



ECO Systems **WTE & Complete MSW Treatment System**

Unique Bio Mass & Solar Thermal Power
Plants – BOT projects



WASTE to DME

MSW Management – Current Practice

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!!!

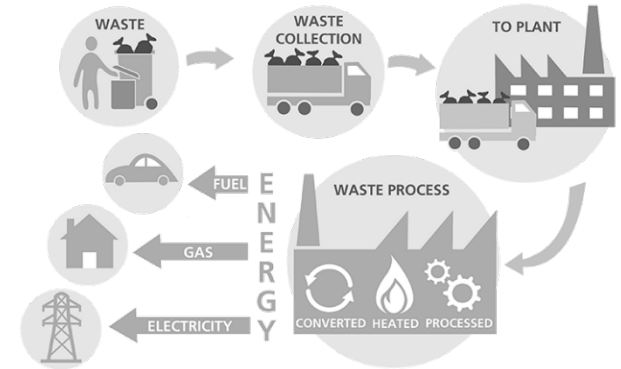
Paper and Plastic have impurities and cannot be used 100%

Diapers and milk cartons are not recycled.

Landfills are filling up fast and cause many environmental problems.

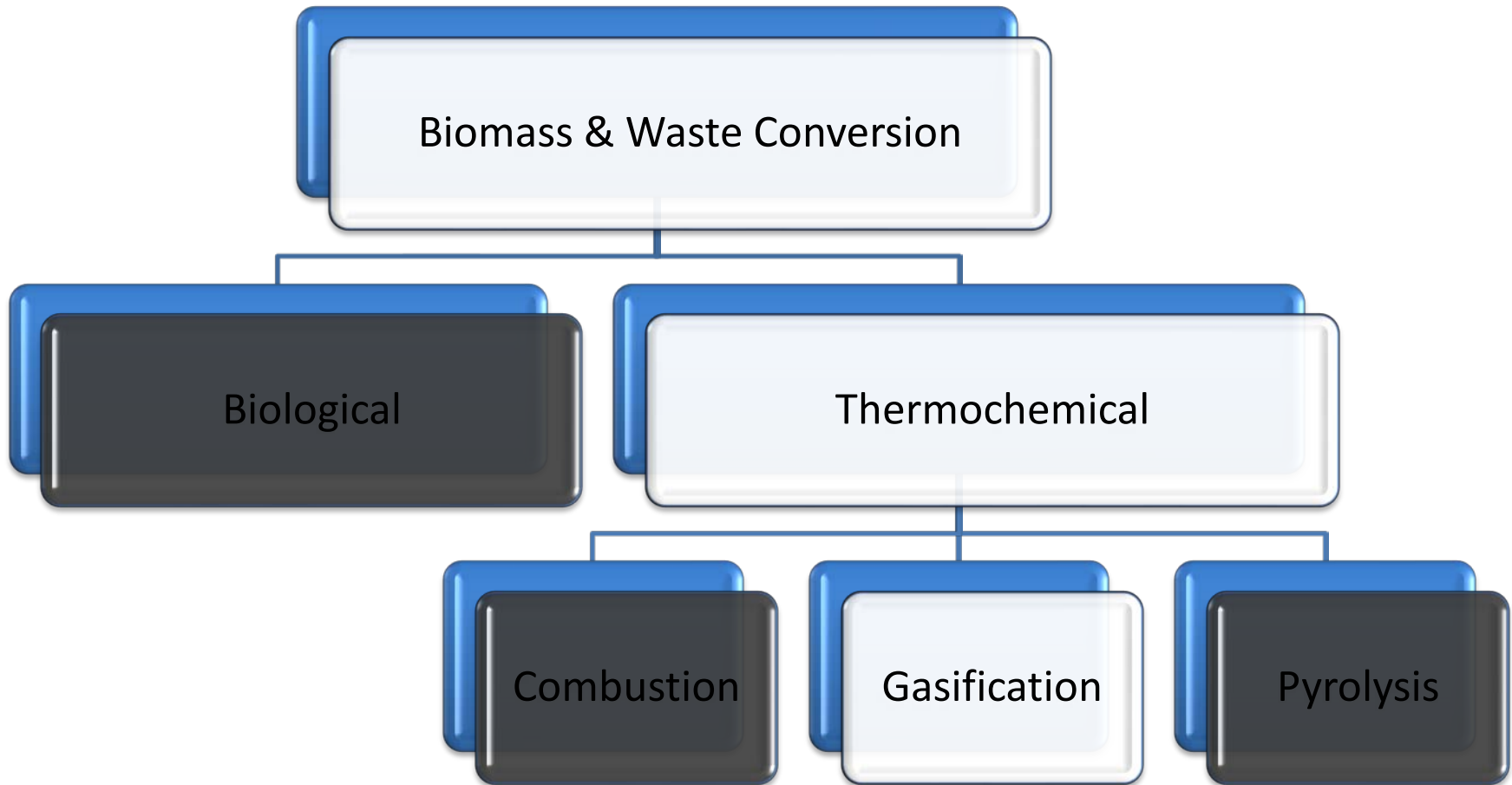
Current MSW management is expensive and cumbersome.

