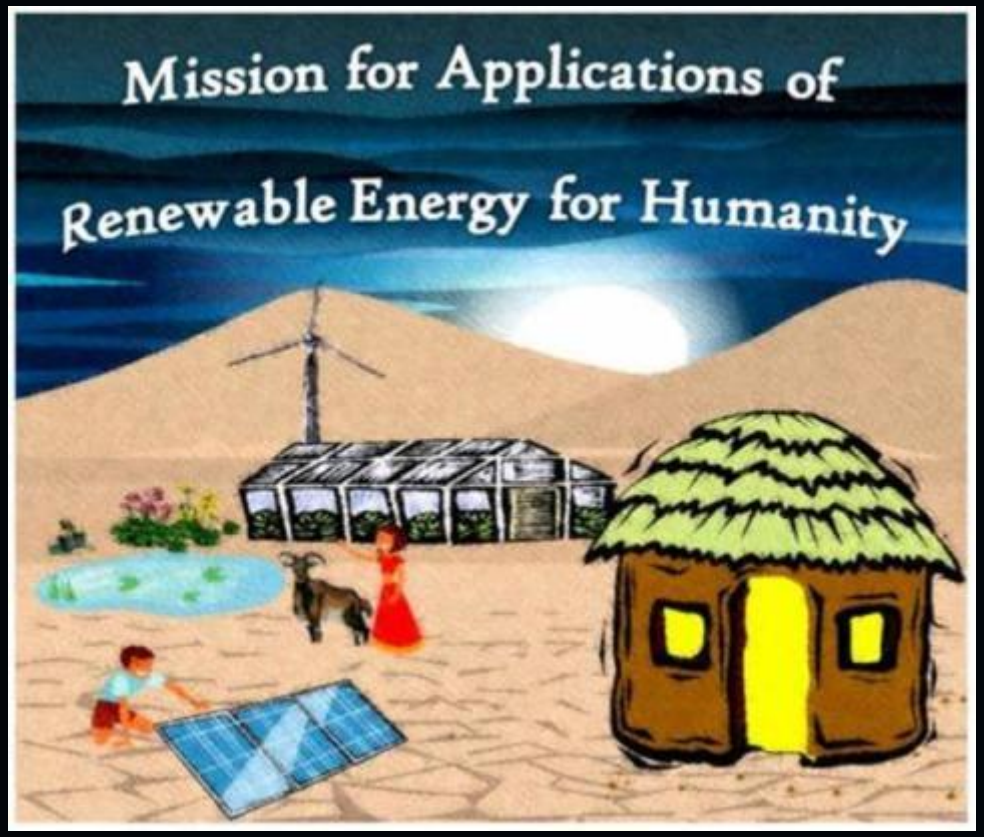

Waste Water and Municipal Waste to Biogas Renewable Power Technologies Overview

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Waste Water and Municipal Waste to Biogas Renewable Power Technologies

A Public Service Presentation

prepared for

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Energy Efficiency Management For a Cleaner and Brighter World

Mission for Applications of Renewable Energy for Humanity

Waste Water and Municipal Waste to Biogas Renewable Power Technologies

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Background

- The Pueblo of Zuni currently has 200 acres set aside for a system of 12 Waste Water Lagoons.
- Operating and maintaining these lagoons and associated waste water treatment facilities is costly and burdensome to the community budget.
- Pumping water from the lagoons to use in local agricultural fields requires energy that is costly either in fuel costs and/or renewable equipment capital costs and life-cycle costs.
- The Pueblo of Zuni could actually profit from their liquid and solid waste treatment by replacing their existing systems with modern waste-to-energy turn- key systems and create local jobs from supplemental aquaculture associated with the proposed waste-management system upgrades.
- Life-cycle costs analyses show that even when replacing newly installed older technologies with waste-to-energy system a significant ROI is achieved.

