WaterSmart Environmental, Inc.

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Press Release

Contact: C. G. Steiner
Phone: 913.897.2727

For Immediate Release
Date: September 5, 2007

Subject: WaterSmart Environmental, Inc. Completes Feasibility Study for BioWastes-To-Renewable Energy, Biofuels, Organic Foods, and Water Independence for the Province of Nova Scotia, Canada.

WaterSmart Environmental, Inc. announces the completion of the feasibility study for the very first wastes-to-**renewable energy** project in Canada. The location is the Province of Nova Scotia on the extreme east coast of Canada. The project consists of the construction of several large buildings that will engage in agricultural production and processing. The project building that will be constructed at Sydney will provide a total solution to the clean up of the Tar Ponds that now contain many years of solids and liquid pollution.

Sydney's Highly Polluted Tar Ponds

The solution consists of the anaerobic digestion of the tar ponds. The biodegradable components will be converted into methane and carbon dioxide gases. The non-biodegradable components will be used as aggregates in the manufacture of precast concrete panels and piping as recycled construction products. The process design is shown on attached WSE Engineering Drawing No. S-5099-1.

WaterSmart Environmental is marketing its Kyoto Protocol compliant wastes-to-energy technology on an economic development platform to concentrated animal feeding operators and to municipalities. Animal farmers benefit by purchasing biodiesel, electricity, and natural gas (methane) at a 20% discount from retail. Municipalities also benefit by making biodiesel, electricity, natural gas, and potable water available to its citizens and businesses at a 20% discount from existing prices. The technology is marketed on a build-own-operate basis thereby eliminating the necessity for local sales and property tax increases since project financing is entirely secured from the financial marketplace. Municipalities that embrace the waste-to-energy technology automatically become zero waste-to-landfill and zero carbon footprint communities.

The waste-to-renewable energy technology has been slowly developed over the last 10 years. It is just now being introduced to the international marketplace. The technology has the clear potential for making every single city throughout the world energy and fuels independent while reducing oil and natural gas imports. The technology will also permit every single city throughout the world to improve water and wastewater treatment infrastructure while creating jobs and investment opportunities. The waste-to-energy technology can also be applied to Sugar Cane Mills as well as Pulp & Paper Mills with equal success. Both types of mills become energy, food, fuels, and water independent while significantly increasing profits from routine operations. In the case of Sugar Cane Mills temporary and seasonal jobs turn into full time better paying jobs. **Widespread use of the technology carries with it the potential for contributing substantially to the reversing of global warming.**

WaterSmart Environmental, Inc. is a provider of waste-to-energy, food independence, water independence, and energy independence technologies and a manufacturer of highly engineered water purification components and systems. The company designs and builds a wide variety of water treatment equipment including packaged water and wastewater treatment plants, UltraPaq™ aerobic package plants, OAT™ Process anaerobic digesters with associated energy production, aerators, filters, PuriSep™ and SmartWater™ oil/water and solids/liquids separators, RainDrain™ perimeter trench sand filters for stormwater runoff, dissolved air flotation separators, air strippers, complete skid assembled aqueous waste treatment plants, FilterFresh™ skid mounted potable water production plants, skid mounted wastewater treatment systems for laundromats, commercial laundries, and car/truck wash facilities with water reclamation and reuse, softeners, demineralizers, activated carbon treatment equipment, and water purifiers for domestic and international markets.

WASTE CRUSHING AND GRINDING BUILDING

CONCRETE WALL PANELS

WASTE MIXING

MUNICIPAL SOLID WASTES

TAR PONDS SOLID WASTES

FERROUS AND NON-FERROUS METALS TO MARKET

FILTERED COMBUSTION AIR

SANITARY WASTEWATER DILUTION WATER

TAR PONDS LIQUID WASTES

BIODIESEL PROCESSING WASTES

STEAM CONDENSATE

TO ENCLOSED MICROALGAE PHOTOBIOREACTOR

STEAM

STEAM TURBINE ELECTRIC POWER GENERATION

STEAM BOILER

MEMBRANE DEAERATOR

OVERFLOW

FINISHED WATER QUALITY

TDS < 50 mg/L
BOD < 1 mg/L
COD < 1 mg/L
TOC < 1 mg/L
TSS < 1 mg/L
NPK < 1 mg/L
TC < 1 MPN/100mL

TO SURFACE WATER DISCHARGE

EXHAUST GAS

MICROALGAE GROWTH NUTRIENTS

CONCENTRATION LOOP

TO ENCLOSED MICROALGAE PHOTOBIOREACTOR

BIODIESEL

BIOLUBRICANTS™

SUPERBIODIESEL™

TO MARKET

TO MARKET

CLOSED MICROALGAE PHOTOBIOREACTOR

EQUALIZATION AND FEED TANK

™ ANAEROBIC DIGESTER
U.S. Patent No. 5,630,942

TO MARKET

DIGESTATE

CEMENT MANUFACTURING

CONCRETE WALL PANEL MANUFACTURING

REV.	DATE	DESCRIPTION	BY	CHK

DO NOT SCALE DRAWING. USE DIMENSIONS ONLY.

WaterSmart Environmental, Inc.
Post Office Box 26346
Shawnee Mission, Kansas 66225-6346

TITLE: BICYCLE™ PROCESS

JOB: TAR PONDS TREATMENT AND SITE REDEVELOPMENT

SCALE: NONE | DRAWN: B.E.H. | DWG. NO.: S-5099-1

DATE: 9/5/07 | CHECKED: C.G.S.

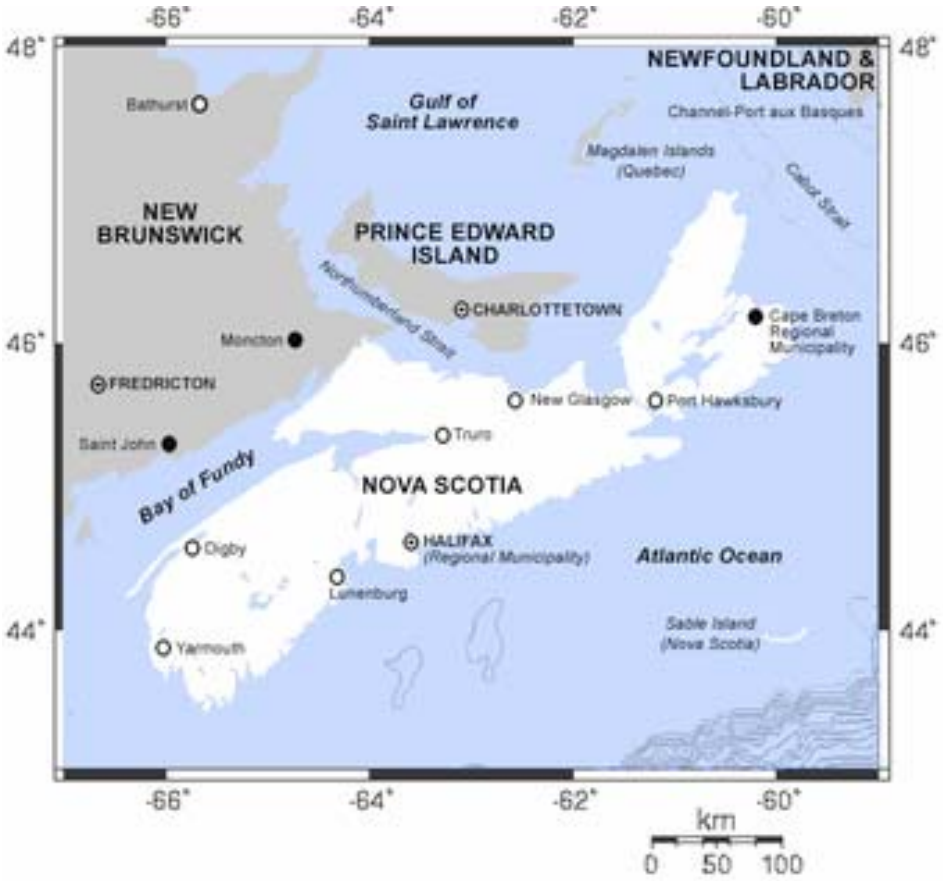
Plot Date 9-5-07/1500 Plot Scale 1=1 Produced On AutoCAD Release 2000i

PROPRIETARY AND CONFIDENTIAL

F E A S I B I L T Y S T U D Y

Province of Nova Scotia, Canada

BioWastes-To-Renewable Energy, Food, Biofuels, and Water Independence



WaterSmart Environmental, Inc.

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A CHP Partner, an AgSTAR Ally, and Members of ACORE, AWWA, and WEF.

September 5, 2007

Subject: Kyoto Protocol Compliant BioWastes-To-Renewable Energy, Food, Biofuels, and Water Independence Project Description

Technology Provider: *WaterSmart Environmental, Inc.*

Project Developer: *WaterSmart Environmental, Inc.*

Dear Investor:

A much needed economic development initiative is designed to achieve renewable energy independence for the Province of Nova Scotia, Canada through waste-to-renewable energy. The technology also achieves food, biofuels, and water independence as well. A total of 26 project buildings will be constructed that will house agricultural production and processing facilities. One of the project buildings will engage in the manufacture of self-biofueled concrete ships, self-biofueled trains & locomotives, and tidal generators to produce additional revenue. The waste-to-energy technology has been favorably reviewed by both the Food and Agricultural Organization of the United Nations and the World Bank.

The renewable energy technologies include agricultural farming and processing, the generation and distribution of electricity, the production and distribution of renewable natural gas, the production and distribution of potable water, the treatment of sanitary wastewaters, and the total management of solid wastes all of which in full accord with Kyoto Protocol on climate change.

The exportable food products produced by the technology consist of tilapia fish and pork. Additionally, liquefied nitrogen will be exported to the chemical processing industries. The domestic products produced consist of electricity, water, and the biofuels of biodiesel and compressed natural gas (CNG). The tilapia and pork will be produced 100% organic. The tilapia fish will also be certified as mercury free.

The water produced will be of reverse osmosis (RO) quality associated with bottled water. It will be distributed free of charge to end users. The waste-to-energy technology will be treating sanitary wastewaters at no charge. The waste-to-energy technology will be accepting municipal solid wastes (MSW) and other wastes at no cost to the waste generator. The waste to energy technology will be producing and retail selling electricity at the discounted price of US$0.045/kWh. Revenues from the distribution of potable water, the treatment of sanitary wastes, and the acceptance of MSW are not necessary as the technology's IRR without these revenue sources remains in excess of fifty percent. A full fifty percent of the annual profits produced by the technology will be donated to the communities served.

