ESTECH USA

# The Mod – 3 System

21st Century, Sustainable,

Municipal Waste Reduction

Recycle and Recover with Fibrecycle™


## MOD-3 SYSTEM = The " VIRTUAL LANDFILL"

- The Mod-3 System is a sustainable solution for MSW disposal.
- Designed with technology that combines both intuition and innovation
- Crafted to meet the challenges of environment and service for decades to come, the Mod-3 System equipment serves as evidence that the top line can be deployed while enhancing the bottom line without dependency on subsidies
- The Mod-3 System is an integration of three sub-systems: the Fibrecycle®, the WaterCycle®, and the PowerCycle®.

*Technologies by*

**ESTECH USA**

When we made the commitment to create the Mod-3 System, our work was not dictated by a timetable, but rather by our desire to get everything right. The result is a system built at the boundary where proven great designs meet skilled engineering. In addition to meeting and exceeding US environmental requirements, the Mod-3 System has earned the coveted “Best Environmental Technology Option” in the UK, and “Best Green Technology Innovation of 2009” in the US.

Mod-3 System provides the benefits of decades of development, and years of field demonstration. It also provides extensive automation for labor savings, and recovers sterilized recycled materials for sale. Clean, dry biomass is used to generate marketable electricity, and carbon credits.

The system is, after all, a product designed by professionals who value quality, reliability, and performance with innovation.

***Recovered biomass2energy***

***Preserves water and recyclables***

***Highest rates of recycling***

***No harmful air and water emissions***

***No burning of plastics or chemicals***

***Low electricity generation cost next to fossil fuels***

# ESTECH USA TECHNOLOGIES

Estech USA configures,, builds, installs, commissions, and operates its equipment, bringing the benefits of reduced waste transport and disposal to the site owner and community.

The investment in the autoclave and its operations are underwritten by “tipping fees” – a per ton charge to accept contract waste. Contract income, as received from the sale of recovered resources and sale of electricity, provides the investor substantial payback .

The Mod-3 System and its options are designed to recover capital investment costs within 5 years: however, one site currently under development may achieve a 1.5 year payback.

Estech USA first assembles the system at its headquarters site to both confirm the operations meet specifications, and to train client’s operators. The equipment is then easily disassembled, transported and installed on the clients site.

Estech USA provides a guarantee of performance on its operations.

- The Mod-3 System uses recovered biomass to power the plant
- 100% of waste is sterilized; all bacteria and viruses are killed
- Animal bi-products and co-incidental medical waste are sterilized
- Glass products are broken into smaller fragments
- Most plastic products shrink and ball-up
- Metals are cleaned and labels are stripped off
- Biomass fibers from food, paper stocks, and lawn clippings are thermo-mechanically pulped
- Food and vegetable wastes are reduced to various fibers.
- Common household chemicals are hydrolyzed and detoxified

# ESTECH USA TECHNOLOGIES

Globally we have been relying on landfills to dispose of municipal wastes. Recycling captures but a small fraction of valuable products from the waste stream while communities are demanding less landfill and more recycling.

Mod-3 System substantially reduces waste streams, enabling communities to reach ambitious recycling goals, while lowering the costs of transport and disposal.

From This

# To These

+

**Municipal waste streams processing by Mod-3 System:**

**Water** – is extracted fro the MSW

**Biomass /Cellulose** – is cleansed, dried, sterilized, qualifying as "renewable fuel" it is converted to electricity

**Metals** – are sterilized and cleansed for extraction and sale

**Mixed Plastics** – are removed for re-use and sale

**Other** – small volume fractions are more economical to land-fill, but may be converted to roadbed or architectural fill materials, or used as a landfill cap material. The Mod-3 System process sterilizes the waste stream, removes putrescibles, and detoxifies household chemicals. Non-renewable resources are extracted (cleansed) for sale and re-use. In typical applications, the residual waste consists only of sterilized glass fragments, construction debris, and the like. All of the biomass contained in the MSW is removed and utilized.

Therefore, 100% of the MSW is utilized without the need for a landfill.

Recycle and Recover with Fibrecycle™

**FibreCycle® is autoclaving,** the use of pressurized steam to sterilize "wet" materials. Autoclaving was invented in 1879, shortly after the 1862 invention of pasteurization.