“ZERO-WASTE” becomes the standard!!!

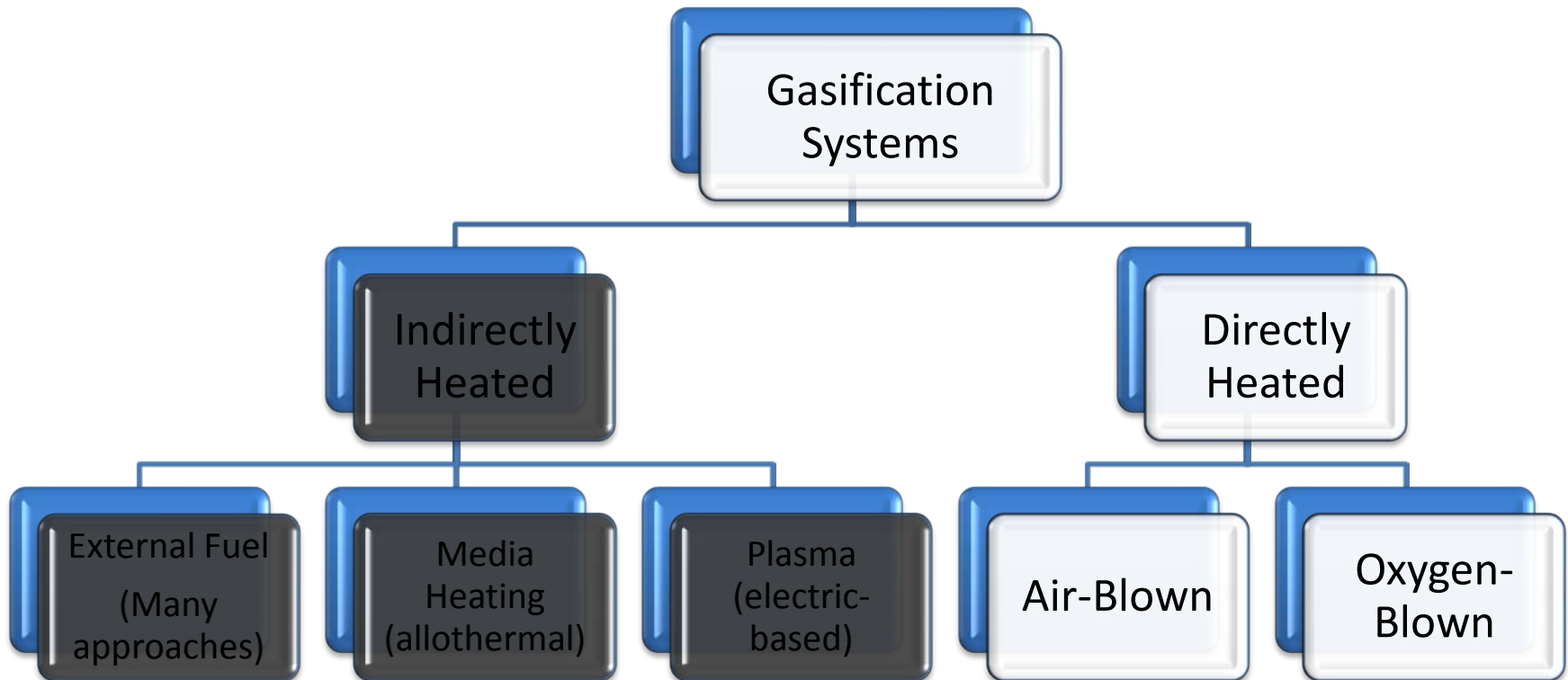




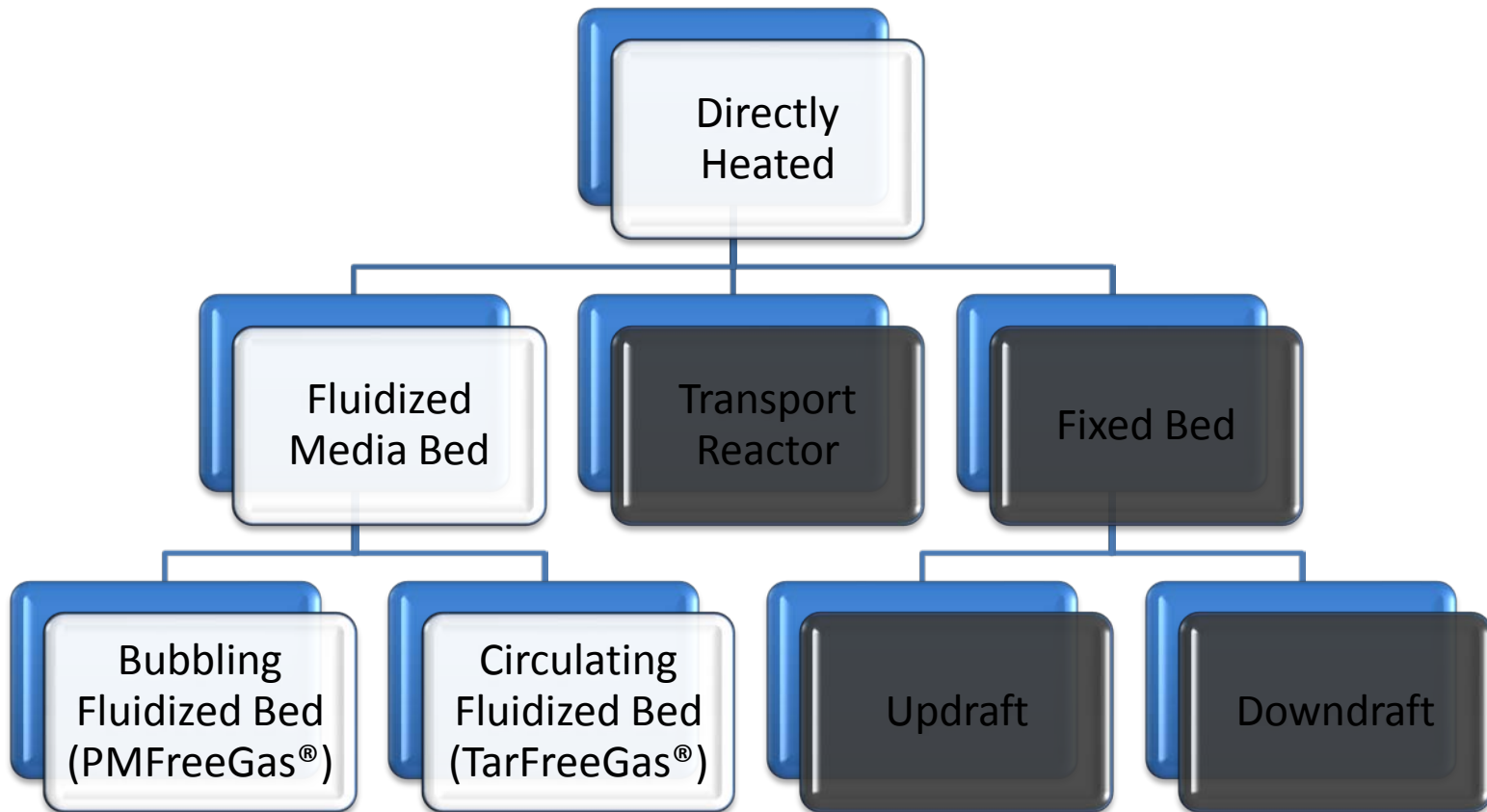
Types of Conversion Systems



Types of Gasification Systems

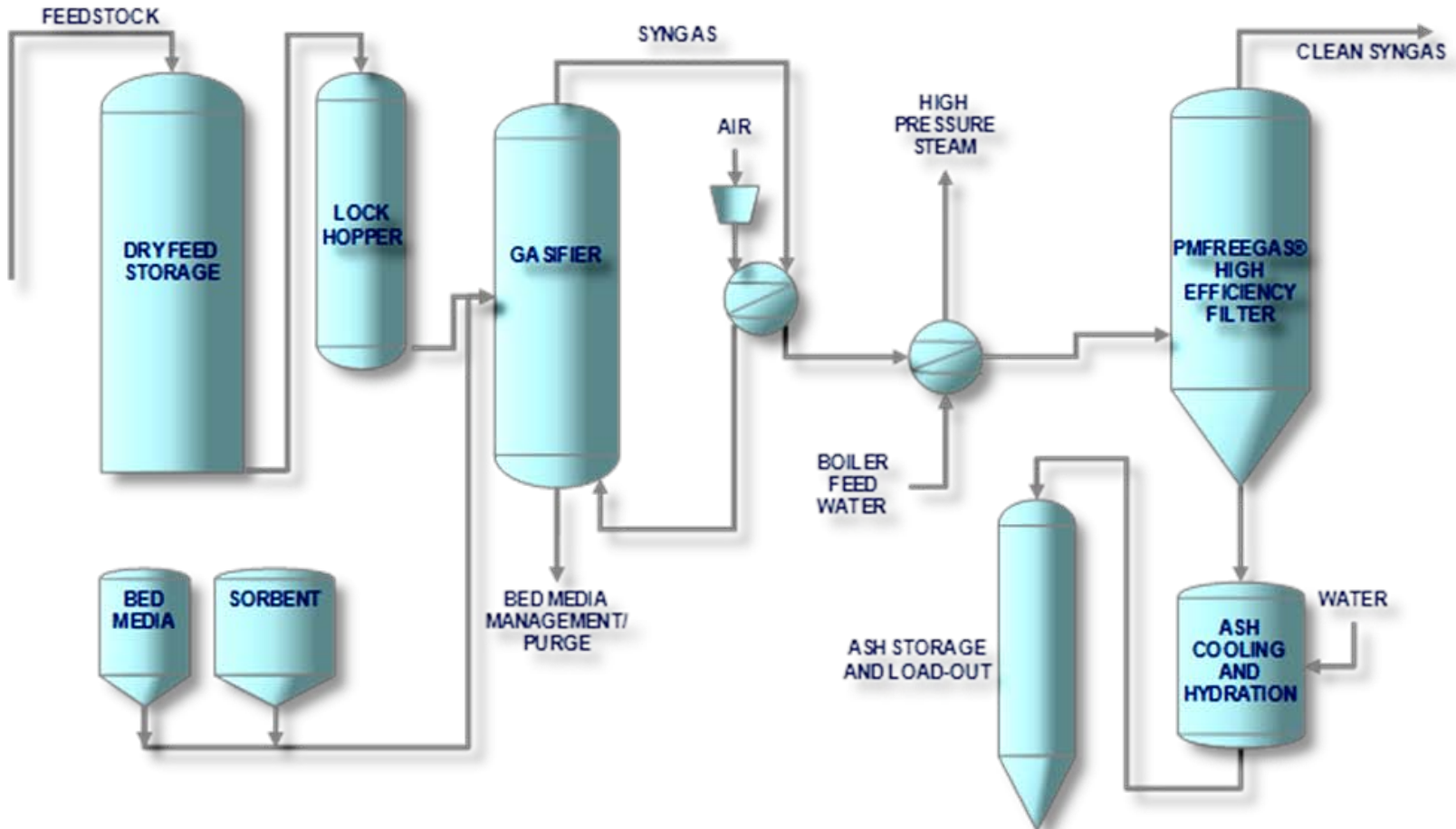


Direct Gasification Reactors



Frontline PMFreeGas® Gasification System

Ultra Low PM, Low Alkali, Low Chloride Syngas





Energeon International LLC.

Frontline PMFreeGas[®] Gasifier Technology

Scalable. Omnivorous. Commercially Proven.

- 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**



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206 E 81 St. #5C, NYC, NY 10028 Ph: +1(914)-924-3138 Email: rafisela@gmail.com



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



Energeon International LLC.

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.



