# Next Generation Biodryer® Technology

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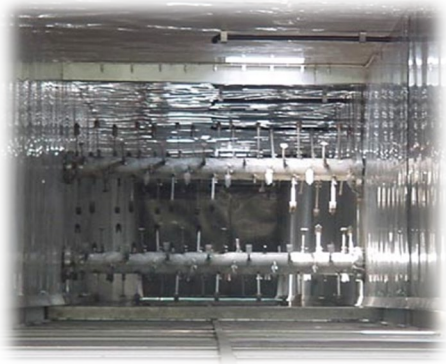
***COVID-19 Update***

***Solutions for cleaner more sustainable communities***

# The Biodryer®

An efficient, sustainable solution to convert organic waste and biosolids into clean, renewable energy

Whistler, B.C. Canada



- Tunnels designed to rapidly digest organic waste, then dry into a biofuel
- All organic waste is efficiently processed:
  - Biosolids & sludge from sewage
  - Food, wood, paper, cloths of natural fibers
  - Agricultural, Industrial, Marine, Medical
  - Tissue, sinew, bones, plant stocks
- Environmentally safe, non-odorous, carbon-neutral continuous processing without using any auxiliary fossil fuels
- Specially designed boiler burns the biofuel, feeding steam through turbine to generate reliable continuous electric power
- No noxious fumes with ability to recapture $CO_2$ to maximize greenhouse plant growth

Disney, Florida USA

**All by-products are useful commodities with zero harmful or non-usable residues**

**Clean water, steam, electric power, potash, $CO_2$**

# The Biodryer® Solution

A revolutionary proven technology addressing all organic waste and biosolids issues

## The Issues

- Biosolids, sewage, sludge and green-bin waste from urban centers are hauled over long distances, dumped into landfill sites, becoming an ever-growing part of municipal budgets
- Landfill leaching and gases threatening our water, soil and air
- Sewage, sludge and animal waste dumped on fields in rural areas increasing phosphorus levels and potential for water table contamination, including E-coli, viruses and un-digested antibiotics
- Fishery cleaning and canning waste polluting our shorelines
- Burning or burial of agricultural waste increasing harmful gases
- Stockpiles of wood waste reaching dangerous levels as fire and pollution hazards
- Under-performing municipal investments in anaerobic digesters, resulting in extremely inefficient power generation and digestates spread on fields rendering them unfit for farming for up to five years
- Backlog of development awaiting costly new sewage plants or upgrades
- Costly, intermittent wind and solar power solutions rife with other long-term issues
- Undigested viruses leached into our water systems and agricultural soils

**We can solve all of these issues and generate clean, reliable energy**

# The Biodryer® COVID-19 Solution

A final solution to address the serious issues surrounding the consequences of COVID-19 on our environment

## The Issues

- Biosolids from sewage and sludge carry the COVID-19 Corona virus
- Current disposal methods dump biosolids into landfills, oceans or on to fields, where the Corona virus has yet to be proven that it is not 100% eradicated in the normal course of wastewater management
- The Corona virus, as do some bacteria, survive and leach into the water table and cycle into our potable and irrigation water systems
- Cross contamination is already occurring in other species, which may lead into our food supply carrying COVID-19 or a deadlier version
- An ever-growing volume of respiratory protection masks are collecting without a safe disposal plan because traditional dumping will only further contaminate the soil and burning will add significant harmful pollutants to our atmosphere
- Hospitals are accumulating medical organic waste laden with the Corona virus