**Rotating autoclaves** were invented in the 1980's for processing municipal waste. In essence, the rotating autoclave performs a thermo-mechanical pulping process on the wastes, liberating biomass and fibers while sterilizing all of the contents and accomplishing other valuable functions.

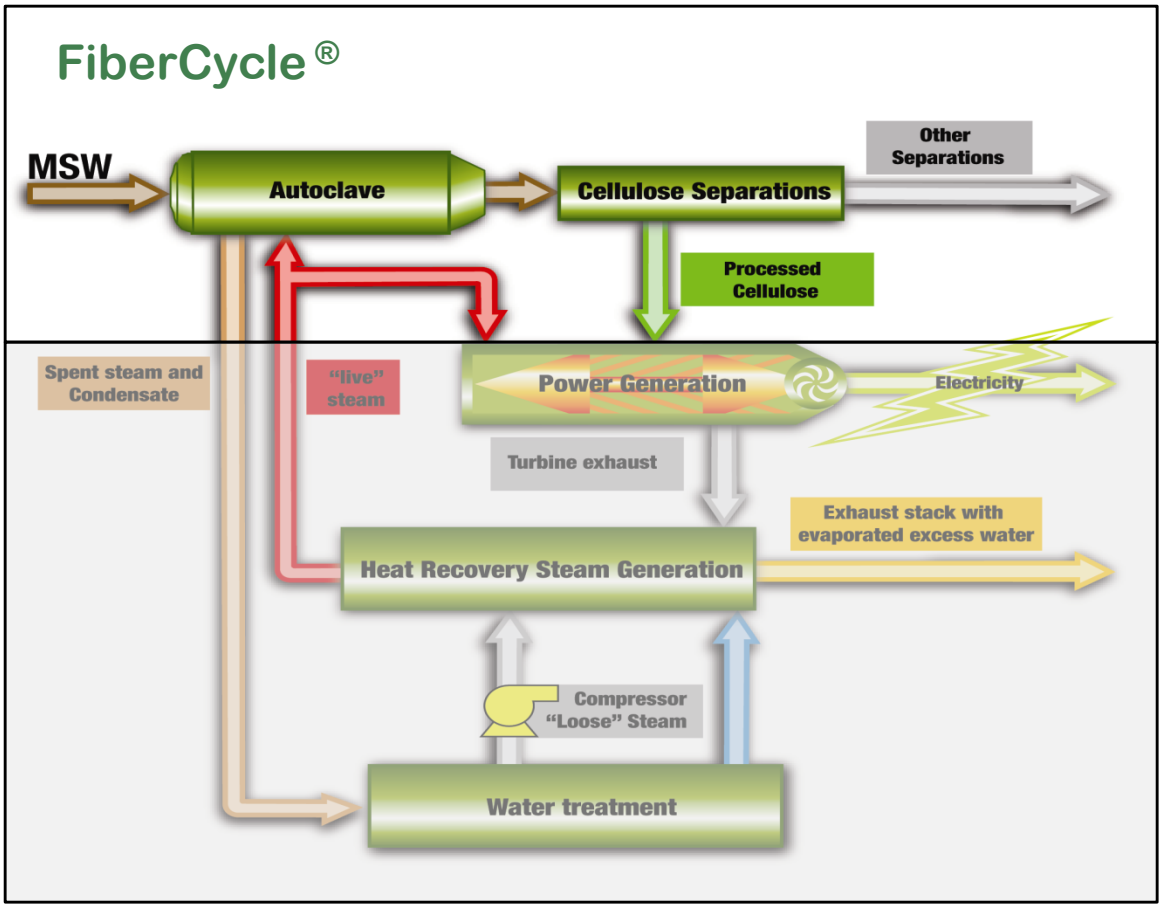
Several competing groups have now been attempting to commercialize their basic and low performance autoclave technology. However, at Estech USA, a 15 years of development and years of commercial operation support our high quality and high performance equipment offerings.

**The Mod -3 System**, in addition to being commercially proven, provides:

- The highest possible temperatures/pressures for **destruction of organisms** such as "mad cow", Ebola, etc.
- Extensive **automation** for labor-savings
- Rugged design for **20+ year operations**, using off-the-shelf equipment
- The production of a **dry biomass fiber product**
- **Years** of commercial testing success

# FiberCycle®

FiberCycle ® is  a patented set of two autoclaves with their support equipment: the pre-treatment loading system and the post-treatment separation of the biomass.




