IT Committee

From: Erfan Ibrahim <erfan@tbbllc.com>
Sent: Sunday, August 29, 2021 12:50 PM
To: IT Committee
Cc: Laksmi M. Abraham
Subject: NuCarbon LLC presentation to Maui County IT Committee on 8/30
Attachments: NuCarbon_pyrolysis_presentation_Maui_083021.pdf

Hi Laksmi:

Attached is the latest PDF version of my presentation for the IT Committee of Maui County at 9 AM Hawaii time on Monday August 30.

I will log on to the Blue Jeans portal 15 minutes at 8:45 AM to perform the sound check and make sure I can move the slides during my presentation. I look forward to speaking with you tomorrow.

Best Regards

Erfan

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Pyrolysis Plant Proposal For Carbonaceous Waste Remediation in Maui, Hawaii

By Dr. Erfan Ibrahim (Technical Advisor, NuCarbon LLC)

August 30, 2021

Key Drivers for Project

- Tangible alternative for carbonaceous waste dumping at landfills or incineration in Maui
- Improve environmental sustainability
- Generate renewable fuel for transportation
- Generate industrial oils/lubricants
- Produce char for water filtration & soil enhancement
- Create jobs in Maui (indigenous and expat)
- Support Hawaiian economy
- Improve reputation of Hawaii in the US national and global environmental movement

2012 Aggregated MSW Composition (by Weight) County of Maui 90 % Confidence Interval

Material	(%) Tonnage
Paper	24.3%
Plastic	12.3%
Metals	4.7%
Glass	3.0%
Inorganics	6.0%
Durables	1.8%
Green Waste	14.5%
Wood	7.0%
Organics	24.9%
Household Hazardous Waste	0.2%
Problem Materials	1.3%
GRAND TOTAL	**100.0%**

Proposed Municipal Solid Waste Remediation Plant Project for Maui

- Process 200 metric tons per day of MSW, used tires, agricultural residue, tree trimmings and food waste generated in the County of Maui, Hawaii (~ 50% moisture content)
- Project initially funded by private investment
- Solution Provider – NuCarbon LLC
- Technology Vendor – Global Green International Investments (GGII) – Singapore HQ
- Technology – Pyrolysis of MSW
- Manufacturing facility – Japan
- Build, own and operate plant through a Joint Venture registered in Maui, Hawaii between NuCarbon LLC and private investors
- Products -
    - Bio-char (soil enhancement), activated carbon (water filtration)
    - Industrial oils/lubricants
    - Renewable diesel fuel (EN 15940) and/or A1 grade jet fuel
    - Electricity to power plant
    - Process heat for pyrolysis

nu carbon

globalgreen international

Advantage of Pyrolysis

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Table 3 Brief Comparison between Incineration, Gasification and Pyrolysis

	Incineration	Gasification	Pyrolysis	Pyrolysis
Example	Tuas Incineration Plant, Singapore	Synoya, Netherlands	GGII (All Electricity)	GGII (Hybrid)
Output	Electricity 1650 MWh (68 MW_e)	Electricity 36 MWh (1.5 MW_e)	Electricity 96 MWh (4.0 MW_e)	Electricity & Diesel 43.2 MWh (1.8 MW_e) 12,000 litres diesel
Feedstock	3,000 tons/day MSW	30 tons/day MSW	70 tons/day MSW	70 tons/day MSW
Conversion Efficiency	20% - 24%	30% - 35%	30% - 35%	50% - 60%
CAPEX	NZ$1,000 M	NZ$10 M	NZ$25 M	NZ$25 M

