Waste To Energy
Water & Sewage Sludge Drying

MSW, Sludge, Manure & Food Waste to Energy

January 2011
Sewage Sludge Treatment

Many wastewater treatment plants are coping with a waste stream of digested sludge. The sludge is normally dewatered by means of a centrifuge or belt filter press. After dewatering the sludge has a typical dry solids content of approx. 20 – 25%.

Every country has a lot of problem with the fast increasing sludge, shortage of sewage treatment plant and limitation of landfill size. The volume is increased by 10%–20% every year by building up new sewage plant in every country. How can we treat these increasing sludge? We are not allowed to dump the sludge to sea.

I think the best solution is to covert sludge to energy, which is possible when we dry sludge less than 10% water content and then possible to use sludge for the gasification and power generation which will be treated by Devolatization or gasification equipment.

The dried sludge (Bio-Solid) can be applied as a fertilizer to improve and maintain productive soils and stimulate plant growth. They are also used to fertilize gardens and parks and reclaim mining sites. landfill with 4/1–5/1 reduction of volume, incineration, fuel for cement plant and etc.. also fertilizer depending upon heavy metal content.. etc.. means economic drying of around 80% sludge to dried sludge less than 10 % water content would be the key solution to save the world

Here is the patented Microwave Near Infrared Ray System (MW-NIR) drying any sludge, manure and waste food to 10%–0% humidity.. and also integrate with Devolatization or gasification system and power generation..

We can generate around 1 MW electric power and/or syngas from 100 tons per day 80% sludge.. or dried sludge can be used for landfill, fertilizer, bio-coal and etc....which requires 1~2 million dollars of investment for complete drying system plus special filter press.. if including gasification and power generation system will need 6 million dollars ( 1~2 million dollars drying system + 6 Million dollars of gasification and power generation.)

This systems are modular type and can be installed one by one separately for drying system, gasification system, and power generation subject to the budget and purposes. ..
Five Typical Sludge Treatment

1. Digestion
   - Aerobic and anaerobic digestion
   - Dewatering

2. Lime stabilisation
   - Lime
   - Lime stabilised biosolids

3. Composting
   - Green waste
   - Composting process
   - Composted biosolids

4. Heat treatment
   - Heat stabilised biosolids
   - Pelletisation of biosolids
   - Biosolids pellets
   - Failed to meet biosolids grade

5. Energy from waste
   - External power source
   - Energy recovery
   - Residual
   - Landfill

Beneficial uses include:
- Agriculture
- Domestic and commercial landscaping
- Forestry
- Further processing
What is in Dried Sludge?

Dried Sludge are mainly a mix of water and organic materials that are a by-product of the sewage treatment processes. Most wastewater comes from household kitchens, laundries and bathrooms. Dried Sludge may contain: Macronutrients, such as nitrogen, phosphorus, potassium and sulphur and Micronutrients, such as copper, zinc, calcium, magnesium, iron, boron, molybdenum and manganese.

Dried Sludge may also contain traces of synthetic organic compounds and metals, including arsenic, cadmium, chromium, lead, mercury, nickel and selenium. These contaminants limit the extent to which Dried Sludge can be used, with all applications regulated by appropriate government authorities. Every country has one of the strictest regulatory regimes for Dried Sludge production and application in the world.

What are Dried Sludge used for?

Dried Sludge can be applied as a fertilizer to improve and maintain productive soils and stimulate plant growth. They are also used to fertilize gardens and parks and reclaim mining sites. The applications are:

Co-generation/power production/energy recovery
Land application in agriculture (vine, cereal, pasture, olive)
Road base, Land application in forestry operations,
Land rehabilitation (including landfill capping)
Landscaping and topsoil, Composting, Incineration, Landfill
Gas and Oil from sludge, Bricks and construction material
Bio-fuel (Bio-Coal), Fuel substitute (cement works), etc.
Project

- Various Water Sludge Treatment Project – Drying and Power Generation.
- Microwave Near Infrared Ray (MW-NIR) Drying system
- 80% Moisture Sludge $\rightarrow$ 50-60% Moisture Sludge $\rightarrow$ 10% Sludge
- Modular Package Drying System for 100 Tons per Day and 300 Tons per Day.
- Drying for landfill, reclamation, fertilizer, fuel for cement plant, etc…
- Dried sludge less than 10% moisture for gasification and power generation
- Modular Package for MW-NIR Dry and Gasification based on 100 tons/day
- No competitor in the price and function of drying sludge in the world
- Start the project 100 tons/day and 300 tons/day for Drying & Gasification
- Low investment and high profit return rate and lower O&M costs..