**FiberCycle ® and the Mod-3 System**

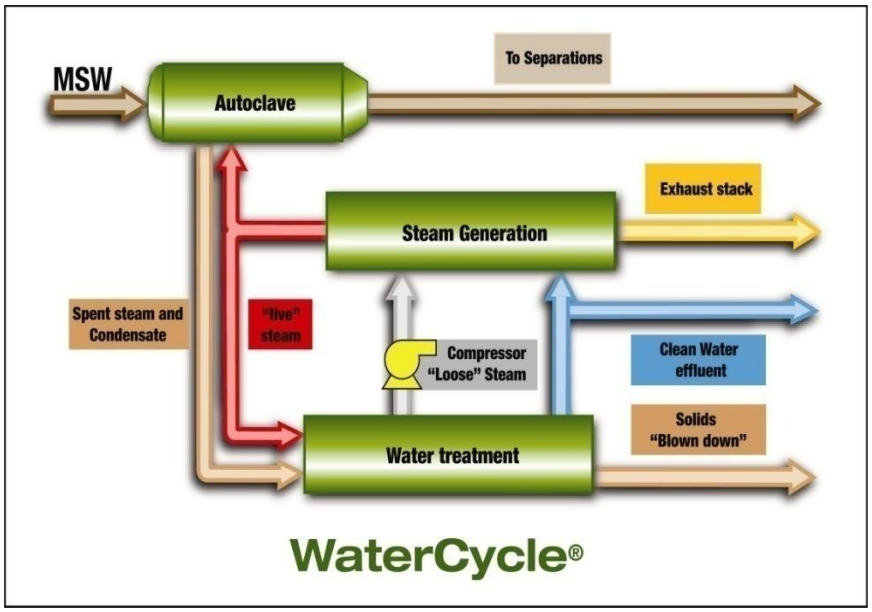
Each of the two autoclaves is capable of treating 10 tons of MSW per hour. Therefore, based on a 22 hours per day operation, seven days per week, a full size plant processes  a total of  150,000 tons of MSW per year.

# WaterCycle®

WaterCycle ® harvests water from the MSW for re-use, and energy from spent steam.

WaterCycle® is an integrated steam recovery process for the basic FibreCycle ® autoclave. The (patent pending) WaterCycle® reclaims and cleans contact steam. Reclaimed steam is provided back to the autoclave system, recapturing the heat used in its evaporation.

The WaterCycle ® monitors for hazardous contaminants and provides information necessary for isolation and containment in the case these should be detected.