GGII Pyrolysis Technology Advantages

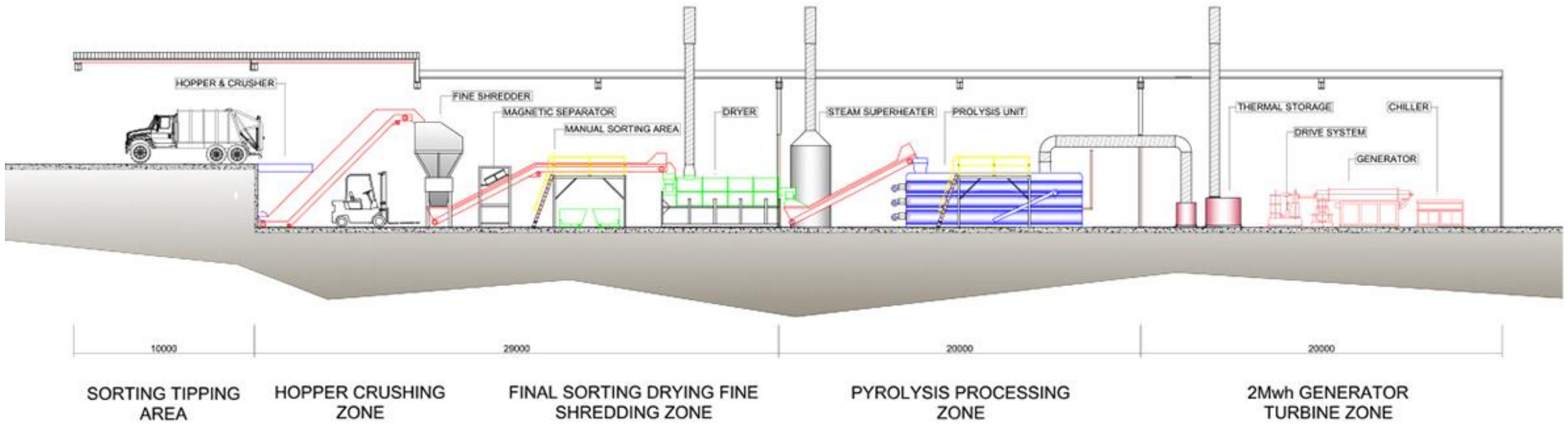
- Proven technology (operational plants for 15 years)
- Using specialized technology partners from Hitachi, Mitsubishi and Tipton Ceram
- Modular design with scalability
- Flexible waste feedstock (MSW, tires, plastic, biomass, rubber)
- High calorific value refined fuels and industrial oils produced
- High energy efficiency from patented pyrolysis technology (34% for diesel only, 50% for hybrid fuel + electricity)
- Energy self sufficient plants beyond startup
- Limited CO_2 SO_2, N_20 and dioxin production
- Meets global air, soil and groundwater emission standards
- Minimizes waste to landfills

Pyrolysis Plant Mass Balance

- 200 metric tons of MSW per day (50% moisture content)
- Dried down to 100 metric tons of MSW per day after drying
- Sorted down to 84.6 metric tons of MSW per day (7.7% of original MSW removed as non-combustible material – glass and metal)
- 350 days of operation
- Daily capacity required: 88.23 metric tons per day
- GGII module capacity: 40 – 45 metric tons per day
- Minimum # of modules required: 2

Plant Physical Specifications

- Physical plant size – 5,000 square meters
  - 2 pyrolysis module
  - pyrolysis module line dimensions (70m x 10 m x 8m)
  - 2-week storage capacity
  - pre-processing and post processing areas
- Fencing around plant perimeter
- 10-meter-high metal enclosure over plant (prefabricated)
- Concrete slab for main plant flooring
- Administrative building: 300 square meters (part of plant)



Pyrolysis Plant Capacity and Power Specifications

- Modular design
- Per module waste processing capacity: 40 - 45 metric tons per day (based on calorific value of waste and processing time)
- Plant capacity: 2 modules (40 - 45 metric tons per day)
- Plant power requirements: 20 min startup heat with LPG (20 MJ per startup per module)
- Steady state power requirements: 230 KVA generator per module (powered by syngas and waste heat recovery)
- Plant external power requirements: none (besides startup heat)
- Minimal water main requirement
- No electric grid required

Module/Plant Product Output

Module output –

- 15,000 liters per day of Renewable diesel/ AI Jet fuel
- 3,750 liters per day of industrial oils/lubricants
- 3 metric tons of char per day
- 5 Kg of ash per day (inert)
- Module is carbon negative to 35,000 metric tons per year