The project will be implemented in two phases. The first phase consists of the construction of project buildings that measure 1 km x 1 km x 3 story high precast concrete buildings. These buildings will engage in pig farming, tilapia fish production, and biofuels production. The biofuels consist of renewable natural gas and biodiesel. Most of the processed pork and tilapia fish will be sold to export commodity markets. Spirulina microalgae farming will also be accomplished with some of the microalgae converted into biodiesel biofuel and the balance used a fish and pig feed. All of the wastes associated municipal solid waste management and the treatment of food production and processing wastes will be accomplished through anaerobic digestion to produce methane and carbon dioxide gases. Some of the methane will be converted into electricity with the balance sold as CNG biofuels.

Each of these seven building will employ about 1,500 full time workers in a variety of unskilled, skilled, and managerial jobs. The first jobs will be associated with construction and as building construction is nearing completion the jobs will be replaced with agricultural based jobs utilizing the same employees.

The second phase of the project will consist of adding stories to the existing buildings. The added stories will engage in the agricultural activities consisting bananas, beef cattle, black bass, cassava, coffee, cotton, corn, lobster, prawns, rice, sugar cane with white sugar refining, shrimp, sweet potatoes, and trout. The second phase will also include the construction of concrete freeways (not tollways) that will connect all of Nova Scotia's major and minor communities. The freeways will also include a light rail transit system common to the major cities of the world. The second phase of the project will be internally funded from the first phase revenues. Estimated time to complete the entire makeover of Nova Scotia's economy is estimated at only 5 years.

As the second phase becomes reality existing outdoor agricultural activities will gradually occur indoors where much greater productivity can be achieved while accomplishing total waste treatment. During the second phase the light rail transit system will gradually become operable for the entire province. This system will be implemented and donated to the public thereby enabling free transportation for everyone throughout the entire provincial area served.

The sharing of profits with the communities will enable each to implement community projects that have heretofor been postponed due to lack of funding. The inexpensive electricity will be highly appreciated by those interested in starting or further development of their business interests. Inexpensive electricity always supports industrial development. The free processing of sanitary wastewaters and municipal solid wastes also helps industrial development.

The shipbuilding/shipbreaking project building will be constructed in the Halifax/Dartmouth greater metropolitan area. This facility will engage in the manufacturing and construction of self-biofueled concrete ships, self-biofueled trains & locomotives, and the construction of tidal generators. Information on all three activities is contained within the feasibility study.

The economic development impact on the Province of Nova Scotia will be immediate and immense. In addition to significant economic development the project also fully qualifies as a humanitarian project in that it provides for the health, education, and housing of its employees, provides employment for the unemployed and underemployed, distributes clean drinking water, provides food for the poor, combats climate change, gives something back to the world, and enhances the lives of others. Your investment interest is hereby solicited. With Warm Regards I am

Very truly yours,

WaterSmart Environmental, Inc.

C. G. (Chuck) Steiner
President and CEO

CGS/mns

enclosures

PROJECT KEY PROFESSIONAL STAFF

Curriculum Vitae

7030

Employee: **C.G. (Chuck) Steiner, BS, JD**

Education

St. John's University, Collegeville, Minnesota. B.S. Degree in Chemistry, 1959

Wm. Mitchell College of Law, St. Paul, Minnesota. J.D. Degree in Law, 1969

Publications

Steiner, C. G., "Take a New Look at the RBS Process, "Water & Wastes Eng., 41, (May, 1979)

Steiner, C. G., "The Biological Approach to the Rotating Disc Process," Presented at the First National Symposium on Rotating Biological Contractor Technology at the Seven Springs Mountain Resort, Champion, PA, (February 4-5, 1980).

Steiner, C. G., "A Primer on Separators and Particle Separation", Pollution Equipment News, Vol.18, No.3, (June, 1985).

Steiner, C. G., "Plate Separation--Budding Conventional Technology?", WATER/Engineering & Management, (March, 1986).

Steiner, C. G., WSE Publication No. 380, "Silica Contamination Removal From Spent Fuel Pools And Refueling Water Storage Tanks At Nuclear PWR Power Generation Plants", (June 1993).

Steiner, C. G., "Advanced Aqueous Waste Treatment Concepts", Presented at the Environmental Management and Technology Conference & Exhibition International at Atlantic City, NJ, (June 9-11, 1993).

Steiner, C. G., WSE Publication No. 394, "A Historical Review of Oil/Water Separator Designs", (March 1994).

Steiner, C. G., WSE Publication No. 796, "Design Manual and Tutorial – Particle/Liquid Separation Systems", (May, 1996).

Steiner, C. G., "Energy From Wastes", Asia Water, (October, 1999).

Steiner, C. G., "Understanding Anaerobic Treatment", Pollution Engineering, (February, 2000).

Steiner, C. G., "Biofuels For Energy Independence", REFOCUS, (March/April, 2003).

Steiner, C. G., "Kyoto Protocol-compliant waste-to-renewable energy with zero air, water, and solids pollution", The Bulletin on Energy Efficiency, (December, 2004).

Steiner, C. G., "Waste-to-Energy Plan", Pollution Engineering, (March, 2005).

Steiner, C. G., "Biodiesel – The Probable Only Fuel of the Future, Renewable or Otherwise", Earthtoys - Emagazine, (October, 2005).

Steiner, C. G., "Economic Development Through Biomass Waste-To-Energy Technology", Earthtoys - Emagazine, (December, 2005).

Steiner, C. G., "Energy Independence For Everyone, To Include Food, Natural Gas, Biodiesel, And Water As Well", The Bulletin on Energy Efficiency, (December, 2005).

Steiner, C. G., "THERE'S GOLD IN THEM THAR WASTE HILLS", Earthtoys - Emagazine, (April, 2006).

Steiner, C.G., "Reversing Global Warming Through A Worldwide Waste-To-Energy Policy", Earthtoys - Emagazine, (October, 2006).

Steiner, C. G., "**SuperGreen** Buildings Technology With Zero Greenhouse Gas (GHG) Emissions To The Environment", Earthtoys - Emagazine, (December, 2006).

Steiner, C. G., "**SuperGreen™**, Self-Fueled, Double Hull, **Dual-Biofuel™** Powered SuperStrong Concrete Barges and Ships That Exhibit Zero Greenhouse Gas (GHG) Emissions and Include Onboard Ballast Water Treatment", Earthtoys - Emagazine, (February, 2007).

Patents

Two-Phase Anaerobic Digestion Process Utilizing Thermophilic Fixed Growth Bacteria (US Patent No. 5,630,942)

Certifications

40 Hour OSHA Course, 1990-1997

Memberships

American Council On **Renewable Energy**

American Institute of Chemist (Professional Chemist - Accredited)

American Meat Institute

American Society for Testing and Materials

American Water Works Association

Global Village Energy Partnership

Incinerator Institute of America, Member T-6 Testing Committee

National Air Pollution Control Association

National Canners Association

USEPA Combined Heat and Power (CHP) Partnership

Wastewater Equipment Manufacturers Association

Water Environment Federation

Experience Summary

Thirty Five years in design, marketing, new product development, plant operation, and general management of water purification equipment manufacturing and supply.

Employment History

President, Chief Executive Officer, and Principal Scientist of WaterSmart Environmental, Inc., a manufacturer of water and wastewater treatment equipment and a worldwide provider of next generation waste-to-**renewable energy** and other climate change technologies.

Chief Process Engineer for Smith & Loveless, Inc., a manufacturer of water and wastewater treatment equipment.

Product Manager for Pielkenroad Separator Company, a manufacturer of particle/liquid separation equipment.

Director of Environmental Services for Geo. A. Hormel & Company with P&L responsibility over its two pollution control equipment manufacturing divisions.

Director of Marketing for Cherne Industrial, Inc., a national supplier of packaged laboratories for the water and wastewater treatment industry.

Director of Environmental Control for Fire Engineers, Inc., a manufacturer of solid waste disposal incinerators.

Department Manager for Twin City Testing & Engineering Laboratories, Inc., a large regional independent testing laboratory.

Chief Analytical Chemist for Federal Cartridge Corporation, a munitions manufacturer.

R&D Chemist for 3M Company, a diversified manufacturer.

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Press Release

Contact: C. G. Steiner
Phone: 913.897.2727

For Immediate Release
Date: June 1, 2004

Subject: Renewable And Sustainable Food & Energy Independence Technologies

WaterSmart Environmental, Inc. announces the scientific development of water and renewable energy independence for the production of food, the generation of electricity, and the manufacture of both biofuels and biolubricants. The technologies do not require governmental subsidies as the economic principles of Natural Capitalism, pioneered by the Rocky Mountain Insititute[1], are applied throughout the entire food and energy independence business models. These technologies may be implemented by every nation on earth without regard to its climate, population, or geographic location. Both technologies utilize massive greenhouses on a distributed basis. All of the wastes generated in food production and food processing are anaerobically digested in order to provide the required heat and electricity to operate the anaerobic digester and associated greenhouse. Because of extremely efficient waste management substantial excess electricity and methane gas are produced and sold to the marketplace on a distributed basis. Every crop that is now grown outdoors may be grown indoors as each of the growth variable of photosynthesis, humidity, temperature, macronutrients, micronutrients, soil pH, plant diseases, pests, and weeds may be precisely controlled. The technologies replace coal fired power plants and electricity distribution grids.

In an expression of its humanitarian values, the company is today donating the Food Independence Technology to both the **Food and Agriculture Organization of the United Nations and the World Bank Group,** simultaneously and independently, for the special purpose of scientifically enabling either or both organizations to implement this grand technology in the impoverished countries of sub-Saharan Africa and South Asia. This quite remarkable science has the ability to completely solve world hunger within 15 years on a sustainable basis and it is this objective we are most interested in supporting with our food independence technology donation.