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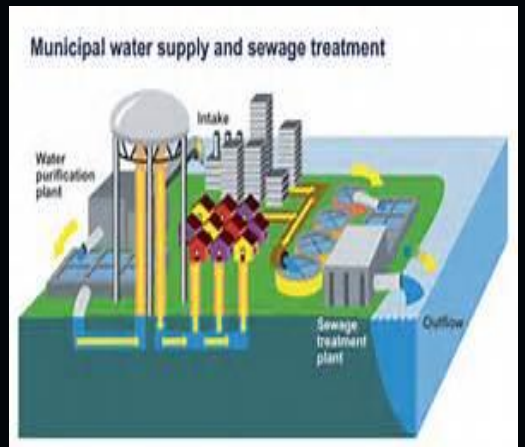
Waste Water and Municipal Waste to Biogas Renewable Power Technologies

Introduction

- Todays municipalities face a variety of waste problems from house hold garbage, trash, and sewage to industrial, commercial, and agricultural wastes.
- Many of these waste products are mixed into municipal sewage systems in a complex and toxic mixture of water born waste products.
- Handling the ever increasing volume of toxic and highly hazardous waste water is becoming more and more unaffordable for many communities, especially smaller rural communities with limited tax revenues.



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Waste Water and Municipal Waste to Biogas Renewable Power Technologies

The Problem

- Municipal Waste is a problem for communities that is growing in complexity of materials to be handled and costs to safely handle the waste.
  - Volume of waste is Increasing
  - Types of waste products is diversifying
  - Costs of safe treatment is skyrocketing
  - Environmental regulations are stricter
  - Tax revenues are decreasing
  - Fee increases are harder to implement
  - The public and environmental organizations are demanding municipalities to fix the problem now!

Traditional Waste Water Lagoons

- Handling of Municipal waste water and solid biomass wastes has become a more complex and increasingly costly endeavor for communities.
- Traditional methods of treating waste water using sewage lagoons can create environmental, land use, human safety, and budgetary challenges.
  - Gray water disposal
  - Pharmaceutical and Heavy Metal laded solids disposal
  - Potential Raw Sewage Leakage Hazards
  - Requires Extensive Land Use
  - Human and wildlife potential safety hazards

Traditional Waste Water Lagoons (Cont.)

- Traditional Waste Water Lagoons provide an solution for sewage water but do not address unsightly and costly dry biomass waste hazard problems faced by communities.
- Community generated biomass materials are comprised of biodegradable wastes such as:
  - Food waste from homes and businesses
  - Yard wastes like grass clippings, leaves, and trees
  - Construction wastes such as wood and cardboard
  - Paper waste from homes, restaurants and businesses

Traditional Waste Water Lagoons (Cont.)

- Most rural and even many urban communities have a variety of agricultural operations for raising livestock operating within their region.
- Animal waste products from these operations are generally treated by spreading them raw directly on fields or storing them for extensive periods in tanks above ground or even worse in open lagoons, where it contaminate ground water supplies
- Animal waste can releases obnoxious and harmful fumes and greenhouse gases into the environment

Traditional Waste Water Lagoons (Cont.)

- Traditional Waste Water Lagoons are more then a pit for waste water they are a highly inefficient and environmentally unsustainable money pit.
- Traditional Waste Water Lagoons are costly drain on tax revenues to build, operate, and maintain.
- Traditional Waste Water Lagoons with toxic chemicals, pharmaceuticals, and deadly pathogens are a potential environmental disaster waiting to happen to a community at any time.

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There is a better environmentally safe and economical solution!

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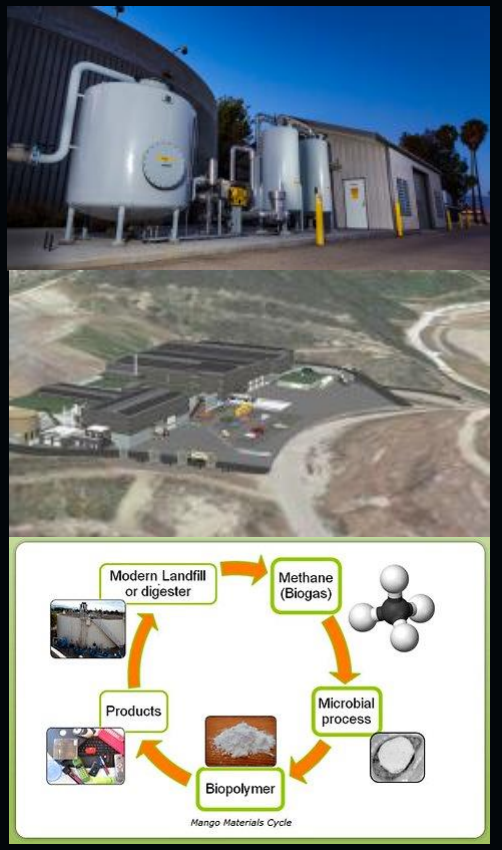
Waste Water and Municipal Waste to Biogas Renewable Power Technologies

Waste to Environmentally Sustainable Biogas and Cash

- Today municipalities are abandoning their obsolete and potentially damaging waste water lagoons and other treatment plants for environmentally friendly and profitable biogas producing waste-treatment plants.
- Biogas generating waste-treatment facilities can turn waste water, solid biomass waste, and plastics into:
  - Environmentally safe biogas that can be used to operate municipal electrical plants
  - Safe reusable compost materials
  - Materials for making environmentally safe biodegradable plastics for consumer use.

