8,580,019
- Producer gas is cooled to condense and capture alkali, chloride, and particulates, *in the presence of tars*
- PMFreeGas® removes bad actors from producer gas ahead of combustion
  - ~99.999% of particulate matter: <2 mg/Nm³
  - ~95% of chlorides: <50 ppmv with RDF feed
  - Virtually complete capture of volatile alkali
- Allows for simpler back-end controls, even for RDF feedstocks
- Allows for fixed-bed approaches for further treatment

URS Corporation has delivered an independent engineer’s review of Frontline technology that confirms the ability to use RDF at commercial scale.
miniMRF® - a partnership between Envision Holdings and Novelis

One miniMRF™ module can process 50 ton per hour of MSW with anticipated 16 hour per day operation.
Energeon International LLC.

Frontline's Simple Steam Cycle for Waste To Energy

MSW → miniMRF® recycling

RDF Shredding and Briquetting

RDF Briquetting

Frontline Gasifier

Clean Fuel Gas

Clean exhaust

Renewable Electric Power

Fluff

Flue gas scrubber

Turbine-generator

HP Steam

Package Boiler with Low-NOx combustion and SCR

Sequestered Carbon and ash

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Applications for TarFreeGas® Plus

- 500 dry ton/day biomass or waste
- TarFreeGas® Gasifier
- FT Synthesis
  - 700 BPD FT drop-in fuels
    - Renewable diesel
    - Renewable jet fuel
    - Lube oil base stocks
    - Waxes
    - Mixed Alcohol drop-in fuels
- Hydrogen Production
  - 14 MSCFD Renewable Hydrogen
    - Fuel cells
    - Renewable hydrogenation
    - Other applications
- Combustion Turbine, IGCC
  - 29 MW Renewable Power
- Syngas Fermentation
  - 16-21 MGPY Ethanol
- Methanol Synthesis
  - 24 MGPY Methanol

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Project Creō – Integrated BioRefinery to Produce Drop-In Diesel and Jet Fuels

- Frontline will scale-up its TarFreeGas® gasifier to 10 tpd demonstration plant and integrate with SGC Energia’s 1 barrel-per-day Fischer-Tropsch (FT) pilot plant
- Biomass and waste feedstocks will be converted into advanced, drop-in biofuels in the form of military spec diesel and jet fuels
- Performance data will be used to inform commercial plant design
- The U.S. Department of Energy is providing 50% cost share for this $8.3M project
- Project will be constructed at SGCE’s XTLH® Technical Center in Pasadena, TX
Energeon International LLC.

“ZERO-WASTE” the new standard

Single Waste Bin

Single Bin Collection One Truck

Automatic Sorting – No Landfill

Synthesis gas

CO + H₂ (syngas)

H₂ (NH₃)

Synthetic fuels

CH₃OH dimethylether

Advanced Gasification

Gas

Oil

Coal

Bio mass

steam reforming

partial oxidation

gasification

water-gas-shift reaction

Fischer-Tropsch synthesis

methanol synthesis

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“ZERO-WASTE” the new standard

1 MMBTU of Clean Syngas = $3

85% is Gasified
14% Recycled
Less than 1% Landfilled

1.5 MT of unsorted MSW produces 1 MT of RDF, 1 MW Electricity and 1.5 MW Heat.

WIN-WIN SITUATION
Energeon International LLC.
DME from WASTE

1. Less expensive and cleaner than NG or Oil

2. Solves MSW management problems

3. Cleaner environment

4. “Green” fuel

5. Affordable pricing
I can't change the direction of the wind, but I can adjust my sails to always reach my destination.

Jimmy Dean