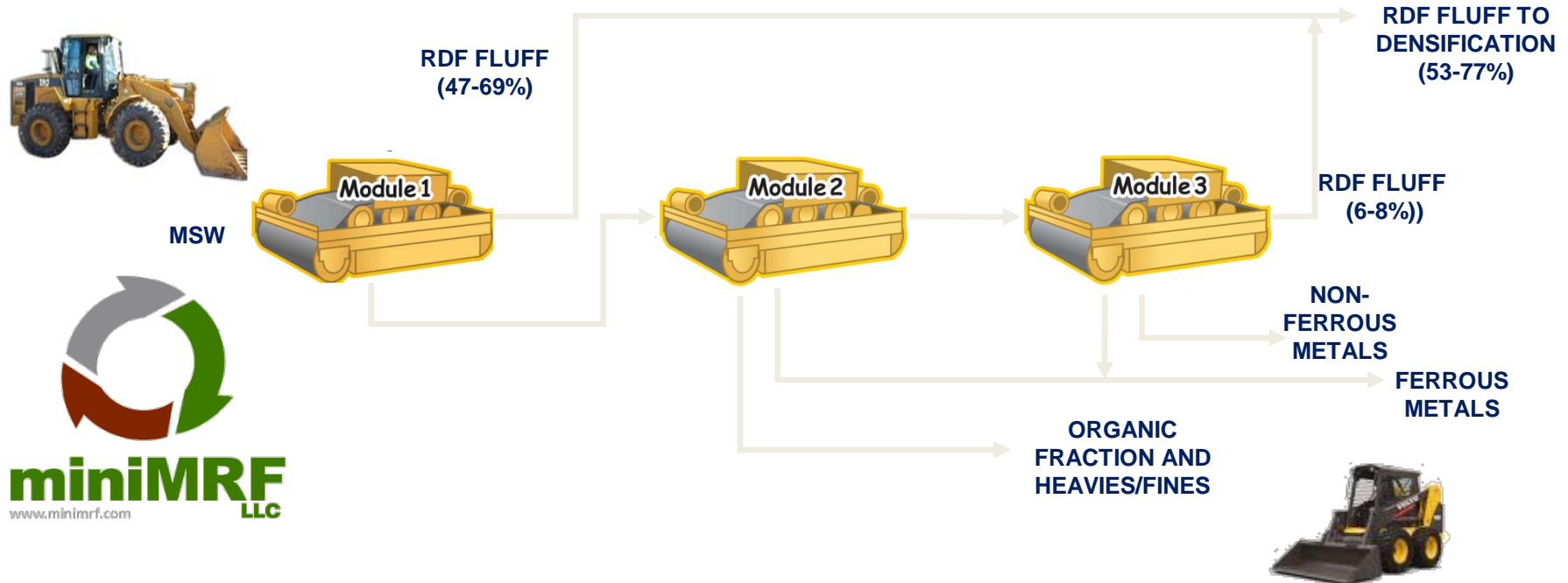
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