SOLUTION

1. Drying 80% Sludge to 10% Sludge by Microwave-Near Infrared Ray (MWNIR)
   - Landfill (Volume is reduced to 1/4 - 1/5) or Incineration
   - Reclamation and fertilizer subject to heavy metal
2. Dried Sludge $\rightarrow$ Devolatization $\rightarrow$ Fuel & Gas $\rightarrow$ Power Generation
3. Clean Fuel and Hydrogen for industries, home and car.
What is Microwave Near Infrared?

Main technology is to use both Microwave and NIR (Near Infrared Rays) heating technology simultaneously in the drying processes.

Microwave causes vibrations and cracks among molecular particles with heat and then high penetration of IR actually increases surface moisture levels from the inner part.

\[
\begin{align*}
\text{a : Internal water} & \quad \text{b : Adsorption and adhesion water} \\
\text{c : Interstitial capillary water} & \quad \text{c : Capillary held water}
\end{align*}
\]

**Diagram:**
- Internal Heating (Microwave) + Surface Heating (Near Infrared) = Uniform Heating (Combination)
Features & Benefit

Features

• Combination of Microwave- NIR (Near Infrared Rays) makes uniform heating and hard-to-dry object possible
• Saves energy because not the atmosphere but the object itself is heated i.e., Direct heating, not heat conduction
• Achieved the top efficiency of heating amounting to 80% above
• Sterilization of micro-organism by destroying and evaporating internal water by MW-NIR
• Reliable with an intelligent service and maintenance concept
• Dry Smart & Green: Environment-friendly solution because of the minimum emissions of secondary pollutants (dust, CO, CO2, NOx, SOx, etc.) by use of ONLY electric energy

Benefits

• Reduction of processing cost through highly efficient energy use
• Destroys 100% of pathogens
• Integrates easily with all dewatering machinery
• Reduction in emissions and foul odors
• Easy to maintain with simplified facility with the use of PLC (Programmable Logic Control)
• Immediate warm up and cool down - no waiting time
• Multiple-phase integrated installations, small sites possible and scalable depending on volume
# Patent

<table>
<thead>
<tr>
<th>Patents</th>
<th>Reg. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sludge drying method and apparatus</td>
<td>10-0539413</td>
</tr>
<tr>
<td>Waste water evaporation method and apparatus</td>
<td>10-0540165</td>
</tr>
<tr>
<td>Exhaust gas processing device for energy efficient using of microwave</td>
<td>10-0794238</td>
</tr>
<tr>
<td>electric heating element and plasma ultraviolet rays lamp</td>
<td></td>
</tr>
<tr>
<td>Exhaust gas processing device for energy efficient using of microwave</td>
<td>10-0794236</td>
</tr>
<tr>
<td>electric heating element</td>
<td></td>
</tr>
<tr>
<td>Apparatus for drying processing object containing moisture</td>
<td>10-0608296</td>
</tr>
<tr>
<td>An apparatus and method for rapid drying sludge</td>
<td>10-0928277</td>
</tr>
</tbody>
</table>

- **NET (New Excellent Technology) Certificate No. 277**: “Waste water sludge drying technology by the simultaneous use of Microwave and NIR (Near Infrared Rays)” – Energy Efficiency 83.27% (2007.06)
- **Applicable New Technology Certificate** by LH Corp. “Drying Plant by using both Microwave and NIR” (2007.06.18)
Technology Summary

1. Combined Light
   - Easy decomposition of water in various chemicals
   - Drying of hard-to-decompose material

2. Excellent energy efficiency
   - Drying food and marine product
   - Various range of heating temperature
   - Simultaneous mixing and evaporating
   - Shortening specific heat and heat process
   - Immediate evaporation

3. Unheard-of sterilizing & deodorizing power
   - Breakdown of molecular structure
   - Near Infrared and Ultra violet

4. Weakens ventilation & air gas
MW-Advantages

Microwaves generate higher power densities, enabling increased production speeds and decreased production costs.

Microwave systems are more compact, requiring a smaller equipment space or footprint.

Microwave energy is precisely controllable and can be turned on and off instantly, eliminating the need for warm-up and cool-down.