Waste to Biogas Technologies

- Three primary waste to biogas technologies encompass the three primary waste management problems for municipalities.
  1. Liquid waste (sewage) from residential, commercial, and agricultural sources
  2. Solid biomass wastes such as, grass and leaves, manure, waste food products, and wood products such as chips, mulch, construction wood residues, etc.
  3. Plastics of virtually all types, even those not normally considered recyclable can be converted to biogas, vehicle fuels, and raw ingredients for new biodegradable plastic



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Waste Water and Municipal Waste to Biogas Renewable Power Technologies

1) Waste Water Treatment to Biogas Plants

- Modern State-of-the-Art waste water digester plants can cleanly and safely convert municipal, commercial, and agricultural waste water into clean biogas and compost.

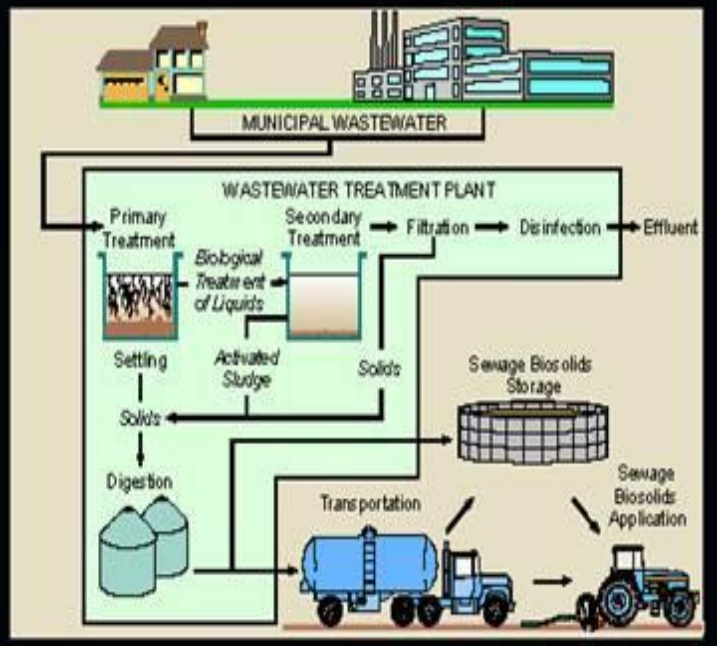
Enclosed waste water treatment plants are environmentally safe and clean

1.2 MW DFC1500 fuel cell power plant

Clean water & environmentally safe communities

Waste Water Treatment to Biogas Plants (cont.)

- **Biogas is a Cost Effective Replacement for Existing Waste Water Treatment Systems**
- Energy efficient system upgrades have regularly been shown to be so cost effective that replacing even recently acquired older technology systems has proven to:
  - **Reduce operating cost** enough to pay for the upgrades in just a few years
  - Turn cost centers into **revenue generation** centers
  - Generate **new revenue** streams
  - **Reduce** environmental protection costs
  - **Eliminate/Reduce** municipal facilities electric and heat/cooling energy costs



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Waste Water Treatment to Biogas Plants (cont.)

- Converting municipal waste water to biogas and compost while making the water environmentally safe is scalable to fit the needs of the municipality.