Plant minimum product output -

  - 30,000 liters per day of diesel
  - 7,500 liters per day of industrial oils/lubricants
  - 6 metric tons of char per day
  - 10 Kg of ash per day
  - 70,000 metric tons of carbon credit per year

Plant Construction Plan & Commissioning

- Plant modules and peripherals manufactured in Japan
- NuCarbon & GGII jointly approve EPC company for site development
- Training of plant staff in Maui and Japan on actual plant by GGII staff after manufacturing
- Plant disassembled and shipped to Maui by GGII
- Plant reassembled and commissioned in Maui by GGII - NuCarbon
- Plant implementation schedule: 10 – 12 months from initial order subject to civil works completion

Pyrolysis Plant Financials – High Level

- Equipment price: $14 million per module
- EPC cost: $1000 per square meter
- Plant physical size: 5,000 square meters
- # of modules: 2 modules
- Plant capacity: 40 - 45 metric tons per day
- OPEX: $600,000 per module (< 5% of module CAPEX)
- NuCarbon O&M Cost: $180,000 per module
- NuCarbon Corporate Overhead: $2 million per year
- Plant CAPEX: $33 million
- Plant OPEX: $1.2 million per year
- Total annual cost: $3.56 million

Plant Financials (Contd.)

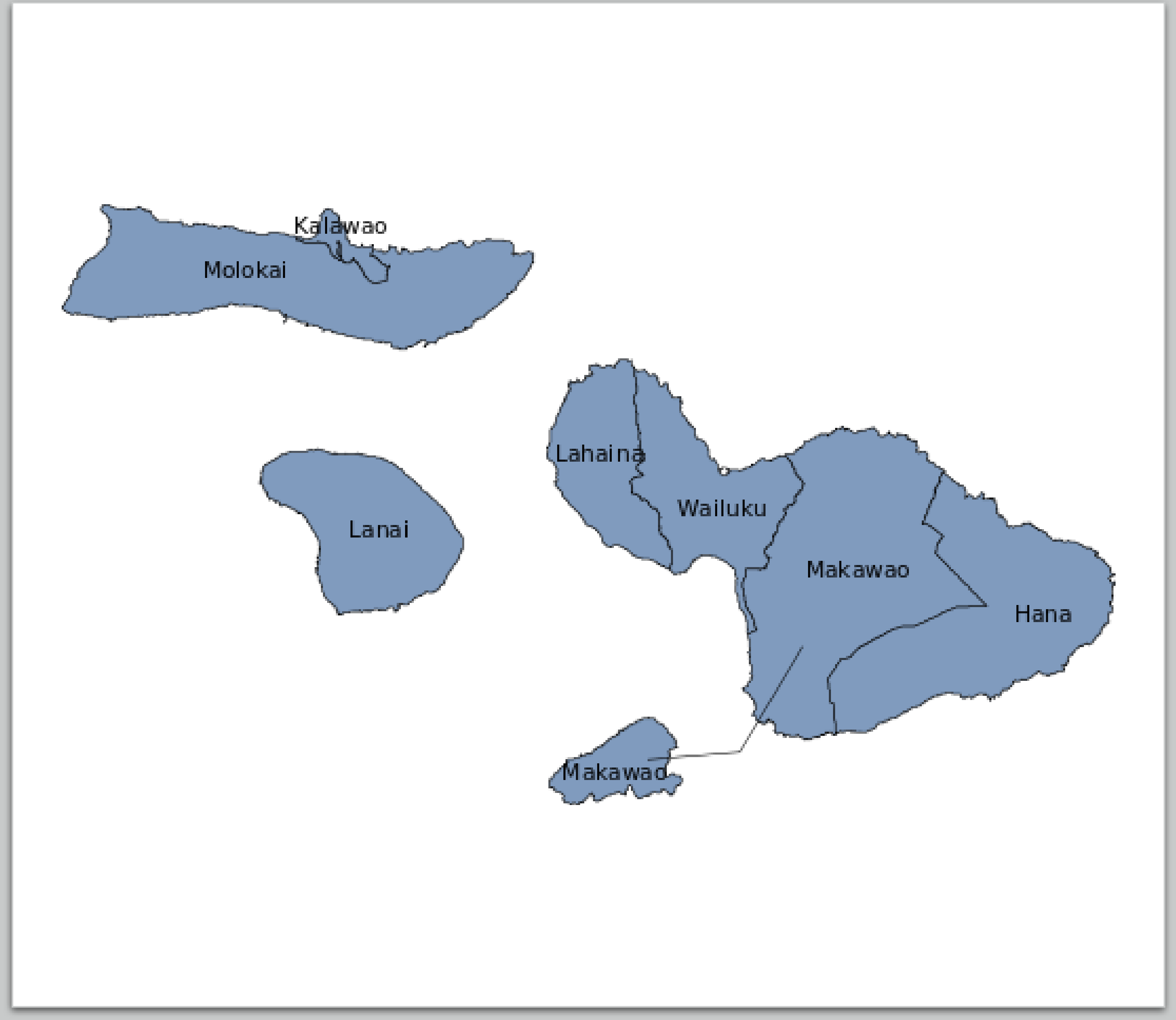
- No gate fees assumed initially
- Total diesel fuel (EN15940) : 10.5 million liters @ market price
- Total industrial oils/lubricants sold per year: 2.625 million liters @ market price
- Total char sold per year: 2,100 metric tons @ market price
- Total carbon credits per year: 70,000 metric tons @ market price