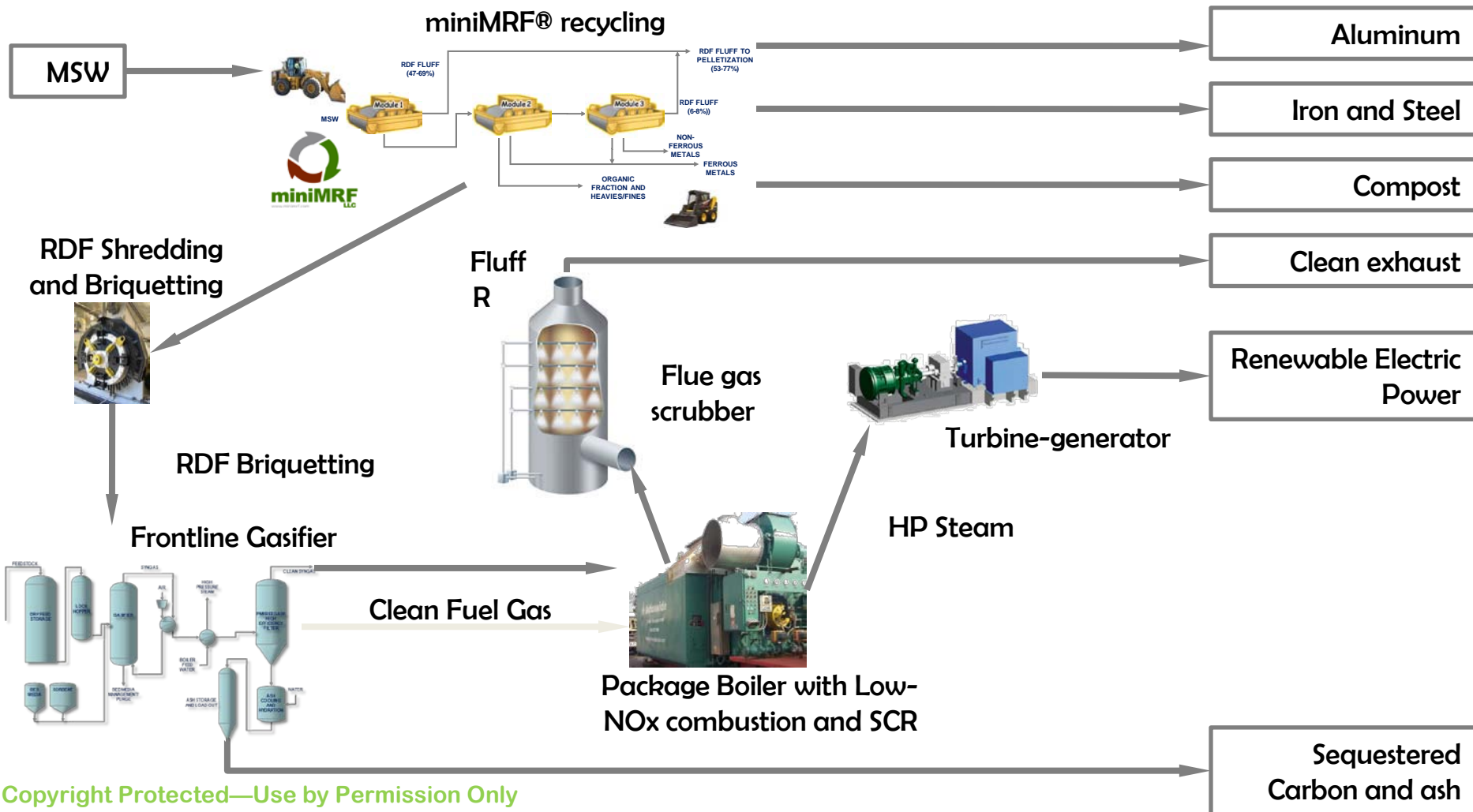
Energeon International LLC.