Lack of high temperature heating surfaces reduces product fouling in cylindrical microwave heaters. This increases production run times and reduces both cleaning times and chemical costs.

Microwaves are a non-contact drying technology. One example is the application of IMS planar dryers in the textile industry, which reduce material finish marring, decrease drying stresses, and improve product quality.

Microwave energy is selectively absorbed by areas of greater moisture. This results in more uniform temperature and moisture profiles, improved yields and enhanced product performance.

The use of industrial microwave systems avoids combustible gaseous by-products, eliminating the need for environmental permits and improving working conditions.
K.G. Chemicals Co., Ltd. – dries The Hardest-to-Decompose material of PNS (Poly Naphtalene Sulfonate) waste gypsum and recycles it.
# MWNIR™ Plant in Operation

<table>
<thead>
<tr>
<th>Material</th>
<th>Client</th>
<th>Test result</th>
<th>reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium A waste gypsum</td>
<td>GS Cosmo Chemicals Co., Ltd.</td>
<td>- water content 32% - 1st Drying 13% - 2nd Drying result 2%-0.3%</td>
<td>Plaster board</td>
</tr>
<tr>
<td>Titanium C waste gypsum</td>
<td>GS Cosmo Chemicals Co., Ltd.</td>
<td>- Material water content : 64% - 1st Drying : 12%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fertilizer / cement/ construction resources including plaster board</td>
<td></td>
</tr>
<tr>
<td>TiO₂</td>
<td>GS Cosmo Chemicals Co., Ltd.</td>
<td>- oxidized at 1,200° C</td>
<td>precipitator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- dries down to 0.02% moisture</td>
<td></td>
</tr>
<tr>
<td>Ferrous sulfate</td>
<td>GS Cosmo Chemicals Co., Ltd.</td>
<td>- decompose molecular particle FeSO₄ +7H₂ O</td>
<td></td>
</tr>
<tr>
<td>Fe₅ SO₄</td>
<td>GS Cosmo Chemicals Co., Ltd.</td>
<td>- waste water purifier</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- leather waste water purifier, red tide protector 20 times stronger then ocher</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- remove jellyfish</td>
<td></td>
</tr>
<tr>
<td>Copper sulfate</td>
<td>GS Cosmo Chemicals Co., Ltd.</td>
<td>- copper sulfate recycling</td>
<td></td>
</tr>
<tr>
<td>waste Phosphate gypsum</td>
<td>Dongbu Hannog Co., Ltd.</td>
<td>- Half gypsum or dried gypsum</td>
<td></td>
</tr>
<tr>
<td>Smug Cake</td>
<td>GS Cosmo Chemicals Co., Ltd.</td>
<td>- Material water content 68%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 1st Drying : 16% (BULK particle)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 2nd Drying result : 9.11%</td>
<td></td>
</tr>
<tr>
<td>PNS hardener</td>
<td>KG Chemicals Co., Ltd.</td>
<td>- Concrete cement mixer</td>
<td></td>
</tr>
</tbody>
</table>
### Recent MWNIR™ Plants Ordered

<table>
<thead>
<tr>
<th>Year</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008.5~</td>
<td>Provided 1 set of MW-NIR drying plant in Gangneung Sewage Plant and acquired NET (New Excellent Technology) Certificate No. 277 from the Ministry of Environment - MBC News</td>
</tr>
<tr>
<td>2009.3</td>
<td></td>
</tr>
<tr>
<td>2009.9</td>
<td>Won the bid of waste water treatment technology in Gyeryong city in a consortium with Taeyoung Construction company and Entec company</td>
</tr>
<tr>
<td>2010.4</td>
<td>Provided 1 set of mobile MW-NIR drying plant for Ecowave LLC (a wholly owned subsidiary of Natural Blue Resources, Inc., Nasdaq listed company) - Orange peel dryer Has contracted to provide a total of 50 sets of MW-NIR drying plants by the end of 2011</td>
</tr>
<tr>
<td>2010.3</td>
<td>Won the bid of waste water treatment technology in Gimcheon city in a consortium with Taeyoung Construction company and Entec company</td>
</tr>
</tbody>
</table>
MWNIR™ Structure