WaterSmart Environmental, Inc. is a provider of waste-to-energy technologies and a manufacturer of highly engineered water purification components and systems. The company designs and builds a wide variety of water treatment equipment including packaged water and wastewater treatment plants, UltraPaq™ aerobic package plants, OAT™ Process anaerobic digesters with associated energy production, aerators, filters, PuriSep™ and SmartWater™ oil/water and solids/liquids separators, RainDrain™ perimeter trench sand filters for stormwater runoff, dissolved air flotation separators, air strippers, complete skid assembled aqueous waste treatment plants, FilterFresh™ skid mounted potable water production plants, skid mounted wastewater treatment systems for laundromats, commercial laundries, and car/truck wash facilities with water reclamation and reuse, softeners, demineralizers, activated carbon treatment equipment, and water purifiers for domestic and international markets.

[1] www.rmi.org

- 30 -

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Members Water Environment Federation and American Water Works Association

June 1, 2004

Jacques Diouf
Director-General
Food And Agriculture Organization Of The United Nations
Viale delle Terme di Caracalla
00100 Rome, Italy
and
James D. Wolfensohn
President
World Bank Group
1818 H. Street
Washington, DC 20433 USA

Subject: Donation Of Food Independence Technology

Gentlemen:

WaterSmart is a manufacturer of water and wastewater treatment equipment and a provider of waste-to-energy technologies. WSE Publication 198 shows our equipment manufacturing capabilities and BWE Publication 100 explains our waste-to-energy applications in the marketplace.

Our first marketplace waste-to-energy application was the development of a BiowastEnergy Regional Industrial Park business model. If this technology were widely deployed within the United States oil imports would eventually cease. This technology was unsuccessfully donated to the United States for the purpose of improving our national security relative to imported oil. Relevant correspondence is attached.

Our second marketplace waste-to-energy application was the development of energy independence technology utilizing biodiesel as a potential 100% substitute for fossil based fuels and lubricants. This technology was unsuccessfully donated to The Carter Center for the purpose of improving the lives of 25 countries of Jimmy's choosing. Relevant correspondence attached.

Our most recent marketplace waste-to-energy application is the development of **food independence technology** utilizing greenhouse farming coupled with the holistic management of the several associated wastes streams generated. The greenhouses would practice intercropping thus greatly increasing the total food value of each greenhouse facility.

In our study of the food independence business model we concluded that food products produced in countries experiencing hunger would have no significant commercial value in the marketplace because of existing poverty. Since we are marketing food independence technology for profit on a build-own-operate basis, these countries do not represent current market potential. We are therefore quite willing and extremely desirous of donating this technology to both the FAO and World Bank Group, simultaneously and independently, for the purpose of enabling either or both such organizations to implement this grand technology in impoverished countries, namely sub-Saharan Africa and South Asia. The technology has the ability to completely solve world hunger within 15 years on a sustainable basis and it is this objective we are most interested in supporting with our technology donation.

A complete technology information package is attached. Upon study, your engineers and analysts will fully understand the scientific validity of the food independence technology. To the extent that our expertise in the design, fabrication, and/or operation of the digester is desired, it is available at cost. We do not intend to make a profit from our contribution. If others are used for the design, fabrication, and/or operation of the digester, we can also live with that approach. We do, however, have important input on the economical construction of massive greenhouses that we will gladly disclose upon request. Our only agenda is to eradicate hunger on a forever basis. Your acceptance of this donation is solicited.

Very truly yours,

WaterSmart Environmental, Inc.

C. G. (Chuck) Steiner, J.D.
President and CEO

enclosures

CGS/rgh

联合国粮食及农业组织

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE

ORGANIZACION DE LAS NACIONES UNIDAS PARA LA AGRICULTURA Y LA ALIMENTACION

منظمة الأغذية والزراعة للأمم المتحدة

Viale delle Terme di Caracalla, 00100 Rome, Italy

Cables: FOODAGRI ROME

Telex: 625852 FAO I
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Facsimile: +39 0657053152

Telephone: +39 0657051

Our Ref.: IL 2/2 USA

Your Ref.:

- 7 JUL 2004

In reply please mention our subject code ref. and date of this letter

Dear Mr Steiner,

I refer to your letter of 1 June 2004 addressed to the Diretor-General, which has been forwarded to me for reply.

I acknowledge with thanks the very detailed technical material you kindly sent us regarding the various anaerobic treatment processes. I understand that you have also developed a Food Independence Technology utilizing greenhouse farming coupled with the holistic Optimized Anaerobic Treatment Process to manage the associated wastes streams and produce a number of energy, solid, liquid and gaseous products. I am circulating the material to the various services of FAO involved in the very wide spectrum of areas of interest in this technological approach and I am sure they will find it useful and most informative.

Regarding future cooperation between our organizations, may I invite you to visit the web site of our Procurement Service:

http://www.fao.org/unfao/procurement/en/index.html

Details on the way FAO can operate with companies such as yours and on modalities to utilize technological innovations are explained in this site. I hope you find this information useful.

I thank you again for your interest in collaborating with FAO and for your concern regarding poverty in developing countries and congratulate you on your technological research and technological results.

Yours sincerely,

John H. Monyo
Assistant Director-General
Sustainable Development Department

Mr C.G. Steiner, J.D.
President and CEO
WaterSmart Environmental, Inc.
P.O. Box 26346
Shawnee Mission
Kansas 66225-6346
USA

The World Bank
INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

1818 H Street N.W.
Washington, D.C. 20433
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(202) 473-1000
Cable Address: INTBAFRAD
Cable Address: INDEVAS

September 21, 2004

Mr. C.G. Chuck Steiner, J.D.
President and CEO
WaterSmart Environmental, Inc.
Post Office Box 26346
Shawnee Mission, KS 66225-6346

Re: Donation of Food Technology Independence Technology

Dear Mr. Steiner:

We would like to acknowledge receipt of your letter dated June 1, 2004 to Mr. James D. Wolfensohn, President of the World Bank Group, with regards to the above subject matter.

Thank you very much for sharing information on your endeavors in contributing to the challenging goal of solving world hunger on a sustainable basis with us. Indeed this is a wonderful initiative. We will gladly share the technology information package with interested World Bank staff .

Again, thank you for sharing information on this wonderful initiative with us.

Sincerely,

Kevin M. Cleaver
Director
Agriculture and Rural Development

RCA 248423. WUI 64145 FAX (202) 477-6391

Engineering Data Sheet

3315

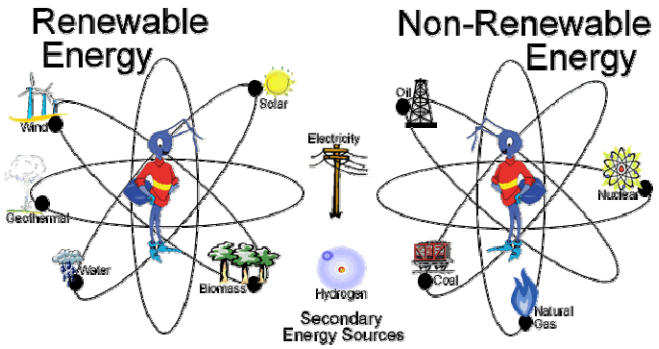
Technology: Renewable Energy

Renewable Energy includes electricity that is produced from sources that replenish themselves naturally such as wind, sunlight (solar), hydroelectricity (dams), heat from our planet earth (geothermal), ocean tides and ocean waves (tidal energy). By comparison, nonrenewable energy consists of burning limited supplies of fossil fuels like coal, oil, and natural gas. Even nuclear energy is nonrenewable energy because its uranium fuel source is nonrenewable. The recent development of the biofuels of biodiesel and compressed natural gas (CNG) also qualify as renewable energy since they are produced from renewable oil (lipid) in the case of biodiesel and renewable wastes in the case of CNG produced through anaerobic digestion.

These renewable sources of electricity and biofuels have less impact on the environment than traditional methods of electricity production and fossil fuels. Natural gas and coal, for example, are not renewable because their use consumes gas and coal reserves at a much quicker rate than they can be replenished. Renewable energy and energy efficiency technologies are key to creating a clean energy future for not only the nation, but the world.

If you're wondering what renewable energy and energy efficiency are all about, you've come to the right place. Renewable energy technologies are a lot friendlier to the environment than conventional energy technologies, which rely on fossil fuels. Greenhouse gases—carbon dioxide, methane, nitrous oxide, hydrocarbons, and chlorofluorocarbons—surround the Earth's atmosphere like a clear thermal blanket, allowing the sun's warming rays in and trapping the heat close to the Earth's surface. This natural greenhouse effect keeps the Earth's average surface temperature at about 60°F (33°C). But the increased use of fossil fuels has significantly increased greenhouse gas emissions, particularly carbon dioxide, creating an enhanced greenhouse effect known as global warming. According to the U.S. Environmental Protection Agency (EPA), carbon dioxide is responsible for one-half to two-thirds of our contribution to global warming. Renewable energy technologies, however, can produce heat and electricity with a very low or no amount of carbon dioxide emissions.

Fossil fuels contribute significantly to many of the environmental problems we face today—greenhouse gases, air pollution, and water and soil contamination—while renewable energy sources contribute very little or not at all. As fossil fuel supplies continue to dwindle all around the world, people have begun looking for new sources of energy. Most people, though, are not satisfied with just any source of energy. Many are aware of the ramifications that burning fossil fuels has had on the environment and are looking to other cleaner sources of energy. But little do people know that renewable sources are all around them. Not only are these sources renewable, they are clean as well. Sources such as the sun, rivers, tides, wind and even the heat from the earth are all clean, renewable sources able to provide nearly limitless amounts of power. Fortunately, though, people are working to improve on current technology so that years down the line, these renewable sources of energy will be cheaper and more reliable than traditional fossil fuel power plants. Energy use from fossil fuels is also a primary source of air, water, and soil pollution. Pollutants—such as carbon monoxide, sulfur dioxide, nitrogen dioxide, particulate matter, and lead—take a dramatic toll on our environment. On the other hand, most renewable energy technologies produce little or no pollution.



What are the most common renewable energy sources?

- **Biomass-To-Energy**
- **Geothermal Energy**
- **Hydroelectricity**
- **Solar Energy**
- **Tidal Energy**
- **Wind Energy**

Biomass-To-Energy – Biomass facilities burn plants and organic matter such as wood, agricultural wastes and/or methane gases from landfills to spin a turbine that generates electricity. Landfill gas is one of the most widely used forms of biomass generation. At those facilities, gases from decomposing organic matter are collected and burned to generate electricity. While biomass-based generation is not entirely pollution free, it does not contribute to global warming.