Next Steps

- Seek private investor for $10 million
- Finance $23 million at low interest from a financial institution
- Secure 5 acres of private land in Maui for plant site on a long-term lease
- Establish Joint Venture between NuCarbon and private investor to build, own and operate plant
- Sell diesel, industrial oils/lubricants, biochar and carbon credits in the market @ wholesale prices (offtake agreements)
- Deliver Infrastructure ROI under 3 years for private investor
- Compete for County of Maui MSW and sewage sludge waste feedstock agreement through formal RFP process after completion of 6-month “trial period”
- Expand plant capacity to meet Maui County needs in Year 2 of operation subject to award of MSW and sewage sludge waste feedstock agreement

Conclusion

- Project will accomplish following goals:
  - Create infrastructure to remediate about 1/3 of MSW produced in County of Maui daily
  - Generate renewable diesel refined fuel for land and air transportation
  - Produce pure carbon for water filtration and/or fertilizer substitute
  - Increase community resilience
  - Improve local environmental conditions
  - Create good paying jobs in Maui
  - Expand Hawaiian economy
  - Promote Hawaii as a national and global leader in environmental protection



Q&A

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Courtesy Maui News

Reference Data Slides of GGII Technology

Pyrolysis syngas composition

The chart below references the impact of higher temperatures (above 1000ºC) which results in quality syngas and hydrocarbon condensates having more hydrogen at the expense of CO_2, CH_4 and less carbon in the biochar.

Table 1 Effect of Temperature on Gas Composition

Temp. ºC	H_2 mol%	CO mol%	CO_2 mol%	CH_4 mol%	HHV (MJ/m^3)
500	5.56	33.5	44.8	17.50	12.3
650	16.6	30.5	31.8	11.00	15.8
900	32.5	33.5	18.3	4.50	15.1

(Source: Farokh Sahraei & Sara Akhlaghi, 2011)

Superheated steam in the later stages of the pyrolysis results in syngas and hydrocarbon being further enriched in their heat values. Pyrolysis oil from traditional pyrolysis is normally of low heat value and must be refined further to produce EN590 grade diesel.

Steam Gasification Benefits

Table 2 Effect of Heating Method on Heating Value of Product Gas

Producer Gas	Gasification Agent	HHV of Product Gas (MJ/Nm^3)
Direct heated gasification	Air	4 – 6
Pure oxidation gasification	Oxygen	10 – 12
Indirect heated gasification	Steam	15 – 20

(Source: Higman & Burgt, 2008, 2003)

Based on our understanding of the post pyrolysis oxidation of the melt, the end products of the syngas and hydrocarbon condensates has higher heat values, up to 15 to 20 MJ/Nm^3.