- MWNIR™ consists of several modules, including main frame, chambers, screws, hopper, magnetrons, Infrared lamps, generators, and control panel.
- The unheard-of our technology named MWNIR™ originates from the combined synergy of microwave and near infrared wave. Accordingly, Magnetrons and infrared lamps are used in our patent-acquired technology system.
- The MWNIR™ helps various industries and factories whoever wants to dry their product or sludge, eventually to recycle them.
- For example, petrochemical or fertilizer factories can optimize the work process fully by using our MWNIR™
- Drying material is black lead, aluminum, slack lime or quicklime or carbonized lime, and waste water sludge. food waste, and etc.
- The magnetrons of our MWNIR™ can enhance the heated material temperature up to 500° C~600° C, whereas reducing the heating time down to 70%~80% of the time during the drying process.
- Your factory does not need to make much room for our MWNIR™ drying system, it occupies only 1/5~1/10 of the floor of your previous dryer, if you have one.
MW-NIR1.25 Plant Specification

① Three chambers: Outside dimension (2,000W X 8,000L X 5,500H)
   - Upper part SUS 304 x 6 mm thick and SS41
   - Two covers for heat-retaining and recycling
② Screw Conveyor: φ140 x φ145
   - Upper edge 6,080mm x 8 sets
   - Middle edge 6,080mm x 8 sets
   - Lower edge 6,080mm x 4 sets
③ Motor and Decelerator: 5HP x 4P x 1:60 ratio (5-30 rpm)
④ Bushing: SS400 100 x 45 x 16
⑤ Current and Voltage: 300kw (380V, 60Hz, 4P)
⑥ Frame: Pipe form (100mm x 100mm x 6 mm thick)
⑦ High pressure turbo fan for Cooling
⑧ Hopper is best suited and designed for input and the quality of it is SUS 304.
⑨ Magnetron of 1.2Kw incl. Transformer:
   - Upper chamber: 60sets, Middle chamber: 60set, Lower chamber: 30 sets
⑩ Microwave: Electromagnetic waves ranging from 1,000Mhz to 300,000Mhz
   - with wavelength of 1 centimeter.
⑪ Microwave reflects on the metallic surface of chambers and does not transform it.
   - Anode Voltage / Current / Temp.: 4,200DC / 330Madc / 250degreeC
   - Output Power / Frequency: 1,050W / 2,458MHz
   - Cooling Fan: Above 2.7m3 * 25mmAq
⑫ The 80% of the input voltage transforms into the very efficient heat.
⑬ Near Infrared Lamp(IR Lamp): 1.5Kw φ 200 x 470mm x 0.7
   - Upper chamber: 84sets, Middle chamber: 84, Lower chamber: 42 sets
⑭ Control Panel: User-friendly designed Power, Temperature, Screw frequency,
   Input frequency, Ventilation blower, Heater, IR Lamps control
MW-NIR1.25 Drying Plant

We have developed the patented drying equipment based on the Microwave and Near Infrared Ray as follows, which would need 1/5 – 1/10 floor area, 1/5 cost of operation, no fossil fuel and only electricity, no operation noise, and less manpower, nearly no exhaust gas, meeting EPA. Faster drying capability and synergy drying of Near Infrared direct surface heating.
Our Microwave has much faster drying capability more than 30 times of evaporation power than gas heating blow and also realize synergy drying by Near Infrared direct surface heating without any loss of IR lamp transmission heat.
# MW-NIR1.25 Drying Plant

## Very High Energy Efficiency

<table>
<thead>
<tr>
<th>Description</th>
<th>MW-NIR 1.25</th>
<th>Hot Wind Dryer</th>
<th>Heat Media Dryer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Content</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Sludge</td>
<td>80 %</td>
<td>80 %</td>
<td>80 %</td>
</tr>
<tr>
<td>Dried Sludge</td>
<td>10 %</td>
<td>10 %</td>
<td>10 %</td>
</tr>
<tr>
<td>Evaporation Required Calorie</td>
<td>750 kcal/kg</td>
<td>850 kcal/kg</td>
<td>900 kcal/kg</td>
</tr>
<tr>
<td>Drying Energy Efficiency</td>
<td>80 %</td>
<td>75 %</td>
<td>70 %</td>
</tr>
<tr>
<td>Source of Energy</td>
<td>Electricity</td>
<td>LPG</td>
<td>Oil(Steam)</td>
</tr>
</tbody>
</table>