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

Frontline's Simple Steam Cycle for Waste To Energy

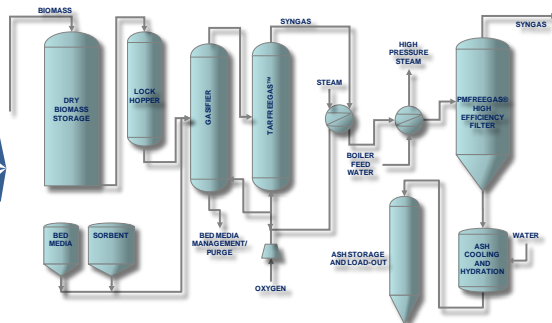




Energeon International LLC.

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

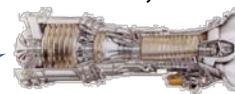
Hydrogen Production



14 MSCFD Renewable Hydrogen

- Fuel cells
- Renewable hydrogenation
- Other applications

Combustion Turbine, IGCC



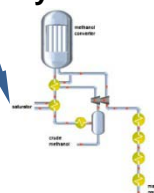
29 MW Renewable Power

Syngas Fermentation



16-21 MGPY Ethanol

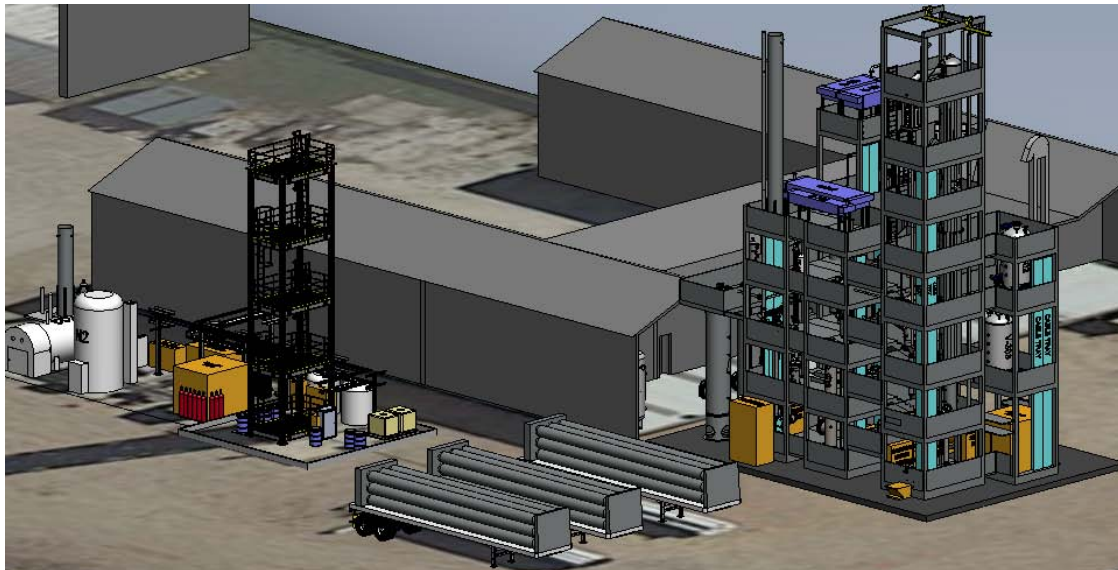
Methanol Synthesis



24 MGPY Methanol

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.