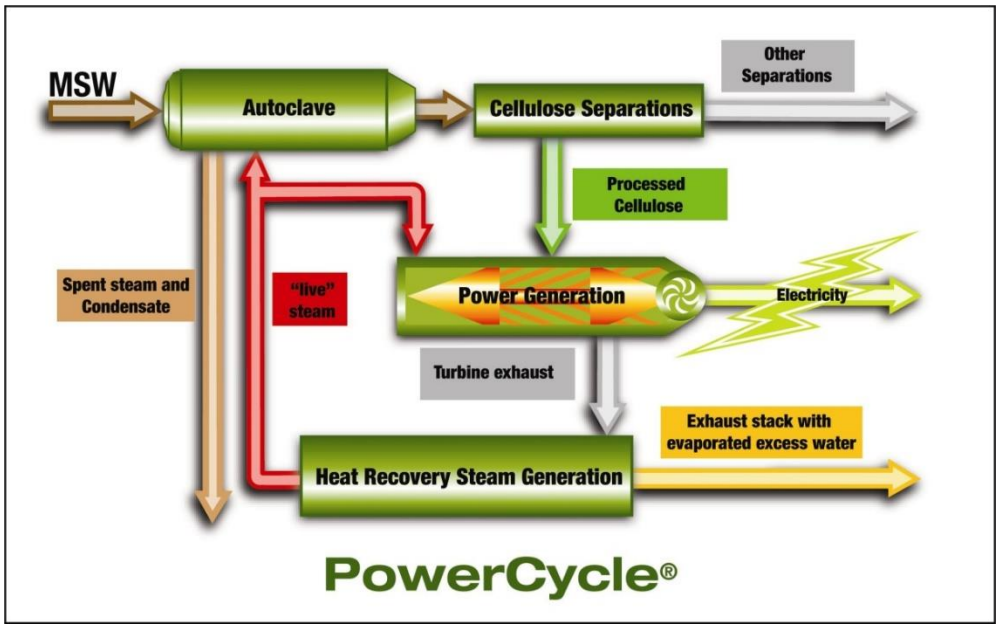

**The WaterCycle ® steam reclamation provides a highly energy-efficient autoclave cycle**

Since the Mod-3 System is a "Batch" type system all 100% of the MSW processed is tested for hazardous contaminants. When a contaminant is detected the 10 ton batch is isolated and handled in accordance with the applicable regulatory requirements.

The WaterCycle ® process is ideal for sites where water/wastewater infrastructure is expensive or unavailable. The system may be expanded for toll processing of water from other sources (eg. leachate)

# PowerCycle®

At typical sites, the PowerCycle® generates over 500 kilowatt hours of renewable electricity per ton of waste for sale to users while supplying site and vessel power and steam needs. The design operation yields 6-9 megawatts to the grid, 24/7, based on 30% biomass content of the MSW and on the choice of biomass-to-electricity conversion technology. Approximately 1 megawatt is used for the plant operation thus totaling 7-10 megawatts of electricity produced continuously.




The Mod-3 System separates plastics out for the more valuable recyclables market, thus allowing carbon credits to be created by the fiber – gasification – power technology. Chlorine, lead, cadmium, etc., containing and plastics, basically a solid petroleum product, should not be burned. Because Mod-3 system only uses cleaned and sterile recovered biomass to generate power, the PowerCycle ® is a true "green" technology.

The PowerCycle ® technology offers operational flexibility to address both the market rates for peaking power and the growing premium for renewable energy. Our technology of choice is comprised of an integral gasifier/combustor/ turbine/HRSG generator. Other technologies, such as IC engine/gasifier, maybe used with somewhat reduced yield in electricity production.

In this typical configuration with WaterCycle ®, external source of water is not needed, and excess water is not generated.

**Specifications – Two Vessel System**

**Capacity** – 10 tons per hour per autoclave, 440 tons per day

**~150,000 tons per year**, mixed municipal wastes

**Model Components**

- **Tipping Floor Module** – peak rate 90 tons per hour reception capacity. May be owned/operated by site owner (as in an existing transfer station) or by Estech USA
- **Steam supply** – average 20,000 pounds steam per hour– site generated by the PowerCycle@ system
  - Fueled by biomass renewable fuel separated from the MSW
  - Steam supply for autoclaves is provided by HSRG
- **Electricity supply** – renewable electricity
  - Fueled by biomass renewable fuel separated from the MSW only, no plastics are burned
  - Biomass converted to electricity, net 6-9+ MWe to grid
- **Water supply**
  - Extracted from incoming waste stream
- **Wastewater Treatment (process)**
  - Zero discharge
- **Valuables extractions** (based on the US EPA 2015 MSW composition data)
  - Biomass renewable fuel (typical ~ 50,000 tons per year)
  - Ferrous (typical ~6,000 tons per year)
  - Non-ferrous (typical ~2,000 tons per year)
  - Plastics (typical ~ 12,000 tons per year)

"Supercharged" Mod-4 Pilot System designed and built by Estech USA for Procter&Gamble

- Imagine a waste disposal system for the 21st century
- Installed at your location
- **Absolutely guaranteed** to perform to specifications. No financial risk

**Providing:**

- The highest possible temperatures/pressures to destroy **bio organisms** and to prevent plastics off-gassing
- Extensive **automation** for labor-savings
- Rugged design for **20+ year operations**
- **Energy self sufficient with zero environmental foot print.**
- Income from the 24/7 production of electricity
- **Green Power carbon credits, or other subsidies** for additional income

Find out more:

ESTECH USA TECHNOLOGIES

**www.EstechUSA.com**

Estech 's experimental units


Mod-2 System built under Estech's license and operating in Wakefield, UK