## Meeting Exhaust Gas and Odor Emission Standard

<table>
<thead>
<tr>
<th>Section</th>
<th>Dust (mg/sm³)</th>
<th>HCl (ppm)</th>
<th>SO₂ (ppm)</th>
<th>CO (ppm)</th>
<th>H₂S (ppm)</th>
<th>Ammonia (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation</td>
<td>100</td>
<td>6</td>
<td>500</td>
<td>200</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Average</td>
<td>3</td>
<td>ND</td>
<td>ND</td>
<td>1</td>
<td>1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

## Meeting Electromagnetic Limits

<table>
<thead>
<tr>
<th>Section</th>
<th>Frequency (2.45GHz)</th>
<th>Electromagnetic Field Strength (V/m)</th>
<th>Magnetic Field Strength (A/m)</th>
<th>Power Density (W/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit</td>
<td>61.00</td>
<td>0.16</td>
<td>0.16</td>
<td>10.00</td>
</tr>
<tr>
<td>Generation</td>
<td>40</td>
<td>0.10</td>
<td>0.10</td>
<td>5</td>
</tr>
</tbody>
</table>
Our proposal includes only MW-NIR 1.25 Dryer. The Sewage and sludge treatment plant has already had Dehydration Centrifuges, storage, sludge feeding and gas treatment.
Our Proposal

Filter Press & MW-NIR Dryer for 60%–50% Water Content Sludge

There are various types of filter press to reduce 80% water content to 60%–50% water content sludge and under assumption of using filter press for 60%–50% moisture sludge before Microwave Near Infrared Ray (MW-NIR) system, we can reduce investment for MW-NIR by more than one third. As an example, we estimate investment for MW-NIR by using filter press on the basis of 100–150 tons/day and 300 tons/day 80% Moisture Sludge

MW-NIR Dryer: 1.25 ton/Hour (30 tons/Day) Drying Capacity designed on the basis of 50% Sludge to 10%

100–150 tons/day 80% Moisture Sludge → Filter Press → 50–75 ton/day, 60% Sludge →
40–60 tons/day, 50% Sludge → MW-NIR → 23–33 tons/day, 10% Sludge → Gasification (D4)

- 100–150 tons/day 80% sludge : 6–8 units of MW-NIR Dryer . $800,000 x 6–8 Units = US$4.8–6.4 Millions.

** Faster and more drying is possible from 60%–50% water content sludge to 10% water content sludge

** Drying to 60%–50% sludge by filter press can reduce investment for MW-NIR by 1/3–1/5.

300 tons/day 80% Moisture Sludge → Filter Press → 60%–50% Sludge, 150–120 tons/day →
MW-NIR → 10% Sludge , 67 tons/day → Gasification (D4)

- 300 tons/day 80% sludge : 15 Units of MW-NIR Dryer : $800,000 x 15 units=US$12,000,000

- If dried to 60%–50%, 300 tons/day is reduced to 150–120 tons/day and need 5–4 units of MW-NIR

- 5–4 units of MW-NIR x U$800,000 = U$4,000,000 – U$3,200,000

- 300 tons/day 80% Moisture dried by MW-NIR will be 66 tons /day 10% Moisture Sludge
Sludge to Gasification

The dried sludge less than 10% water content can be converted to Syngas by Devolatization or plasma gasification and then used for power generation. The typical composition of sewage sludge we analyze is:

- **Composition**: Moisture 10%, Ash 26.87%, Organic 63.13%
- **Element**: C - 48.02%, H - 7.18%, O - 33.14%, N - 8.93%, S - 2.73%
- **Calorific Value**: High – 3,130 kcal/kg, Low - 2,826 kcal/kg

We propose Devolatization nodal alternative energy systems for sludge to energy. The D4 Energy Devolatization system takes carbon-based feedstock (Municipal Solid Waste, Tires, Biomass, Sludge, etc.) and creates energy.

The patented system uses extreme heat within a continuous closed loop system where the feedstock is broken down at a molecular level and high quality syngas (600 – 750 Btu) is produced along with high quality carbon.

The system has virtually no emissions due to its patented process, and it is self-sustaining using less than 10% – 15% of the produced power to operate the Devolatization system. The D4 Energy Devolatization system produce gas that directly feeds a generator or turbine that in-turn produces electricity for local industry for their heating and manufacturing needs.