1.5 MW Biogas Renewable Cogen Plant for a Wastewater Treatment Plant - City of Oceanside, CA

200 kW Digester Gas-Fired Cogen Plant for a Wastewater Treatment Plant - Burlingame, CA

Back River Wastewater Treatment Plant, treats some 180 million gallons of wastewater everyday, producing some 3.1 MW of electricity - Baltimore, MD

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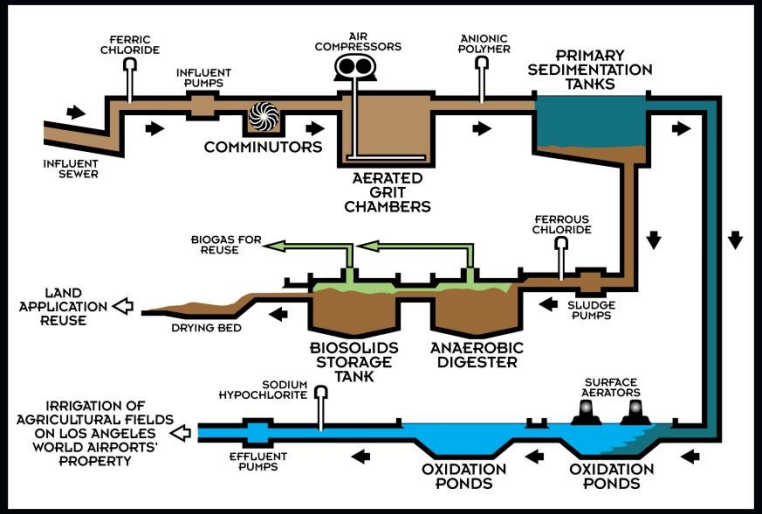
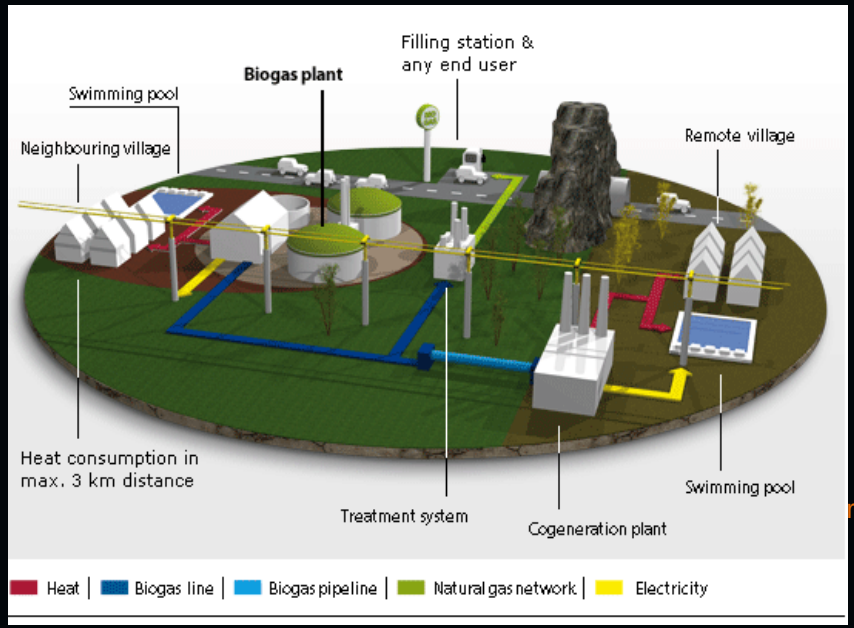
Waste Water Teatment Biogas Plants (cont.)

- Converting municipal waste water into clean burning biogas for electricity and heat/cooling is a proven technology that is available to municipalities as completely turn-key systems ready to run to produce electricity, clean treated water, and agricultural quality biomass products, all while eliminating slightly and environmentally unfriendly waste lagoons and other treatment facilities.



Municipal Waste Water to Biogas process overview



2) Solid Biomass to Biogas Facilities

- Modern State-of-the-Art solid waste digester plants can cleanly and safely convert municipal, commercial, and agricultural Biomass into clean biogas and compost.

Tajiguas CA, Biogas facility, by Bekon, will process 75,000 tons of biomass a year.