Plant pollution emissions table

Table 3.4 Typical Results for Analysis of Pyrolysis Gas from MSW

Test Results

Item \ Classification	Unit	Standard	Measured Result	Test Method
Flow rate	m/s	--	5.14	Automatic Measuring Device
Flow volume	Sm^3/hr	--	3589.54	Automatic Measuring Device
Exhaust gas temperature	C	--	137.8	Automatic Measuring Device
Amount of water	%	--	8.76	Gravimetric Method
Dust	$Mg/S\ m^3$	100	11.2	Semiautomatic Sampling Method
SOx	ppm	500	11.006	Arsenazo III Method
NOx	ppm	200	Not detected	Electrochemical Method
CO	ppm	--	44.35	Electrochemical Method
HCl	ppm	6	Not detected	Mercuric Thiocyanate Method
H2S	ppm	10	Not detected	Methylene Blue Method
CS2	ppm	30	Not detected	Diethylamine Method
HF	ppm	3	Not detected	La Alizarin Complexon Method (Absorption Photometry)
HCN	ppm	10	1.029	Silver Nitrate Titration Method
Phenol	ppm	10	Not detected	4-Amino Antipyrin Method

(Source GGE: Testing performed by Wong Il Science & Environment Co. Ltd April 26-28, 2006)

Courtesy GGII (Data from 20-ton MSW Plant in Mungyeong, South Korea

Plant Emissions Tables (Contd.)

Table | GGII Test Comparison for Maximum Allowable Concentration of Pollutants Defined by CCME, BC, Ontario, USA, and Europe

Contaminant	Concentration Units	Canadian Council of Ministers of the Environment (CCME) Guidelines (1989)	BC Emissions Criteria for Municipal Solid Waste Incinerators (1991)	OLD ONTARIO MOE A-7 (February 2004)	OREGON OAR 340-230-310 Incinerator Regulations – Emissions Limits for New Facilities (April, 2010)	WASHINGTON WAC 173-434-310 Emissions Standards for Large Combusting and Incineration Units (2003)	NEW ONTARIO Guideline A-7 (October 2010)	US EPA 40 CFR Part 60 (May-10-06 Edition) Standards of Performance for Large Municipal Waste Combustors (New Facilities)	EU Directive 2000/76/EC of the European Parliament And Council on the incineration of waste	GGII Emissions Test results Airflow 292.0Sm2/hr Air ratio 5.7%
Total Particulate Matter (TPM)	Mg/Rm3 @ 11% O2	20 (1)	20	17	18	32	14	14.0	9.22(12)	6.75
Sulphur Dioxide (SO2)	Mg/Rm3 @ 11% O2	260 (2)	250	56	53(17)	92(22)	56	55.0(7)	45.82(12)	4.02
Hydrogen Chloride (HCI)	Mg/rm3 @ 11% O2	75 or 90% removal (1)	70	27	30(18)	52(22)	27	26.1(8)	9.22(12)	2.10
Nitrogen Oxides (NOx) (as NO2)	Mg/rm3 @ 11% O2	400(2)	350	207	270	N. Def	198	197.5(9)	183.22(12)	50.20
Carbon Monoxide (CO)	Mg/rm3 @ 11% O2	57 (114 for RDF Systems) (1)	55 (14)	N. Def.	N. Def.	N. Def.	40	41 to 200(10)	45.82(12)	10.12
Cadmium (Cd)	Ug/Rm3 @ 11% O2	100 (2)	100 (15)	14	14	N. Def.	7	7.0	N. Def.	0.03
Lead (Pb)	Ug/rm3 @ 11% O2	50(2)	50(15)	142	140	N. Def.	60	98.0	N. Def.	0.02
Mercury (hg)	Ug/rm3 @ 11% O2	20(3)	200(15)	20	25(19)	N. Def.	20	35.0	45.83(13)	Undetectable
Cd + TI	Ug/rm3 @ 11% O2	N.def.	N.Def.	N.Def.	N.Def.	N.Def.	N.Def.	N.Def.	45.83(13)	1.60
Sum (Sb,As,Pb,Cr,Co,Cu,Mn,Ni,V)	Ug/rm3 @ 11% O2	N.Def.	N.Def.	N.Def.	N.Def.	N.Def.	N.Def.	N.Def.	458.13(13)	0.433
PCDD/F TEQ (Dioxins and Furans	Ug/rm3 @ 11% O2	0.08(4)	0.5(16)	0.08	25(20)	N.Def.	0.08	9.1(11)	0.92	0.042
Organic Matter (as Mathane)	Mg/Rm3	N.Def.	N.Def.	65.5	N.Def.	N.Def.	33	N.Def.	N.Def.	Undetectable
Opacity	%	5	5		10	5	5(2 hr avg) and 10 (6min avg)	10		0.50