Geothermal Energy - Geothermal energy is generated by tapping into hot steam that lies beneath the earth's surface and converting it into electricity. It's the same kind of heat that is observable in volcanic activity and geysers. Geothermal energy plants emit very little air pollution and have minimal impacts on the environment. Geothermal power plants use thermal energy from the earth to spin turbines and generate electricity. Three types of geothermal power plants are used worldwide to harness the energy in geothermal resources.

- A **dry steam reservoir** provides steam but little water, and is the least common type of geothermal installation. In this case, steam alone is brought to the surface and used to spin the turbines that produce electricity.

- A **hot water reservoir** contains water that is 350 to 700°F. In this case, power is produced in a "flash" power plant. Hot water comes to the surface through a production well. The water vaporizes ("flashes") into steam in response to the reduced pressure at the surface. The resulting steam spins turbines and generates electricity.

- A **binary power plant** is used in cases where the reservoir contains water between 250 to 350 °F, which is not hot enough to vaporize into steam simply by a pressure change. The hot water is pumped to the surface and passed through a heat exchanger. The heat is transferred to a second (binary) liquid that vaporizes at a lower temperature than water. This vapor is used to spin the turbines that produce electricity.

The advantages of using geothermal power are enormous. Geothermal power is a clean, inexhaustible source of energy. The technology for drilling and production is mature, efficient and well researched. Geothermal power is a clean energy source and doesn't produce emissions or pollutants. The amount of land needed to build geothermal power stations is small, which limits their environmental impact.

Geothermal plants are also fairly reliable and run 24 hours a day regardless of weather or natural disaster. In addition, the plants can provide an economic boon to the local community because they use an indigenous resources rather than sending dollars elsewhere to purchase fuel. Geothermal energy is a domestic energy resource with cost, reliability and environmental advantages over conventional energy sources. Geothermal energy contributes both to energy supply, with electrical power generation and direct-heat uses, and to reduced energy demand, with savings in electricity and natural gas through use of geothermal heat pumps to heat and cool buildings. Only a small fraction of our geothermal resources are in use today. Much more could be brought on line in the short term with appropriate incentives.

Hydroelectricity – Hydroelectric power provides about twenty percent of the world's electricity. Hydropower relies on the energy contained in moving water to generate electricity. The most common type of hydroelectricity plant is a dam placed on a river to form a reservoir. Water from the reservoir flows through a passage containing a turbine and the water causes the turbine to spin, which controls a generator that produces electricity. This type of plant is called an **impoundment facility.**

The dam allows operators to control the amount of water they release, thus meeting changing electricity needs. Pumped storage facilities consist of two reservoirs. The second stores water that can be released back into the first when the demand for electricity is high. A *diversion* or "run of river" plant is built on a river and the water from the river flows through a canal containing turbines, turning the turbines to generate electricity. This type of plant does not require a dam, which reduces the environmental impact of the installation. A disadvantage to the diversion plant is that operators cannot control the amount of water flowing through the plant at any given time.

Once a dam has been built, its operation costs are virtually nil. A dam requires no fuel other than water, and produces no waste or pollution. A dam creates a constant source of power that is more reliable than wind or solar power. Water can be stored in reservoirs, enabling operators to meet peak electricity demands quickly. Once the facility is built, hydroelectric energy is a renewable, clean resource with a huge potential.

Solar Energy – Sunlight can be converted to electricity directly through photovoltaic (PV) applications, which are semiconductors that directly generate electricity, and other CSP method it can be converted indirectly with solar thermal applications, which use the sun to create steam to turn a turbine or generator. The sun provides the earth with a tremendous amount of energy every day. Solar energy is the cleanest and most inexhaustible of all known energy sources. Solar radiation is the heat, light and other radiation that is emitted from the sun. Solar radiation contains huge amounts of energy and is responsible for almost all the natural processes on earth. The sun's energy, although plentiful, has been hard to directly harness until recently. This energy can be harnessed and used to generate electricity, produce space heating and cooling, heat water and provide lighting for homes and businesses. Concentrating solar power systems use mirrors to focus solar energy on a point or tube. Three types of concentrating solar systems have been invented:

- A **parabolic-trough system** uses a U-shaped mirror to concentrate solar energy on absorber tubes, where it heats a fluid. The heat in the fluid is then used to power a generator and produce electricity.

- A **dish/engine system** uses a parabolic dish-shaped mirror to concentrate solar energy on a receiver. The solar energy heats a fluid, which is used to generate electricity in a small engine attached to the receiver.

- A **power tower** uses a field of tracking mirrors to concentrate the sun's energy on a receiver at the top of a tower. The solar energy heats a fluid—molten salt, in the case of the Solar Two installation in California. The heat stored in the salt generates electricity using a steam generator.

The sun has produced energy for billions of years. Solar energy is the solar radiation that reaches the earth. Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to the different wavelengths of the solar spectrum. When photons strike a photovoltaic cell, they may be reflected, pass right through, or be absorbed. Only the absorbed photons provide energy to generate electricity. When enough sunlight (energy) is absorbed by the material (a semiconductor), electrons are dislodged from the material's atoms. Special treatment of the material surface during manufacturing makes the front surface of the cell more receptive to free electrons, so the electrons naturally migrate to the surface.

Tidal Wave Energy - Tides result from the gravitational pull of the moon and sun on the ocean, which produces predictable movement of huge amounts of water twice each day. The equipment used to harness tidal power is very similar to hydroelectric power plants. A huge dam, called a **barrage**, is built over a river estuary. The water moves in and out with the tides, traveling through tunnels in the dam and turning turbines that are connected to generators that produce electricity. The main difference between tidal power stations and hydroelectric stations is that the water flows in two directions in the tidal power station. This is known as an **ebb generating system** and generates electricity from both incoming and outgoing tides.

Tidal power is a renewable resource that produces no pollution. The tides are predictable phenomena, occurring daily and on a regular schedule, and providing a reliable if intermittent source of power. Water is a free resource, and after the installation is built and paid for, it can be operated virtually indefinitely without additional costs. Tidal power has a positive effect on the environment in the long run by helping to reduce the demand for fossil fuels and nuclear energy. Further research must be done in this area, but there is no doubt that tidal power will prove to be a significant source of energy in the future.

Tides are caused by the gravitational pull of the moon and sun, and the rotation of the earth. Near shore, water levels can vary up to 40 feet. Only about 20 locations have good inlets and a large enough tidal range--about 10 feet--to produce energy economically. The simplest generation system for tidal plants involves a dam, known as a barrage, across an inlet. Sluice gates on the barrage allow the tidal basin to fill on the incoming high tides and to empty through the turbine system on the outgoing tide, also known as the ebb tide. There are two-way systems that generate electricity on both the incoming and outgoing tides.

Tidal barrages can change the tidal level in the basin and increase turbidity in the water. It can also affect navigation and recreation. Potentially the largest disadvantage of tidal power is the effect a tidal station can have on plants and animals in the estuaries.

Tidal fences can also harness the energy of tides. A tidal fence has vertical axis turbines mounted in a fence. All the water that passes is forced through the turbines. They can be used in areas such as channels between two landmasses. Tidal fences have less impact on the environment than tidal barrages although they can disrupt the movement of large marine animals. They are cheaper to install than tidal barrages too. A tidal fence is planned for the San Bernardino Strait in the Philippines.

Tidal turbines are a new technology that can be used in many tidal areas. They are basically wind turbines that can be located anywhere there is strong tidal flow. Because water is about 800 times denser than air, tidal turbines will have to be much sturdier than wind turbines. They will be heavier and more expensive to build but will be able to capture more energy. Ultimately, renewable energy technologies could help us break our conventional pattern of energy use to improve the quality of our environment.

Wind Energy – Wind energy is harnessing the wind to do work. Wind energy is really just another form of solar energy. Sunlight falling on oceans and continents causes air to warm and rise, which in turn generates surface winds. Air has mass, and when it is in motion, it contains the energy of that motion (Kinetic energy). Some portion of that energy can converted into other forms – mechanical force or electricity – that we can use to perform work. The wind has been used by humans for thousands of years, first to carry ships across oceans and, later, to pump water for agricultural and household use and grind grain. In the first half of the 20th century, small wind turbines produced electricity for remote farms and ranches. Today, the wind is being harnessed by large wind turbines to produce electricity on a commercial scale. The new generations of commercial wind turbines are placed on towers at least 40 meters tall. The words “wind energy” or “wind power” describe the process where the wind is used to make electricity.

Wind turbines change the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific things or a generator can turn this mechanical power into electricity to power homes, businesses, industries, schools and collages. Wind power is one of

the most best and cost-effective renewable energy sources available today. In the world there are more than 14,000 megawatts of wind power installed. Wind power plants use large blades to catch the wind, turning rotors that produce electricity.

Just like fossil-fueled plants use steam or gases to turn electricity-producing rotors, wind plants use many wind turbines, often put together on a large single wind site called a "wind farm", to make electricity. There is different type of wind turbines – horizontal-axis wind turbines – in which the axis of rotation is horizontal with respect to the ground (and roughly parallel to the wind stream.), vertical- axis wind turbines – in which the axis of the rotation is vertical with respect to the ground (and roughly perpendicular to the wind stream). The output of a wind turbine varies with the wind speed through the rotor.

The modern wind farm can have up to 500 wind turbines connected to the electric transmission grid. Wind turbines begin to make power at about 12 mph wind. Wind plants create electricity only when wind blows, so if the wind is not blowing, the plant is not making electricity. Because of this, wind is called a "recurring resource". Because wind can't be predicted, and because some places have more wind and will produce power more regularly, the value of wind for meeting consumer demand can be high. Also, the recurring nature of wind power does not produce a lot problem for large electric systems as long as wind is a small part of the total system.

Electricity is generated when the wind blows strong enough to spin turbines (windmills) mounted on tall towers. Wind is now the fastest-growing renewable energy source in the world, and its pollution free. Wind generated electricity does not create smog, acid rain or other forms of air and water pollution. Wind energy does not contribute to global warming. Wind energy is one of the most best and cost-effective renewable energy sources available today.