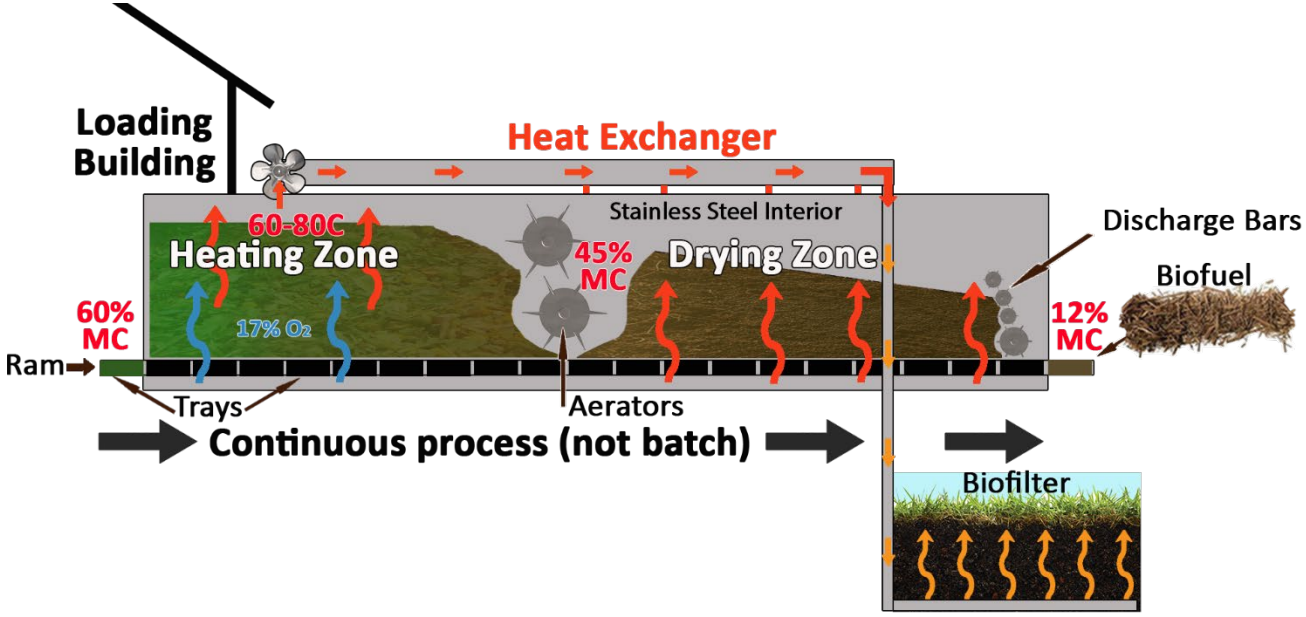
## What the Biodryer can do

- The Biodryer process completely destroys the COVID-19 Corona virus, whether from biosolids or medical organic waste as the biofuel produced is burned in the powerplant boiler at 1100 degrees
- Respiratory protection masks are shredded and destroyed in the Biodryer

**We can solve all of these issues and generate clean, reliable energy**

# The Biodryer® Process

100 tons of daily organic waste produces 50 tons of Biofuel and 50 tons of clean water over a 7-day period




- External fans draw in air to optimize the activity of inherent microbes
- Microbes breakdown organic cellular walls to release trapped water, which causes an exothermic reaction producing a large amount of heat
- The heat evaporates the water and is recaptured as a clean condensate
- A heat exchanger extracts and blows hot air to the Drying Zone of the tunnel
- Aerators (spinners) mix the material that is moved along on trays each day
- The material is dried to a 12% Moisture Content to produce a highly calorific Biofuel
- Exhaust air is fed through a biofilter to remove any odours

# Practical Uses

Crossing the entire spectrum of human life and our industriousness

**Residential & Commercial Development or Infrastructure Renewal**

- Fast track development of residential and commercial properties with an environmentally friendly carbon neutral waste solution that also provides power to the community.
- Accelerate municipal sewage solutions. No odours or leaching. No residual waste or toxic fumes.
- Less expensive than traditional waste and sewage solutions. Scalable to any size of development.
- Localized uninterrupted power generation, reducing transmission and distribution losses.
- Easy synchronization to Power Grid, can operate Power Plant in short durations for Peak loads.

**Industrial & Construction**

- Disposal of wood, cardboard, paper and other organic fibrous materials
- Co-firing for cement plants

**Agricultural**

- Disposal of plant stalks, animal fecal waste and rendering waste
- Fertilizer ash, $CO_2$ and clean water for irrigation are by-products of the Biodryer process

**Airports, Cruise Ship Docks, Hospitals and Disposal of Virus Contaminations**

- Each requiring on-site disposal of potentially hazardous organic waste
- Biodryer effectively handles all organic materials and natural fibres, including clothing & masks

# Statistics

Unleashing the economic power of waste

| Organic waste tons per day | 50 | 100 | 150 | 300 |
|---|---|---|---|---|
| Biofuel produced per day | 25 | 50 | 75 | 150 |
| Net exportable power | 0.7 MWh | 1.5 MWh | 2.4 MWh | 5 MWh |