Courtesy GGII (Data from 20-ton MSW Plant in Mungyeong, South Korea

Plant water requirements

Water is used throughout the plant for steam production, cooling and heating purposes, in the ion exchange scrubber pollution control system and general plant use. Estimated water volumes typical for the 20 tonnes (dry MSW) modular plant are shown in Table 1.

Table 1: Water consumption for a GGII facility

Water usage items	Usage / hr (L)	Usage / day (L)	Usage / yr (ML)**
Ion exchange scrubber	750	18,000	6.3
Cooling tower loss (@ 0.87%)	1,590	38,160	13.36
In-plant use	50	1,200	0.42
Building general	90	2.160	0.76
Staffing & workforce allowance*	74.3	1,784	0.62
Fire testing and storage top-ups			0.01
Total plant water need			21.5
Less plant recycled water used in process (40 t/day)	1,667	40,000	14
Total usage (make-up water)			7.5

* *Assume plant is operational 350 of 365 days per year*

(**ML – millions of liters)

Water

The proposed plant will not discharge to waterways. The MSW storage area is bunded and within building under roof to prevent any contaminated runoff to stormwater. All process water is either discharged to air as waste heat steam, collected and sent to the onsite wastewater treatment plant for reuse within the process or discharged to sewer via a trade waste agreement.

Courtesy GGII (Data from 20-ton MSW Plant in Mungyeong, South Korea

Plant process

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Pyrolysis & Pyrolysis heating (gas air combustion burners)	Dried, shredded feedstock Heat (initially from LPG combustion then supplied by process-generated syngas) Electricity Water (as superheated steam)	Exhaust gas emissions Syngas (~25% by wt.) Crude oil (~65% by wt.) Char residue (~10% by wt.) Heat Cleaned and separated syngas -> hydrogen Wastewater	• Ion exchange scrubber • Chemical (carbon and lime) dosing followed by baghouse filter • Routine exhaust gas air quality and temperature monitoring • System control panel for temperature and pressure control of pyrolysis chambers • Heat collection and storage for various plant reuse applications • Wastewater treatment system and onsite water re-use plus some trade waste discharge. Monitoring as per trade waste agreement.

Table 6: Key plant and equipment per process step

Process zone	Key process step	Key plant & equipment
Sorting and hopper crushing	Waste feedstock storage	Enclosed building with capacity for 7-14 days MSW storage
	Pre-sorting, tipping	Enclosed building large enough for truck turnaround, waste delivery truck, hopper
	Crushing	Crusher, input conveyor
Fine shredding	Final sorting, drying & shredding	Fine shredder/ trommel, magnetic separator, conveyor, manual sorting bench, recycling bins, dryer, dust collector, discharge water tank, desalination unit
Pyrolysis processing	Pyrolysis	Steam superheater, water supply tank, screw auger conveyors, pyrolysis furnace, 2nd combustion burner, ion exchange scrubber, gas scrubbers, baghouse filter, dose chemicals feed system, pumps and tanks, condenser, cooling machine, gas storage tank, pyrolysis oil tank, sludge tank
Power generation	2MWh generator turbine	Thermal storage/ drive system, heat exchanger, generator turbines, chiller, cooling tower, motors, transformer
Post-treatment (external)	Oil refining (diesel)	Hydrocracking and distillation systems, filtration system, reaction tanks, gas-liquid separator, condenser, centrifuge
	Storage of products, materials and waste	Diesel tanks, final sludge/ tar/ wastewater tanks

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Table 5: Process and Technology Overview