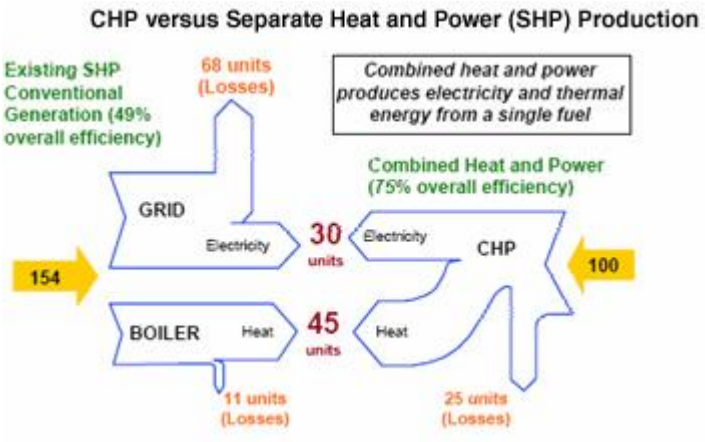
Ultimately, renewable energy technologies could help us break our conventional pattern of energy use to improve the quality of our environment.

Reversing Global Warming Through A Worldwide Waste-To-Energy Policy While Achieving Energy, Food, Fuels, And Water Independence By Utilizing Already Existing And Individually Profitable Holistic Component Technologies

From popular mythology, the ostrich is quite famous for hiding its head in the sand at the first sign of danger. In a *New York Times* story covering the jury instructions in the recent Enron case, the trial judge specifically permitted the jurors to find Messrs. Lay and Skilling guilty of "deliberate ignorance". In legal circles deliberate ignorance is called the "ostrich defense".

In its inaugural 1990 annual report on the "Inventory of U.S. Greenhouse Gas Emissions and Sinks" the United States Environmental Protection Agency (USEPA) listed but a few of the perceived principal sources of carbon dioxide and methane gases. Through perhaps **deliberate ignorance** the USEPA did not include carbon dioxide emissions from some 15,000 wastewater treatment plants. In its most recent 1990-2004 450 page annual report (EPA 430-R-06-002, April 15, 2006), there are over 40 sources of greenhouse gas emissions listed including wastewater treatment plants and even animal farts (scientific term = *enteric fermentation*). The implication that global warming (climate change) is entirely caused by greenhouse gases represents an ostrich defense by past and present administrations to protect the current **energy policy** that includes both coal fired and nuclear power plants.

Combined heat and power (CHP), also known as **cogeneration**, is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source. CHP is not a specific technology but an application of technologies to meet an energy user's needs. CHP systems achieve typical effective electric efficiencies of 50% to 70% — a dramatic improvement over the average efficiency of separate heat and power. Since CHP is highly efficient, it reduces traditional air pollutants and carbon dioxide, the leading greenhouse gas associated with climate change, as well. As seen below, the CHP system can produce the same electrical and thermal output at 75% fuel conversion efficiency as compared to 49% for separate heat and power. This is a 50% gain in overall efficiency, resulting in a 35% fuel savings. **Whenever and wherever higher efficiency is achieved lesser global warming is always realized.**



Fueled by electric industry regulation, environmental concerns, unease over energy security, and a host of other factors, interest in CHP technologies has been growing among energy customers, regulators, legislators, and developers. CHP is a specific

form of distributed generation (DG), which refers to the strategic placement of electric power generating units at or near customer facilities to supply on-site energy needs. CHP enhances the advantages of DG by the simultaneous production of useful thermal and power output thereby increasing the overall efficiency. Whenever overall efficiency is improved in the marketplace there is always a reduced impact on global warming. Through its CHP Partnership program, the USEPA claims that CHP technology can be applied at both central (i.e. coal fired and nuclear power plants) and DG generation applications. Many DG applications have already been implemented in the marketplace but conversion of coal fired and nuclear power plants to cogeneration has yet to be realized. The associated high cost of electricity production at CHP coal fired power plants has been estimated by the USEPA at $1,400/kW, some $400 higher than conventional coal fired power plants. Converting nuclear power plants to CHP has yet to be considered in the marketplace. Because of high costs and other factors there is little likelihood that either coal fired or nuclear power plants will be converted to more efficient CHP technology notwithstanding its quite favorable impact on climate change. Consequently these **central generation plants will continue to increase global warming** for many years to come due to the existing US energy policy.

For starters, the seemingly innocuous **Polar Bear Club** contributes to global warming, perhaps only minimally, but in two distinct ways to disclose the science:

1. By releasing Btus to the environment during their annual outdoor outing to be sure, but including all their outdoor outings throughout the entire year whether wearing clothes or not, and
2. By exhaling more carbon dioxide than the amount inhaled through normal breathing.

In fact, **all humans and animals contribute to global warming by exhaling excess carbon dioxide (font and rear end) and methane gases (rear end) while also releasing Btus to the environment.**

The somewhat plentiful **coal fired and nuclear power plants contribute significantly to global warming** in the following ways:

1. Coal fired power plants release carbon dioxide gas (CO_2), NOx gases, and SOx gases from their discharge chimneys, and Btus from their cooling towers.
2. Nuclear power plants do not release any significant gases but do release massive amounts of Btus to the environment from their large cooling towers.

Btu discharges from humans, animals, coal fired power plants, and nuclear power plants are not accounted for in the EPA reports because gases only are listed. The release of Btus by humans, animals, and power plants has not been quantified by any organization but can be scientifically estimated quite easily by making a few conservative heat loss assumptions. Heated buildings also release Btus to the environment as do holding tanks, elevated pipelines, and a myriad of other structures, none of which have yet been quantified. The total quantity of Btus released to the environment represents a quantity that ought not be ignored in searching for a comprehensive climate change solution. This would be a good task for the USEPA to quantify should it ever be asked to change from a **United States Energy Policy Protector Agency (USEPPA)** to that of an actual **United States Environmental Protection Agency (USEPA).** One only needs to know that there still remain several thousands of acid mine discharges from coal mining activities that have been allowed to

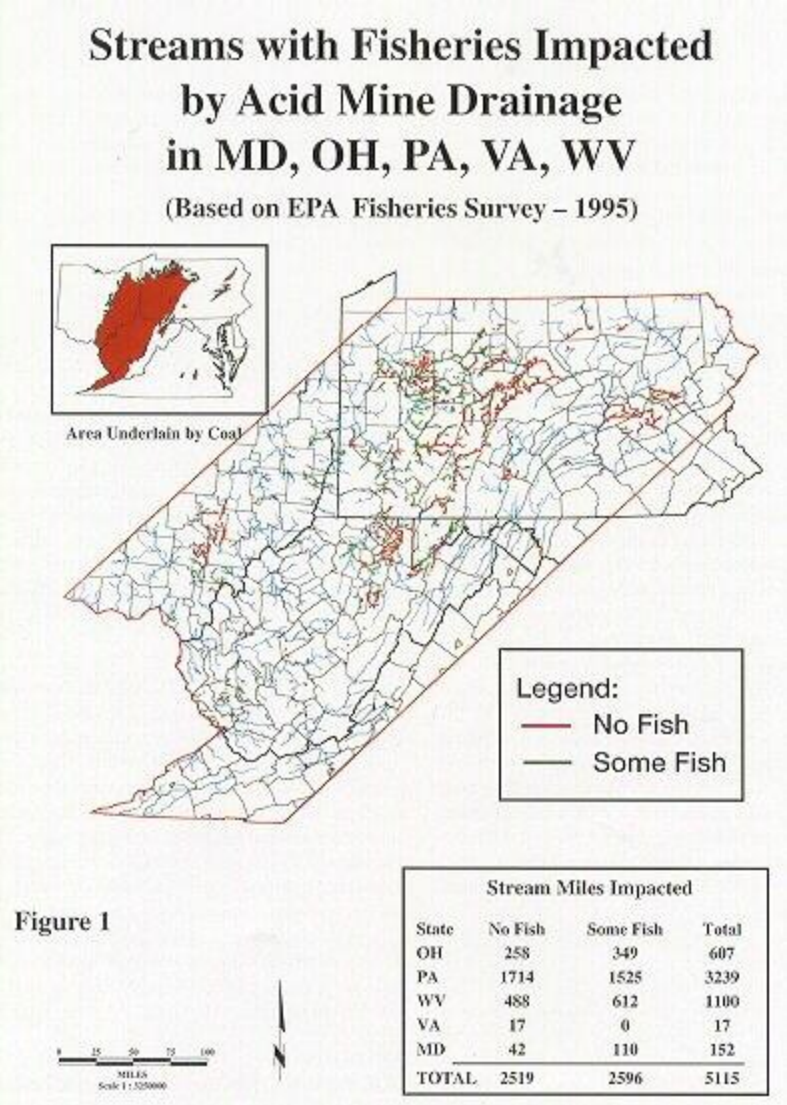


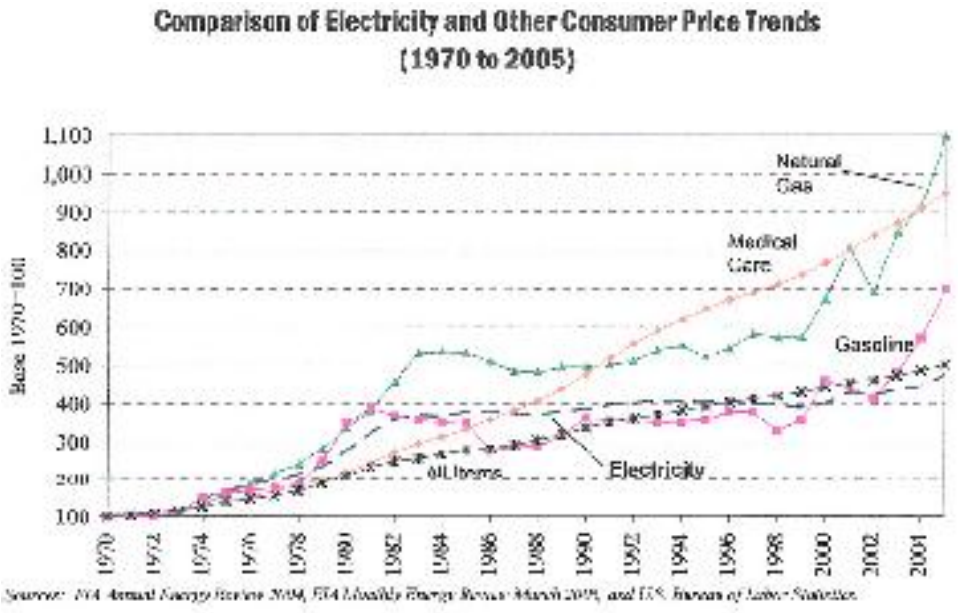
Figure 1

continue their discharges over the last 50 years **without a single stream** undergoing effective treatment. Repeat, **not a single stream**. The USEPPA (aka USEPA) would be happy to correct this assertion if incorrect. According to the United States Geological Survey (USGS), the U.S. Environmental Protection Agency has singled out acid mine drainage as the number one water-quality problem in Appalachia. Estimates place cleanup costs in Pennsylvania alone at around $5 billion. For the last 50 years mercury, sulfur dioxide, nitrous oxide, and carbon dioxide emissions have been permitted at all of our nation's hundreds of coal fired power plants without a single power generation facility having been shut down. Not a single one. It is obvious that the **United States Energy Policy Protector Agency (USEPPA)** (aka USEPA) is doing an excellent job. Gaseous emissions to the environment from coal fired power plants are now being closely monitored. **Btu releases to the atmosphere directly contribute to global warming but heretofore have not yet been considered in the climate change landscape equation.**