Ready to use organic compost

Fuel-Cells turn solid waste into clean energy

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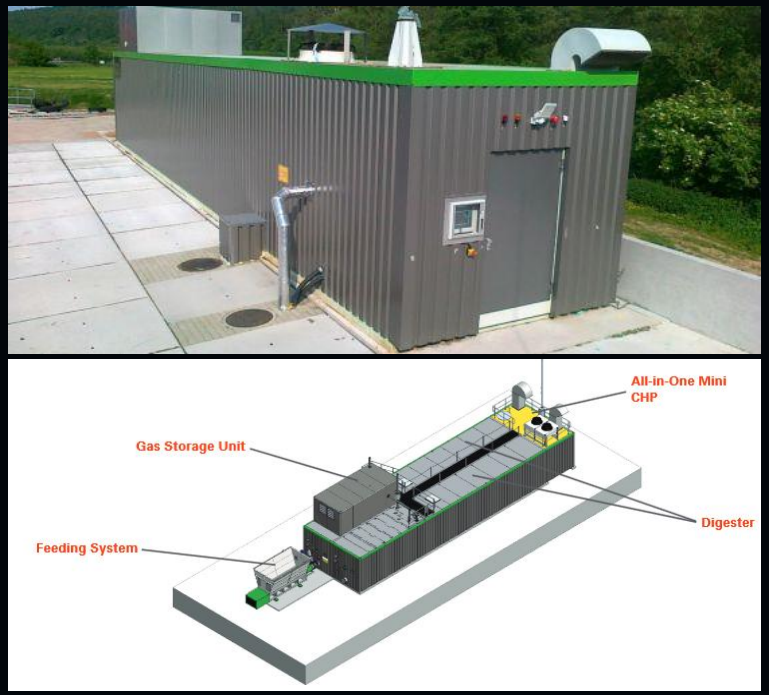
Solid Biomass to Biogas Facilities (cont.)

- While solid biomass to biogas generators come in sizes from individual home size, to farm size, to municipal size treatment plants, whole communities can benefit from the economies of scale associated with continuous operations of a municipal size biomass to biogas facility

The Community benefits from a Municipal Biomass to Biogas Plant



Scalable Small-Scale self contained Biomass Digester and Combined Heat and Power Units (CHP) by EUCOlino

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Solid Biomass to Biogas Facilities (cont.)

- Biogas from liquid or solid waste can be easily and cheaply processed onsite to Bio-Methane, a product that can be directly injected into the commercial natural gas grid. Making it easily distributable to the community through existing gas line network or use locally to power agricultural, personal, or commercial vehicles.

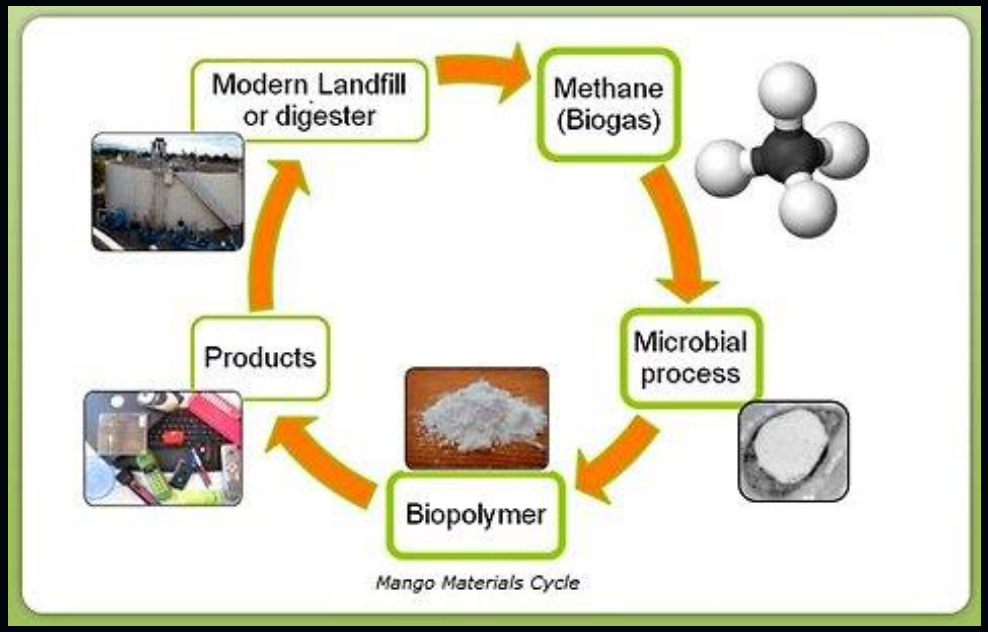
Independent Energy Islands with Biogas!

Locally produced Biogas helps to make a community an independent energy island.

Bio-methane from biogas can be injected into the gas grid or used for vehicle fuel as Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG). - Carbotech

3) Plastic to Reclaimed Fuels Facilities

- Plastic bottles, food and product wrappers, shipping materials, Styrofoam, plasticulture, and many other plastic products are disposed into landfills daily. These plastic items, many not recyclable by traditional means, can easily be converted into a variety of clean fuels and environmentally safe products.