Key process step	Key inputs	Key outputs	Key controls
Waste feedstock storage	Raw MSW	Raw MSW Potentially odorous air Wastewater from MSW Leakage	• Odour controls via enclosed building storage with air extraction activated carbon filtration (4 filters). Deodorant masking mists are also used.
Pre-sorting, tipping	Raw MSW	Pre-sorted MSW Waste components unsuitable for pyrolysis/ recyclables Potentially odorous air	• Waste delivery vehicles use enclosed payloads and load hoppers direct from truck where possible (JIT feedstock supply). • Wastewater treatment system and onsite water re-use plus some trade waste discharge. Monitoring as per trade waste agreement.
Crushing	Pre-sorted MSW Electricity	Crushed feedstock Potentially odorous air Wastewater from crushing/ compacting and general leakage from waste storage	
Final sorting, drying & shredding	Crushed feedstock Hot air (from pyrolysis heat collector) Electricity	Dried, shredded, sorted feedstock Odour emissions from drier Noise emissions Wastewater from shredder and associated equipment	• Drier exhaust combined with building air odour extraction and treated in carbon filters • Enclosed building provides sound attenuation (nearest sensitive receptors >2km) • Wastewater treatment system and onsite water re-use plus some trade waste discharge. Monitoring as per trade waste agreement.

Courtesy GGII

Plant material input/output

Summary by month	Units	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Remarks
	Days/mo	31	28	31	30	31	30	31	31	30	31	30	31	31	
Inputs	Ops Days	29	24	28	27	28	27	26	28	27	26	27	23	29	
Feedstock "RDF"	metric tons	623.5	528.0	618.8	648.0	646.8	618.3	594.8	613.0	610.2	615.4	634.5	512.9	639.1	Sorted MSW & RDF in Korea are predominantly
Average LHV of feedstock "RDF"	MJ/kg	19.2	18.9	19.5	20.1	19.7	19.9	19.1	19.6	19.9	19.4	19.4	19.1	19.8	paper, plastics, timber, textile, etc
															The value is low for RDF at less than 10%
															moisture (typically 22 - 23 MJ/kg)
Outputs															
Actual operating hours	hours	696	576.2	672.3	648	672.5	647.5	624.1	665.4	648.3	624	656.1	552	694.1	
Shutdowns / Trips	number	3	4.5										8	3	
Syngas	Nm3	213,602	175,683	204,984	197,575	205,045	197,423	190,288	202,880	197,667	190,258	200,045	168,305	211,631	20% of this volume is used for retotrt heating
Avg. calorific value	kcal/m3	2,380	2,380	2,380	2,380	2,380	2,380	2,380	2,380	2,380	2,380	2,380	2,380	2,380	9.93 MJ/m3
Actual electrical output	MWh el	132	109	122	120	120	119	119	126	121	122	124	108	136	Electricity generation using syngas in steam boiler
															(internal use)
Carbon black	metric tons	77.79	62.4	72.1	75.2	76.3	78.3	74.4	72.4	75.8	74.7	78.3	66.52	79.98	
Pyrolysis oil	liters	290,580	268,800	298,750	312,727	313,650	299,690	283,200	316,960	311,457	299,598	306,180	250,010	319,928	
Residuals to landfill	metric tons	27.95													
Recyclate	metric tons	8.7													
Availability	%	94%	86%	90%	90%	90%	90%	84%	89%	90%	84%	91%	74%	93%	
Net Input	MT	623.5	528	618.8	648	646.8	618.3	594.8	613	610.2	615.4	634.5	512.9	639.1	
Daily feed	syngas and p	21.5	22.0	22.1	24.0	23.1	22.9	22.9	21.9	22.6	23.7	23.5	22.3	22.0	
Daily pyrolysis oil	liters	10,020	11,200	10,670	11,582	11,202	11,100	10,892	11,320	11,535	11,523	11,340	10,870	11,032	
Ave electricity output	MWe	0.19	0.19	0.18	0.19	0.18	0.18	0.19	0.19	0.19	0.20	0.19	0.20	0.20	
Syngas		32.5%	31.6%	31.5%	29.0%	30.1%	30.3%	30.4%	31.4%	30.8%	29.4%	30.0%	31.2%	31.5%	
Oil		40.1%	43.8%	41.5%	41.5%	41.7%	41.7%	40.9%	44.5%	43.9%	41.9%	41.5%	41.9%	43.1%	
Solids		12.5%	11.8%	11.7%	11.6%	11.8%	12.7%	12.5%	11.8%	12.4%	12.1%	12.3%	13.0%	12.5%	
Energy Balance															
MSW (RDF) input	GJ	11971.2	9979.2	12066.6	13024.8	12741.96	12304.17	11360.68	12014.8	12142.98	11938.76	12309.3	9796.39	12654.18	
Oil - Pyrolysis Crude	GJ	7911	7318	8133	8514	8539	8159	7710	8629	8479	8156	8335	6806	8710	refined diesel sg= 0.83, 80% conversion
syngas avaialble for boiler	GJ	1,620	1,332	1,554	1,498	1,555	1,497	1,443	1,538	1,499	1,443	1,517	1,276	1,605	25% used for retort heating, 75% for boiler
Bichar @ 30MJ/kg	GJ	2334	1872	2163	2256	2289	2349	2232	2172	2274	2241	2349	1996	2399	
Electricity generated for internal use	KWe (ave)	190	189	182	185	179	184	191	188	187	196	191	196	195	