The Bush Administration defends its unrestricted CO_2 gaseous emissions policy as helpful to increased crop production. This assertion is scientifically correct and works each and every time there is sufficient rain during the crop growing season. In other words, not a sustainable policy. CO_2 gaseous emissions not utilized by crops due to an ever increasing insufficiency (due to climate change) of timely rainfall (called droughts)

automatically accumulate in the atmosphere to further increase global warming. Increased irrigation practices cannot make up for insufficient rainfall as the supply aquifers are drying up due to excessive long term withdrawals witness the rapidly depleting Ogallala Aquifer (aka High Plains Aquifer) located beneath the eight Midwestern states of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, and Texas. Recently, and rightfully so, CO_2 gaseous emissions from cars, trucks, trains, barges, and ocean going ships have come under global warming scrutiny. The problems keep on coming. Enough mention of these several and growing global warming/climate change problems. Many United States senators, congressmen, individual state governors, and individual city mayors (most notably the Honorable Greg Nickels of Seattle, Washington) have jumped ship from the Bush administration in support of a more effective energy policy. Virtually all of the remainder of the nations of the world already support the concept of a more effective climate change policy and are looking towards the United States for guidance and direct participation, both of which have been and continue to be sadly lacking. Combating global warming also has trans-Atlantic appeal as Britain and California are preparing to sidestep the Bush administration and fight global warming together by creating a joint market for greenhouse gases. British Prime Minister Tony Blair and California Gov. Arnold Schwarzenegger now plan to lay the groundwork for a new trans-Atlantic market in carbon dioxide emissions. Such a move could help California cut carbon dioxide and other heat-trapping gases scientists blame for warming the planet. President Bush has rejected the idea of ordering such cuts.

The administration's very simple energy policy consists of the continuation supply of inexpensive electricity and transportation fuels both of which enable continued expansion of the gross domestic product (GPD) and associated tax revenues. Coal is the highly favored energy source for electricity generation because of its abundant supply and low cost. Nuclear power is also highly thought of but continuing inability to manage nuclear wastes retards further development of this industry. For many years the energy policy has achieved its objective as indicated in the following chart:



In 2002 the policy began to fail due to the combined forces of higher crude oil prices coupled with the disappearance of domestic supplies of inexpensive natural gas. Since 2002 coal prices have increased substantially and climate change considerations have

risen dramatically. The energy policy that has worked very well since 1970 is now dead. Although the US still has significant deposits of natural gas, it is far more expensive to extract than the natural gas extracted to date. In other words, all the cheap gas is now gone. Natural gas comes from:

- Most (84 percent) of the natural gas consumed in the United States is produced in the U.S. Canada provides much of the rest (13 percent), with 3 percent imported as liquefied natural gas (LNG).
- Production from the lower-48 states will remain the largest component of U.S. natural gas supply, but producers will be challenged to keep production between 18 and 19 quadrillion Btus per year. Canadian exports are expected to fall from 3.3 quads annually to 2.3 quads by 2020.
- In Alaska, huge quantities of natural gas found in the North Slope region are only the tip of the iceberg in terms of the state's total natural gas resources, but these supplies will remain stranded there until an Alaskan natural gas pipeline is built.
- Imports of LNG will continue to rise – growing from 3 percent of U.S. natural gas supply in 2003 to 22 percent in 2020.best energy value.

Since 1999, residential natural gas prices in the United States have exhibited an overall increasing trend. The 2004 national average residential price of $10.74 per 1000 cubic feet (Mcf) exceeded the 1999 average price by more than $4/Mcf. The price of natural gas will continue to increase because of the reliable marketplace laws of supply and demand. The price of coal historically follows in lock step with other energy sources. Since 1999 its price has also increased proportional to the corresponding increase in natural gas prices. The administration plans to import significant liquefied natural gas (LNG) from Asia to help the natural gas supply situation in the United States. Additional LNG terminals are now being built as we speak. Inexpensive natural gas disappeared about 5 years ago. At that time 100% of anhydrous ammonia fertilizer was produced within the United States. In 2005, imports from Asia accounted for over 85% of the anhydrous ammonia during which time continuing price increases of the fertilizer have occurred in the agricultural marketplace. Higher prices of natural gas caused the disappearance Farmland Industries, the largest cooperative in the world, because of their total reliance on inexpensive natural gas in their business model. Because of the limited worldwide supply of crude oil its cost will continue to increase because of the ever reliable laws of supply and demand. Perhaps our Asian friends won't notice the laws of supply and demand…duh.

There are a multiplicity of other factors that, when considered together, can do nothing to change the existing trend of increasing energy and fuel costs. In addition, our national electrical grid system (total of 4 grids) has already reached its practical capacity much like an intra-city freeway during rush hour. This year's record hot weather stressed the grid to its maximum because of the increased consumption of electricity for air conditioning.

Notwithstanding the sit-on-your-hands approach by the United States Government, effective climate change can still be achieved by implementing a **recently developed worldwide waste-to-energy policy**. Here come the several step solutions. Hold on to your hat, tie your shoes, and take a deep breath.

One of the required component technologies is waste-to-energy. Since there are several such technologies let's find the right one. For the last 25 years municipal solid waste-to-energy plants have been built and operated in the United States, Japan, and

Europe. These plants incinerate municipal solid waste (MSW) to produce steam. The steam, in turn, is used to spin a steam turbine in the generation of electricity. The MSW-to-energy plant operator makes a profit on:

1. The MSW tipping fee,
2. The sales of ferrous and non-ferrous metals, and
3. The sales of electricity to the grid.

About 5 years ago the worldwide number of these plants began declining for a number of reasons including:

1. Substantially lesser profit from sales of electricity to the grid,
2. Only slightly increased revenue from MSW tipping fees, and
3. Only slightly increased revenue from the sales of ferrous and non-ferrous metals, and
4. Greatly increased costs related to the required installation of emissions control equipment.

As a result, there has been about a 15% reduction in the number of these incineration plants worldwide. The two principal reasons for the diminished profitability of MSW-to-energy plants are:

1. The reduced price paid by the grid for the electricity generated,
2. The Department of Energy (DOE) would not qualify this technology in the United States as “biomass renewable energy” thereby eliminating the associated government subsidies,
3. The ever continuing increased cost of gaseous emission control equipment, and
4. The ever present high moisture content of MSW that automatically reduces the electricity output potential.

The marketplace future of this technology appears to be all downhill. Over the last 10 years the grid has gradually concluded it isn’t in its best long term financial interests to pay premium prices for MSW-to-energy produced electricity thus departing from its former willingness to do so. In the background the electrical generation/distribution industries are trying to cope with the deregulation of the entire market. Beginning in the late 1990s, corruption has been commonplace of the likes of Enron to include hundreds of other energy players. As the non-regulated energy industry emerges from its legal troubles it will likely be unwilling to pay a premium for energy from MSW-to-energy generation facilities.

There is another MSW-to-energy technology that uses anaerobic digestion technology to produce methane gas. The methane gas, in turn, is used as a primary fuel in the generation of electricity using either internal combustion engines or gas turbines.

Waste Management, Inc. is the world’s largest waste management services provider. It is the leading provider of comprehensive waste and environmental services in North America. The company is strongly committed to a foundation of financial strength, operating excellence and professionalism. Waste Management tailors its services to meet the needs of each customer group and to ensure consistent, superior service at the local level. Headquartered in Houston, the company's network of operations includes 413 collection operations, 370 transfer stations, 283 active landfill disposal sites, 17 waste-to-energy plants, 131 recycling plants, 95 beneficial-use landfill gas projects and 6 independent power production plants. These assets enable Waste

Management to offer a full range of environmental services to nearly 21 million residential, industrial, municipal and commercial customers. The company is engaged in a Cooperative Research and Development Agreement (CRADA), a joint research effort with the EPA to determine which practices best promote the safe operation of large-scale bioreactor landfills. Through our Maplewood and King George County Landfills, we are also participating in the EPA's Project XL, an initiative that uses pilot projects for achieving superior environmental performance from Bioreactor Landfill Technology. The company's goal is to make Waste Management's many landfill gas-to-energy programs even more efficient while making landfills last longer. Waste Management owns traditional MSW-to-energy incineration plants and much newer landfill gas-to-energy plants. Landfills produce methane gas due to the anaerobic digestion of MSW. Anaerobic digestion is deemed more effective than incineration because it is a wet rather than a dry process. The inherent moisture content of MSW therefore increases methane gas production and its corresponding ability to generate electricity. Both active and retired landfills can produce electricity using anaerobic digestion notwithstanding the fact that landfills are regarded by process engineers as quite inefficient anaerobic digesters.

Traditional digesters used throughout the world are therefore quite capable of digesting municipal solid wastes in the same manner as landfills witness the continuing success of Waste Management, Inc.