## Capacities & Output

- A small tunnel can handle 50 tons of waste each day, while typical tunnel is designed for 100 tons
- Tunnels can be assembled in parallel without limit thus processing as much waste as necessary
- 100 tons of waste produces 50 tons of biofuel daily, which can generate up to 1.5 MWh of electrical power and 4 tons of fertilizer ash equivalent to potash

## Size & Scalability

- Standard tunnel is 2.5m high x 3m wide and 100m long
- A typical 3-tunnel solution will require a loading building of 30m x 30m and total land area of 0.4 hectare (1-acre) including the tunnels
- Boilers vary more in height than in footprint depending on the power to be generated
- Biodryers can be situated in lesser urbanized area with lower land costs, while boilers can be separately located in the middle of urban centers to reduce transmission line loss

## Operating & Maintenance

- Only 2 operators are required on a part-day basis
- The tunnels are stainless steel and expected to last 30+ years, only the aerator heads require replacement
- Typical boiler requires 3 days of service each month

## Costs

- Cost will vary based on location, transportation, local manufacturing costs and size of solution, however as a rough approximation, a 3-tunnel solution with boiler producing 5 MWh the cost range is USD $30 to $40-million excluding land, building and site services

# Comparisons

The Biodryer is the most complete & efficient treatment of waste

| | Biodryer | Incineration | Anaerobic Digestion | Gasification |
|---|---|---|---|---|
| **Waste Input (Feedstock)** | **All organic waste** MSW residential, commercial, agricultural, industrial, invasive species | **All MSW waste** Including plastics, metals, etc | **All Organic Waste** | **Organic Waste** of max 25% moisture content |
| **Wet Biosolids (Feedstock input)** | **Yes** Receives wet biomass waste with no pre-drying required | **No** Requires pre-drying with auxiliary fuel | **Yes** | **No** Requires pre-drying with auxiliary fuel |
| **Auxiliary Fuel Required** | **No** | **Yes** Pre-drying of wet waste | Extensive external energy to heat tanks of waste | Extensive external energy to heat tanks of waste |
| **Net Energy Production** | **Highest** Does not require any power generated by the system | **Lowest** Requires power generated to perform incineration | **Medium** Scavenges power for digestion process | **Low** Scavenges power for digestion process |
| **Power** | **Consistent** | **Variable** | **Variable** | **Variable** |
| **Human Health Concerns** | **None** | **High** Release toxic metals, dioxins, acid gases, toxic ashes & residues | **Medium** Inert gas released. Resulting digestate difficult to dispose. | **None** |
| **True Support 3-R's reduce, reuse, recycle** | **Yes** | **No** | **Yes** | **Yes** |
| **Environmental impact potential** | **Lowest** | **High** | **Medium** | **Low** |

# More Comparisons

The Biodryer is the most economical Waste-to-Energy solution

| | Biodryer | Incineration | Anaerobic Digestion | Gasification |
|---|---|---|---|---|
| **Siting of Facility** | Can be in populated areas | Not in populated areas According to WHO | Can be in populated areas | Can be in populated areas |
| **Truly Clean, Green Technology** | **Yes** Only output is biofuel and clean water; no odours | **No** Polluting airborne nanoparticles and toxic ash | **No** Airborne pollutants and highly odorous digestate | **Yes** However very costly way to dispose of waste with low energy production |
| **Usable as Compost** | **Yes** | **No** | **No** No oxygen content thus fertilized land unusable for up to three years | **No** |
| **Scalable & Modular** | **Yes** Low as 50 tons per day to an unlimited daily amount. Most cost effective & real economies of scale. | **No** Cannot operate with low quantities of waste | **Yes** However remains costly due to lack of economies of scale. | **Yes** However remains very costly due to lack of economies of scale. |
| **Capital Costs** | **Lowest** Per ton per kw | **High** Require pollution control systems | **High** Requires scrubbers | **High** Requires scrubbers |
| **O & M Yearly Costs** | **Lowest** | **High** | **Medium** | **Medium** |
| **Typical Return on Investment (yearly)** | **4 to 8 years** | **12 to 25 years** | **12 to 25 years** | **Negligible return** |
| **Stack requirement** | **No** Heat and $CO_2$ may be redirected for use in greenhouses | **Yes** | **Yes** | **No** |