Remarks:

a. This is a 2nd generation pyrolysis plant. Their main focus is to convert sorted MSW into bunker oil for boilers & funances, and to genreate electricity for in-house use.

b. The heat and waste heat from the boiler is also used for drying of the incoming MSW and municipal sludge in nearby facility.

Courtesy GGII (Data from 20-ton MSW Plant in Mungyeong, South Korea

GGII Operating & Planned Pyrolysis Plants

GGII Projects:

	Date of operation	Site	Plant Type	Plant feedstock Type	Tons per day	Liters Oil per day	Status	Electricity Outputs	Operators
1.	April 2010	Tire Plant Hanae-ri, do, South Korea.	Modular 2nd Generation	Tires	15	9,100	In Operation	Nil	Yang, SS Lee Hankook Tires
2.	March 2008	Busan, South Korea	1st Generation	MSW	48	25,000	In operation	Nil	Yang/ SS.Lee SS Oil Inc
3.	January 2009	Chelwon-Gun Gangwon-Do, South Korea.	2nd Generation	MSW	5	3,050	In Operation	Nil	Mr Ku/ An Korean Government
4.	December 2009	Mungyeong-si Gyeongsangbuk-do South Korea	Modular 2nd Generation	MSW	20	11,000	In operation	Nil	Yang/Ahn
5.	February 2010	Pyeongtaek City, South Korea	Modular 2nd Generation Oil Plant	Tires	50	28,000	In operation	48MWh/day	SS Lee/Choi Kumho Tires
6.	October 2020	Manawatu, New Zealand	3rd generation 1 x Hybrid	MSW	40	14,000	Permitting and conclusion of finance	43.2 MW/day	Bioplant Manawatu NZ Limited, New Zealand
7.	February 2021	Banda Ache, Indonesia	3rd generation 6 x Hybrid.	MSW	240	84,000	Concluding permits	273MW/day	GGI Energy Pte Ltd
8.	October 2020	San Pedro, Laguna, Philippines	3rd generation 2x Hybrid 1x All Electricity	MSW	180	28,000	Financing completed	259MW/day	Bacavalley Energy Inc.
9.	November 2020	Geelong, Victoria, Australia	6 x Hybrid	Biomass/ MSW	240	84,000	Contract Stage	273MW/day	Bioplant Limited
10.	November 2020	Samoa	2 x Hybrid plant.	MSW	80	24,000	Contract. Permit/PPA	96MW/day	Village Life Energy
11.	Completed Oct 2018	Tire Plant, Hanae-ri, do, South Korea	8 X Hybrid plants	MSW	200	112,000	Expand existing facilities to 200 ton.	288MW/day	Yang/ Yoshikawa Hankook tires
12.	March 2021	Laverton, Victoria Australia	6 x Hybrid Plants	MSW	240	84,000	Final design & contracts	273MWh/day	Bioplant Limited

Courtesy GGII

GGII Typical Single Line Plant Layout

Courtesy GGII