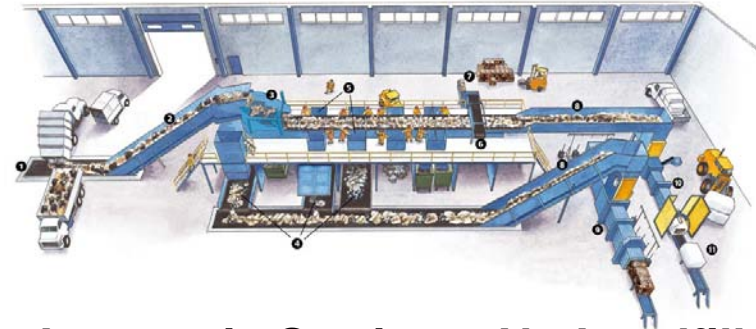
“ZERO-WASTE” the new standard



Single Waste Bin



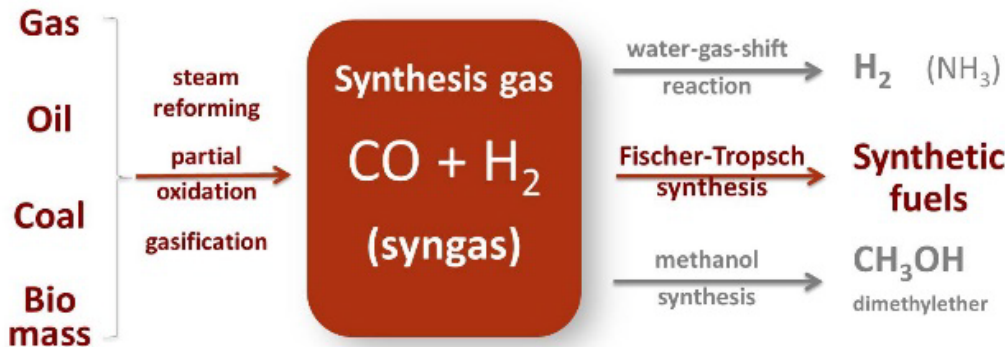
**Single Bin Collection
One Truck**



Automatic Sorting – No Landfill



Advanced Gasification

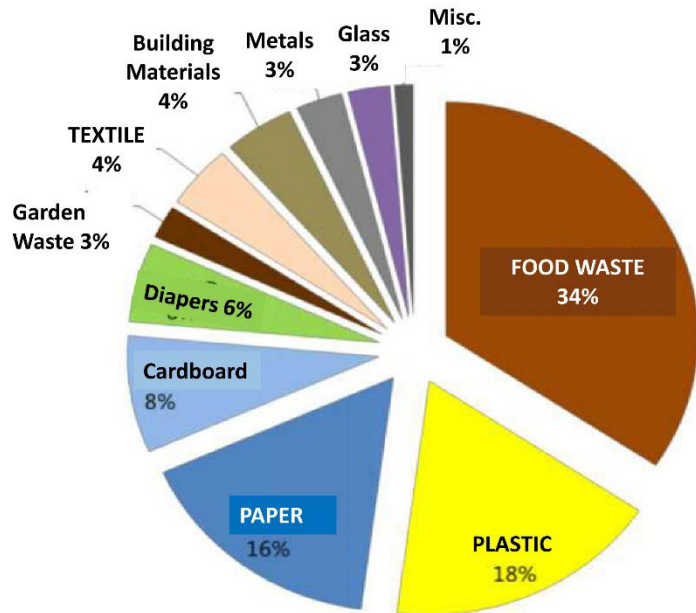




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“ZERO-WASTE” the new standard

MSW by Weight



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**



waste



to



fuel



Energeon International LLC.



219 Kensington High St., Kensington, London W8 6BD **UK**

CEO - Founder

US (Off)+1240-350-6454 US (Cell) +1914-294-3138

rafisela@gmail.com

www.ar-challenges.com

A word cloud featuring the phrase "Thank you" in numerous languages. The central and largest text is "thank you" in red. Other prominent words include "danke" (blue), "gracias" (green), "merci" (orange), "dziękuję" (purple), "obrigado" (green), "spasibo" (blue), "terima kasih" (yellow), "mochchakkeram" (blue), "go raibh maith agat" (purple), "teşekkür ederim" (pink), "ngiyabonga" (blue), "tapadh leat" (blue), "dank je" (green), "sukriya" (purple), "kop khun krap" (green), "grazie" (blue), "arigato" (purple), "takk" (green), "dakujem" (purple), "mersi" (purple), "ευχαριστώ" (blue), "감사합니다" (blue), "hvala" (green), "mauriuru" (green), "sagolun" (blue), "bedankt" (yellow), and "謝謝" (black). The words are arranged in a circular pattern around the central "thank you".

Jimmy Dean