Plastic can be converted to fuel for homes and vehicles in modern facilities like these plant built by Cynar Technology, Spain (top) and Envion Oil, Maryland, USA, (bottom).

Plastic to Reclaimed Energy Facilities (cont.)

- Plastics of almost all types and conditions can be recycled into reclaimed energy safely and environmentally friendly.
- Unlike recycling for reuse in recycled plastic products, which can only accept certain qualified plastics, recycling plastics into reclaimed energy can use any plastic, to make environmentally safe and clean fuels.

Reclaimed liquid fuels containing less than 16 ppm of Sulphur in comparison with the maximum of 30,000 ppm allowable in mainstream fuels - plastic2oil.

Waste Plastics can be gasified and burnt directly with eco-friendly systems such as this EcoClean Burner, or compressed for use in gas turbines to power generators.

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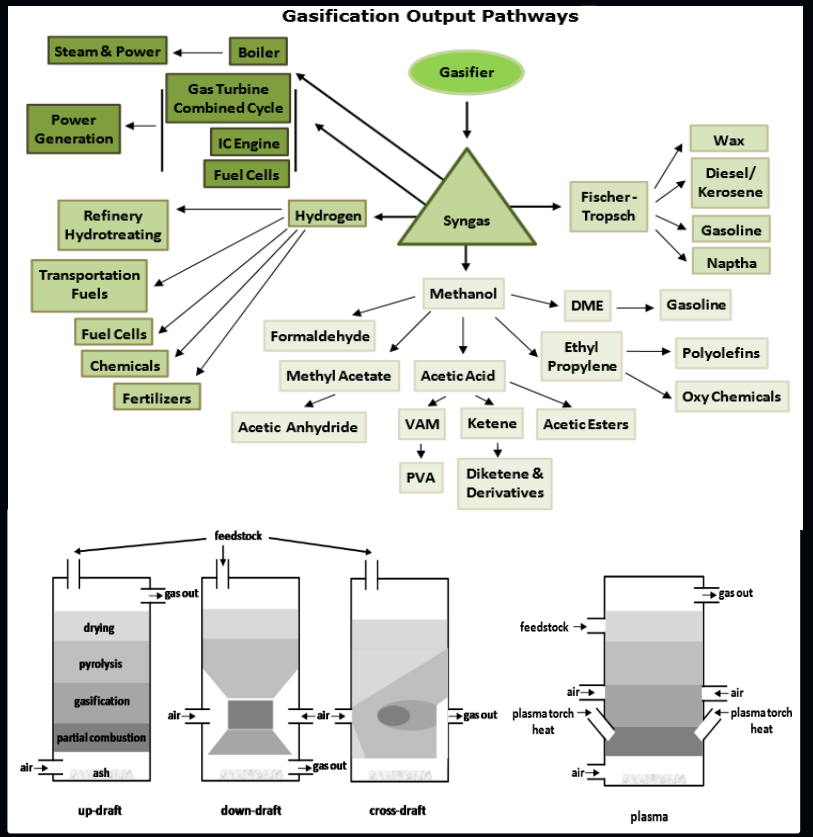
Plastic to Reclaimed Energy Facilities (cont.)

28.9 million tons, 85.5% of recyclable plastic is thrown away = 1.5 billion gallons of fuel

- In addition to plastics of all types, plastic gasification facilities can utilize all of the following materials to create a variety of profitable and environmentally friendly products.

- Waste Wood
- Wood Pellets and Chips
- Aluminum Wastes
- Industrial Wastes
- Municipal Solid Waste (MSW)
- Refuse-Derived Fuel (RDF)
- Auto-Shredder Residue (ASR)
- Coal
- Petroleum Coke
- Agricultural Wastes
- Grasses
- Corn Stover
- Crop Residues
- Mill Waste
- Sewage Sludge
- Black Liquor



Financing

Direct Financing:

- Municipalities can issue bonds to finance projects

Grants:

- Municipalities can obtain state and/or federal grant funding to finance projects

Power Purchase Agreements (PPAs):

- A Municipality can enter into long-term power purchase agreements who will finance, build, and operate the facilities.
- The municipality agrees to buy back the power from the facility at a pre-arranged price per energy unit, over the life of the agreement.

What Next?