The budget price of D4 Energy System per unit is 3 Million US Dollars. A budgetary number for a complete system – material handling, One D4 Energy Module Unit and Power Generation – is $6 Million. The total budget for 100 –150 tons 80% sludge to Energy will be around 8 Million dollars (Filter press U$200,000 + MW-NIR x2 Units U$1.6 Mil + One system of D4 Energy U$6 Million)

The 300 tons 80% sludge to 10% Sludge by filter press and MW–NIR Dryer + D4 Energy:
Filter press $500,000 + MW–NIR 4 Units x $800,000 + D4 2sets x $6 Mil =$15.7 Million
D4 Energy – Converting Hydrocarbons to Energy

Carbon Feedstock → Devolatization → High Quality 600 - 750 Btu Gas → Electricity

Carbon
Our Proposal

For the gasification of 100–150 tons/day and 300 tons/day 80% moisture sludge, the sludge should be dried down to 10% moisture sludge by filter press and Microwave Near Infrared Dryer ...and then the 10% moisture sludge will be sent to D4 Energy Devolatization system for gasification, which requires minimum 10–15% moisture of feedstock.

D4 Energy Devolatization Module System will consume 30 tons of feedstock a day, produce 650–750 Btu syngas that will produce 1.25MW of electricity. The systems are portable and skid–mounted. To meet your power or feedstock consumption needs you put multiple modules together working in parallel. Example, if you want a 25 MW plant we design you a 20 module system. If you have 1000 tons a day of feedstock we design a 34 node system.

The budget price of one D4 Energy System per unit is 2.5–3 Million US Dollars. A budgetary number for a complete system – material handling, One D4 Energy Module Unit and Power Generation (1.25MW) – is $ 6 Million for turnkey system

D4 Energy Module System is mobile and skid mounted unit including conveyor belt to receive MSW or Sludge from trucks, Shredder/Grinder and Hammer.. as shown in the picture. This is a complete system with material handling (primary shredder, material sorting or MERF, conveyors, grinders), a D4 Energy Module System (secondary material handling, hammer mill, feed augers, reactor, carbon and gas cooling/cleaning, carbon storage) and power generation (generator, turbine or fuel cell). Or We can just provide the D4 system without material handling and power generation.

D4 Energy Devolatization System requires the feedstock between 5% – 15% moisture content and the Sewage Sludge 80% moisture sludge should be dewatered to 5–15% moisture. Dewatering can be done by Microwave + Near Infrared Drying system integrated with filter press. We are pleased to propose. :

1. 100–150 Tons per day 80% moisture sludge to Gas and Power Generation.
   - Price of filter press and MW–NIR1.25 for 10% sludge:
     1 Unit Filter Press US$200,000 + 2 Units MW–NIR x US$800,000 =US$1,800,000
   - 10% Moisture Sludge, 23–33Tons per day : One D4 Energy Module System is US$6 Million Dollars
   - The total budget will be Around US$ 7.8 Million for the complete sludge to energy system. (1.25MW)

2. 300 tons per day 80% moisture sludge to gas and power generation.
   - Price of filter press and MW–NIR 1.25 for 10% sludge :
     3 units filter press : US$500,000.. + 4 Units MW–NIR x US$800,000 =US$3,200,000 . Total US$3,700,000
   - 10% Moisture sludge 67 tons per day needs 2 x D4 Energy Module system US$6 Millions = US$12,000,000.
   - To maintain constant output during routine and corrective maintenance – recommend one more US$6,000,000
   - Total Power Generation 2.5 MW and Total Budget is US$15,700,000.00 or US$21,700,000 with one more unit.
D4 Energy's Proprietary and Innovative Technology

Devolatization
D4 Energy devolatization solutions support power generation, including the generation of High Quality 700 - 750 Btu gas and the generation of carbon.

The system has virtually no emissions due to the patented devolatization process and is self-sustaining, using less than 10%* of the produced power to operate the entire system.

Liquefaction (4Q2011)
D4 Energy liquefaction takes carbon feedstock (MSW, tires, biomass, etc.) and can produce over 2.1 million gallons of high quality diesel fuel per year per system.

Mobile Unit (4Q2011)
D4 energy will be bringing to market a mobile expeditionary energy system consisting of 3 – 4 theater hardened tractor/trailer units that from time on site to making energy will be 4 hours.
The Waste-to-Energy Functional Block Diagram
Modular Energy – Managed Growth

60 Tons of trash per day is used to keep a 24/7 operation.

** Node 3 is redundant and used to maintain constant output during routine and corrective maintenance. Node 3 is a customer drive decision but highly recommended.