Traditional digesters are single compartment (one phase) process vessels that are frequently called conventional high rate (CHR) anaerobic digesters. They normally operate at the mesophilic temperature of 37ºC (98.6 ºF). In the last 10 years more efficient digesters are being manufactured that operate at the thermophilic temperature of 60ºC (140ºF). During this same time frame there has been another anaerobic digester marketplace trend, namely the gradual switch from single phase digestion (CHR digesters) to two-phase digestion. CHR digesters operate at a single pH around 7.0 and a single oxidation reduction potential (ORP) whereas two phase digesters operate at two distinct pH ranges, the first phase being acidic and the second phase being basic. The acidic phase operates at a positive ORP whereas the basic phase operates at a negative ORP. In every CHR digester there are two simultaneous microbial digestion reactions that produce gas. One reaction produces carbon dioxide gas whereas the other produces methane gas. If these reactions were permitted in two separate digester reactors, called phase I (one) and phase II (two), the production of carbon dioxide gas and methane gas would be significantly more efficient because they could each proceed at the optimum pH and optimum ORP preferred by their respective anaerobic digestion bacteria. The bacteria that produce carbon dioxide gas prefer an acidic pH (less than 7.0 pH) whereas the bacteria that produce methane gas prefer a basic pH (greater than 7.0 pH). Two-phase digesters that operate at a thermophilic temperature are easily capable of producing twice the gases (carbon dioxide gas and methane gas) at twice the speed as CHR anaerobic digesters. The longest running United States based thermophilic two-phase anaerobic digester has been operating in DuPage County, Illinois at its 12 million gallon per day (MGD) treatment plant (located within Woodridge). It was process designed by the distinguished Dr. Sam Gosh, formerly of the Gas Technology Institute with Consoer Townsend Consulting Engineers providing the overall treatment plant design. The DuPage facility has been operating successfully since 1991. Full marketplace credit for developing highly efficient **two-phase anaerobic digestion** technology goes to the **Gas Technology Institute**, a United States based trade association of the natural gas industries. This was a 10 year program that was terminated about 15 years ago due to significant new discoveries of

natural gas. When the program was initially created it was believed that the United States was running out of natural gas. The just referenced new discoveries of natural gas have already been mostly used up. Apparently an energy policy decision has been made to simply import natural gas from Asia in the form of liquefied natural gas (LNG) to make up the shortfall. Rather than conserving its supply of natural gas for US markets, the natural gas providers are selling it to Mexico at record profits. Sales to Mexico are expected to continue for some time to come.

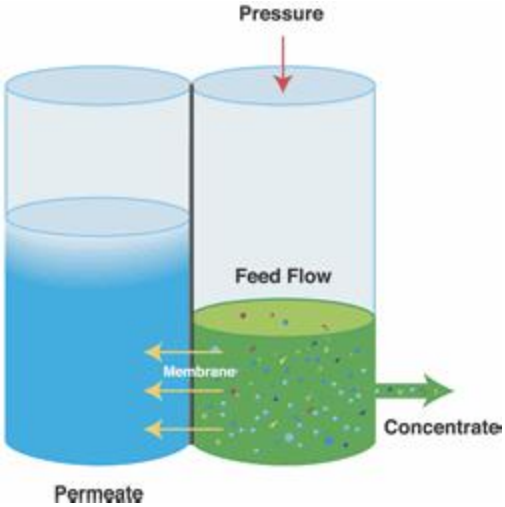
DuPage County, Illinois Two-Phase Thermophilic Anaerobic Digestion Facility

Two-phase thermophilic anaerobic digestion technology converting food waste into energy was demonstrated in Korea in 1998 as shown below.

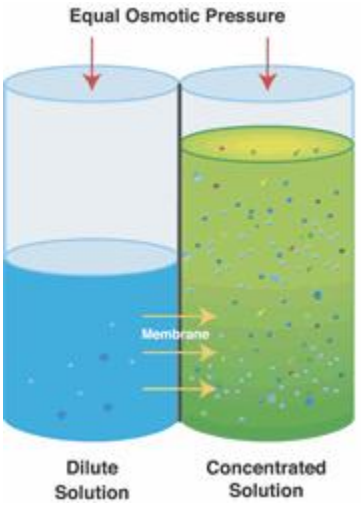
From CADDET Technical Brochure No. 66

Having now identified two-phase thermophilic anaerobic digestion of MSW and other wastes as one of the waste-to-energy component technologies, the task to identify additional required technologies still exists.

The term **reverse osmosis** comes from the process of osmosis, the natural movement of solvent from an area of low solute concentration, through a membrane, to an area of high solute concentration if no external pressure is applied. In simple terms, reverse osmosis is the process of pushing a solution through a filter that traps the solute on one side and allows the pure solvent to be obtained from the other side. More formally, it is the process of forcing a solvent from a region of high solute concentration through a membrane to a region of low solute concentration by applying a pressure in excess of the osmotic pressure. The membrane here is semipermeable, meaning it allows the passage of solvent but not of solute.



The membranes used for reverse osmosis have no pores, the separation takes place in a dense polymer layer of only microscopic thickness. In most cases the membrane is designed to only allow water to pass through. The water goes into solution in the polymer of which the membrane is manufactured, and crosses it by diffusion. This process requires that a high pressure be exerted on the high concentration side of the membrane, usually 2 - 14 bar (30 - 200 psig - pounds per square inch - gauge) for fresh and brackish water, and 40 - 70 bar [(600 - 1000 psig)] for seawater, which has around 24 Bar [(350 psi)] natural osmotic pressure which must be overcome.



In the late 1940s, researchers began examining ways in which pure water could be extracted from salty water. During the Kennedy administration, saline water conversion was a high priority technology goal-"go to the moon and make the desert bloom" was the slogan. Supported by federal and state funding, a number of researchers quickly advanced the science and technology of sea water conversion, but UCLA made a significant breakthrough in 1959 and became the first to demonstrate a practical process known as reverse osmosis (RO). The first viable reverse osmosis membrane was made from cellulose acetate as an integrally skinned asymmetric semi-permeable membrane. This membrane was made by Loeb and Sourirajan at UCLA in 1959 and patented in 1960. The current production of reverse osmosis (RO) membrane materials are based on a composite material patented by FilmTec Corporation in 1970. FilmTec's FT30 membrane is known as a polyamide thin film composite membrane. It was subsequently acquired by Dow Chemical Company. During the period 1995-2005 the **cost of membranes decreased over 50%** due to increased acceptance of the technology coupled with increased competition in the marketplace. From a technology that one couldn't once afford, the technology ascended to the level one couldn't afford to do without.

Maximum membrane sizes have but gradually increased over time from 2"Ø to 13" Ø. With its introduction of a whopper 18"Ø membrane, Koch Membrane Systems has become the worldwide leader of this increasingly important technology.

KOCH MEMBRANE SYSTEMS

MegaMagnum®
Water Treatment Systems

Koch Membrane Systems, Inc. has grown through the internal development of superior filtration products, as well as through acquisitions of leading companies in the field. KMS is headquartered in Wilmington, Massachusetts, with offices throughout the world and manufacturing plants in Wilmington, Massachusetts, and San Diego, California.

Among the acquisitions of Koch Membrane Systems, Inc. were Romicon, Inc. in 1991, Fluid Systems Corporation in 1998, and Puron AG in 2004, all three of which had closely related products and technology. Romicon's outstanding reputation was based on hollow fiber membranes and membrane systems.

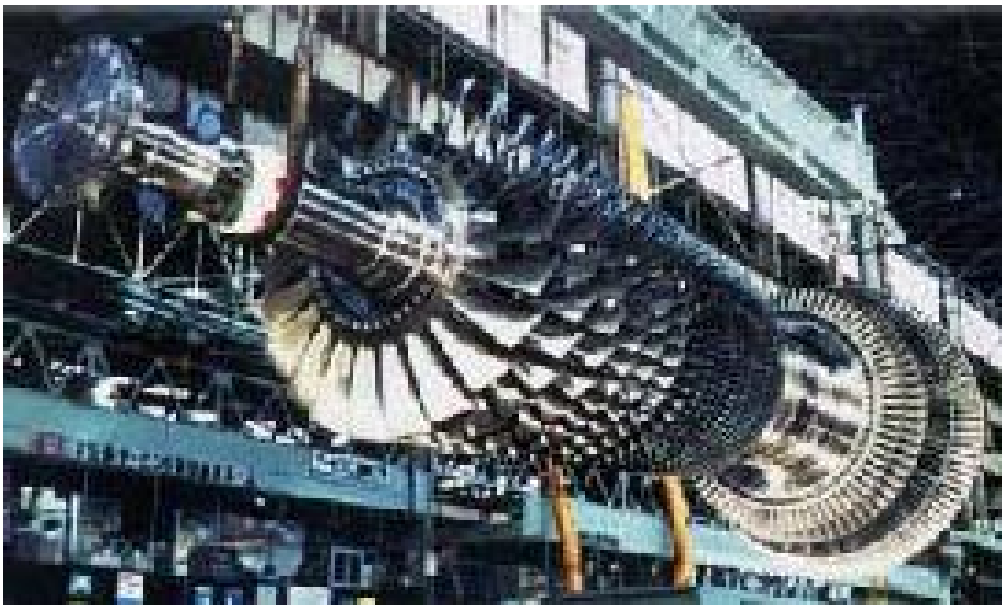
Preliminary list of required component technologies now consists of:

1. Two-phase thermophilic anaerobic digestion of MSW and other wastes, and
2. Reverse osmosis treatment

Another essential technology is the generation of electricity. This can be accomplished using diesel and natural gas (methane) fueled combustion engine generators as well as diesel and natural gas (methane) fueled turbine generators. Both types of power generation systems lend themselves to combined cycle (aka cogeneration) efficiency referenced under the combined heat and power (CHP) section discussed above. The power generated will be used to power the **Regional Biowaste Energy Industrial Park** as well as the surrounding community. The power generation equipment can be supplied by several worldwide vendors. Typical power generation equipment is shown below:

Deutz Model TCG 2020 Natural Gas Engine Power Generator
Source: Deutz Power Systems GmbH & Co. KG

Cummins 1,000 kW Diesel Generator



Two Mitsubishi Model 701F Combustion Gas Turbines
Total Power Generation Capacity 526 MW Electricity

The above power generation equipment always produces carbon dioxide gas, oxides of nitrogen (NOx), and water vapor. These gaseous discharges have to be successfully managed in order to prevent additional global warming. 100% gas managed control technology will be disclosed later on.

Another essential technology is the **accelerated production of microalgae for the purpose of producing biodiesel fuel**. A gasoline engine is about 25% efficient in converting Btus into work (joules). A diesel engine, by comparison, is about 43% efficient. When converted into actual distances, each and every 100 gasoline miles is the near equivalent of 172 petrodiesel or biodiesel miles. These facts are ever present driving forces which favor the use of far more efficient diesel engines.