Renewable Energy Efficiency Audit

- A renewable energy efficiency audit should be commissioned.
  - Looks at current energy demands and provides low/no cost efficiency measures the community can implement now.
  - Addresses energy efficiency measures that should be implemented along with any waste-to-energy projects, such as, cool roofs, equipment upgrades, lighting upgrades, other renewable projects
  - Outlines an overall architecture for a comprehensive integrated technology Waste-to-Energy plan for the community that is both modular and scalable so that it can adapt to the needs of the community over time.
- Create a committee of key players from the local government and community advocates to review potential solutions and present a formal plan to the local government for action.
- Obtain funding via the approved financing plan to begin building the new waste processing facility.

What About Your Existing Facilities?

- Current structural facilities can either be incorporated into the new system design or operated until the new system comes on line and then decommissioned.
- 200 acres of municipal land now tied up in waste water treatment lagoons will be made available for other community use.
  - Some lagoons may be maintained to conduct final filtration/holding of treated water for use in agriculture or other community approved uses.
  - Lagoons no-longer required for water treatment can be cleaned and sanitized for other aquatic uses.
    - Aquaponics - various wetland plants and other plants for resale can be raised by a community owned and operated not-for-profit company.
    - Aquaculture - Lagoon based aquiculture is an ideal configuration for many easy to grow, highly-profitable boutique aquodic species, such as, fresh water prawns, fresh water lobsters, fresh water clams, oysters, mussels, and other select species. Excess heat from the waste treatment facility and passive solar covers can be used to maintain temperatures during the cooler seasons. Project can be operated by a a community owned and operated not-for-profit company. (Municipal Wastewater Aquaculture_EPA600/2-78-110 and Aquaculture Systems for Wastewater Treatement_EPA430-9-80-007)
    - Other Public Use – sufficient clean water for recreational and fishing usage should be available from the treatment system to support adapting some lagoons for this purpose.

Waste Water and Municipal Waste to Biogas Renewable Power Technologies

Summary and Conclusion

Problem:

- Many communities are continuing to employ outdated and costly waste treatment programs for waste water, solid biomass, and plastic recycling.
- Environmental and economic costs are being borne by taxpayers and are burdening already stretched municipal budgets.

Solution:

- State of the art gasification technologies and other energy reclamation technologies are available and affordable today.
- Reclaimed energy from a variety of waste products can pay for treatment facilities in a few years and provide significant positive cash flows over the life of the system.

Conclusion:

- Replacing even newly constructed obsolete-technology-systems now, with positive cash flows to the community, can be significantly cheaper then continued operation of current systems.

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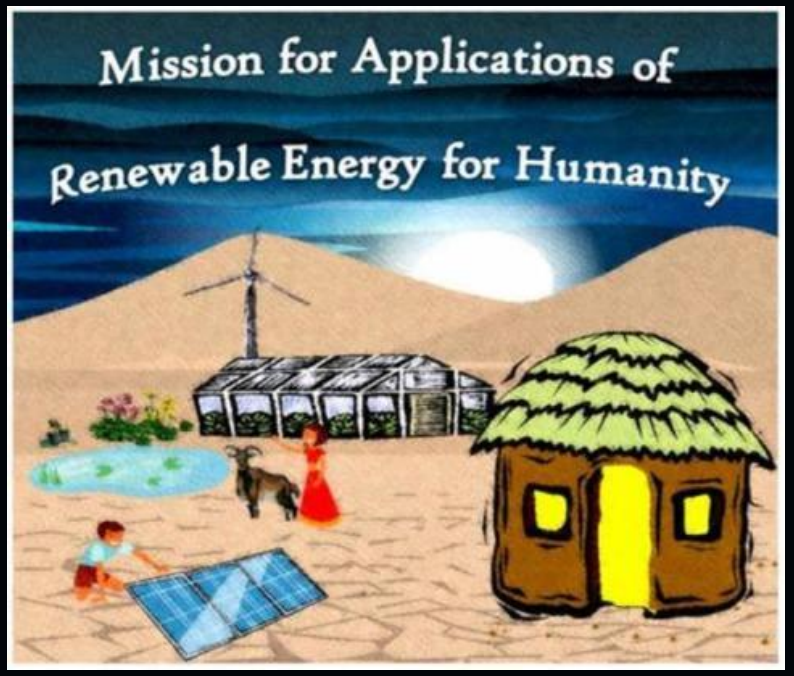
The End



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