As a diesel engine fuel biodiesel is an environmentally preferred and a performance equal to petrodiesel. If refined from waste vegetable oils and fats it is price competitive

with petrodiesel and is now being sold in the marine, transportation, and mining industries as well as for heating oil. If refined from virgin vegetable oils, however, it is not price competitive and therefore not being sold as a 100% replacement of petrodiesel. It is, however, currently being used as a blend component of petrodiesel because of its extremely positive influence on lubricity and environmental emissions. A blend as low as 2% provides a dramatic positive effect on the overall performance of a diesel engine reflecting its extremely favorable fuel characteristics.

The production cost of biodiesel consists of the cost of vegetable oil acquisition (or production) plus the cost of its subsequent refining. There is not a great deal of improvement possible with vegetable oil acquisition or production as most of the some 50 vegetable oils marketed are already fully established worldwide commodities. **The cost of biodiesel refining, however, is susceptible to significant improvement if the associated refining biowastes are converted into energy through anaerobic digestion technology. Biodiesel** is efficiently produced by a chemical process called transesterification whereby raw glycerine is removed from vegetable oils. Raw glycerine must then be further purified before it can be marketed. Because of a continuing worldwide glycerine glut, raw glycerine may be better managed as a biowaste residual of biodiesel refining rather than a salable commodity. And whether the vegetable oils are obtained by crushing or steam extraction there are always additional biowaste residues all of which may be anaerobically digested to produce methane gas. Methane gas can be efficiently converted into steam and electricity, both of which can be holistically and beneficially used in the refining of biodiesel. In addition to methane gas, the two-phase thermophilic anaerobic digestion process generates carbon dioxide gas, organic fertilizer, liquid fertilizer concentrate, and reverse osmosis permeate water, all of which are salable commodities and therefore added value co-products in the refining of biodiesel.

Biodiesel is a pure 100% fuel conforming to ASTM Specifications D 6751. It is referred to as B100 or "neat" biodiesel. A biodiesel blend is pure biodiesel blended with petrodiesel. Biodiesel blends are referred to as BXX. The "XX" indicates the amount of biodiesel in the blend. A B20 blend, for example, is a 20% volumetric blend of biodiesel with 80% petrodiesel. B20 easily meets ASTM Specifications D 975. Biodiesel and biodiesel blends have excellent solvent properties. In some cases, the use of petrodiesel, especially No.2 petrodiesel, leaves a deposit in the bottom of fuel lines, tanks, and delivery systems over time. The use of biodiesel can remove this deposit or sediment which results in the need to change filters more frequently when first using biodiesel until the entire fuel delivery system has been cleaned. This same phenomenon is frequently observed when switching from No.2 petrodiesel to No.1 petrodiesel.

B20 raises the pour point, cloud point, and cold filter plugging point (CFPP) cold weather properties of petrodiesel at least 1.67°C (3°F). Biodiesel antigel products are available that can efficiently and effectively lower the CFPP of B20 biodiesel as low as -40°C (-40°F). Fuel filter and line heaters can also be used to lower the CFPP even further. Neat biodiesel should be transported and stored at temperatures above 10°C (50°F) to guard against gelling. **Biofuels** include ethanol, hydrogen, methane, and biodiesel. All are derived from renewable biological sources. All directly support local agricultural economies on a sustainable basis. All generate less pollution than petroleum-based fuels. Compared with petrodiesel, biodiesel:

- Is cleaner burning.

- Is odor free, non-toxic, and highly biodegradeable.
- Is free of sulfur.
- Is safer for people and the environment.
- Reduces EPA targeted emissions.
- Achieves more complete fuel combustion.
- Is safer to handle, transport, and store.
- Has much higher lubricity.
- Reduces black smoke.
- Eliminates the nauseating smell
- Has a flash point above 150°C (302°F) and therefore exhibits a lesser potential for explosion.
- Reduces greenhouse gas emissions.
- Is a plant-based fuel replacement.

The production of biodiesel from vegetable oil represents an industry that is quickly gaining a worldwide foothold in the biofuels business due to the increased subsidies in the marketplace.

This country's principal effort to develop alternative energies was undertaken by the **National Renewable Energy Laboratory (NREL)**. This laboratory was initially established by the Solar Energy Research Development and Demonstration Act of 1974. Originally called the Solar Energy Research Institute, NREL began operating in July 1977 and was designated a national laboratory of the U.S. Department of Energy in September 1991. NREL has existing partnership agreements with approximately 250 industry partners, 70 universities and 80 not-for-profit organizations. Twenty years of research have yielded significant progress in many renewable energy technologies. The cost of wind energy has declined from 40¢ per kilowatt-hour to about 5¢. Photovoltaic systems can now be manufactured for about $2.20 per watt, down from $4.50 per watt in 1980. And ethanol costs have plummeted from $4 per gallon in the early 1980s to $1.22 today. Yet all of these alternative energy technologies still require governmental subsidies for their application in the marketplace. None yet represents a true scientific (economically competitive) solution.

The closest NREL has come to an economically competitive solution was the ***Aquatic Species Program(ASP)*** that consisted of the production of a biofuel called **algal biodiesel**. Algal biodiesel is produced through the growing of microalgae for their lipid content. The lipid content is then converted into biodiesel through transesterification in the same manner that soybeans and other vegetable oils are converted. Biodiesel produced from microalgae is, as a practical matter, identical with biodiesel produced from vegetable oils. The ASP funding totaled $25.05 million over a 20 year period which began in 1978. Continuation funding was ultimately terminated when it was officially determined that algal biodiesel could not be produced *economically*. Even though every one of the past NREL success stories still require subsidy support for their marketplace use the ASP program was killed for the same reason—likely due to our nation's energy policy that is intimately and equally committed to the existing coal and oil industries.

The ASP obtained its data from growing microalgae in warm open ponds relying on daylight photosynthesis and micronutrients from rainfall runoff events. If the microalgae

is produced under 24 hours photosynthesis conditions with massive amounts of micronutrients added to the culture at about 100 degrees Fahrenheit, production can be significantly enhanced. The micronutrients are provided by the reject (liquid fertilizer concentrate) of the reverse osmosis equipment downstream from the two-phase thermophilic anaerobic digester. By additionally adding the carbon dioxide, NOx, and moisture from the power generation equipment the microalgae production technology becomes compliant with Kyoto Protocol. **The resulting final microalgae production is increased perhaps 100-fold in far less space as the NREL open ponds.** The produced microalgae may be used:

1. In quite economical biodiesel production.
2. In quite economical fish farming.
3. And as an economical animal feed supplement.

Associated co-product management consists of:

1. The retail selling of biodiesel at a 20% discount from petroleum diesel.
2. The transfer of all biodiesel wastes to the anaerobic digester to produce more methane gas, carbon dioxide gas, organic fertilizer (digestate), liquid fertilizer concentrate, and reverse osmosis (RO) water.
3. Fish processing and retail selling of processed fish at a 20% discount from retail.
4. The transfer of all fish farming and processing wastes to the anaerobic digester to produce more methane gas, carbon dioxide gas, organic fertilizer (digestate), liquid fertilizer concentrate, and reverse osmosis (RO) water.
5. The methane gas produced will be:
    a. Used to generate combined cycle electricity for internal BioWaste Energy Regional Industrial Park use with the remainder sold to the local marketplace at a 20% discount from retail.
    b. Retail sold to the local marketplace as compressed natural gas (CNG) fuel at a 20% discount on a gasoline gallon equivalent (GGE) basis.
    c. Retail sold to the local natural gas marketplace at a 20% discount from retail.
6. Some of the microalgae will be sold as an animal feed supplement at a 20% discount from retail on a protein content equivalent basis.

The **Food Independence** technology component may achieved by vertical farming within massive greenhouses. Our planet is rapidly running out of arable land. Those nations which have already run out of arable land are clearing forests (deforestation) for agricultural production. Deforestation causes climate change due to the burning of these forest clearing wastes. The combustion of forest wastes discharges carbon dioxide into the environment. Carbon dioxide is thought to be one of the several gasses that are responsible for global warming. Nations that clear forests for food production, however, have no other choice to prevent food deprivation and in some cases children starvation. Vertical farming (multistory greenhouses) completely solves this tragic problem on a sustainable basis.

Greenhouse farming permits the production of 100% organic foods which are thought by many to be more nutritious. Since precise nutrient and moisture management can be achieved **intercropping** may be practiced thereby producing more food per acre than horizontal farming. Intercropping refers to the simultaneous growing of two or more crops within a common soil matrix. Greenhouse farming eliminates the necessity to use pesticides, fungicides, and herbicides since greenhouse supply air can be

mechanically filtered and sterilized to remove or otherwise sanitize airborne spores. With the next generation technology greenhouse make-up air first passes through power generation combustion engines to produce electricity. The completely sterile products of combustion consist of water vapor, carbon dioxide, and oxides of nitrogen. The carbon dioxide is beneficially used in the photosynthetic production of carbohydrate based food crops. By increasing the carbon dioxide concentration to about 1,200 parts per million by volume (ppmv) (1,200 μL/L) crop growth rates are maximized. By precisely controlling temperature, humidity, nutrients, and artificial lighting crop production can be further optimized. Because the greenhouse weather can be precisely controlled more than one crop per year can be produced. In the case of soybeans, for example, four crops, rather than a single crop, per year are easily achievable. Greenhouse weather control combined with intercropping can achieve 10 times more food production/hectare than traditional horizontal farming.

MSW-to-energy anaerobic digestion plants produce digestate that contains insoluble salts of heavy metals. The digestate will be beneficially used as the granulated soil matrix within greenhouses. Soil scientists list the several micronutrients of Aluminum (Al), Arsenic (As), Barium (Ba), Boron (B), Chloride (Cl), Chromium (Cr), Cobalt (Co), Copper (Cu), Fluorides (F), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Lead (Pb), Selenium (Se), Strontium (Sr), Titanium (Ti), Tungsten (W), Vanadium (V), and Zinc (Zn) as essential for optimum plant growth. It is well known that Hawaii has the most productive soils anywhere found. The productivity is achieved because of the generous content of micronutrients. The soils were initially formed from lava flows which are rich in minerals. The heavy metal content of MSW therefore ends up in a quite productive role within the greenhouse.

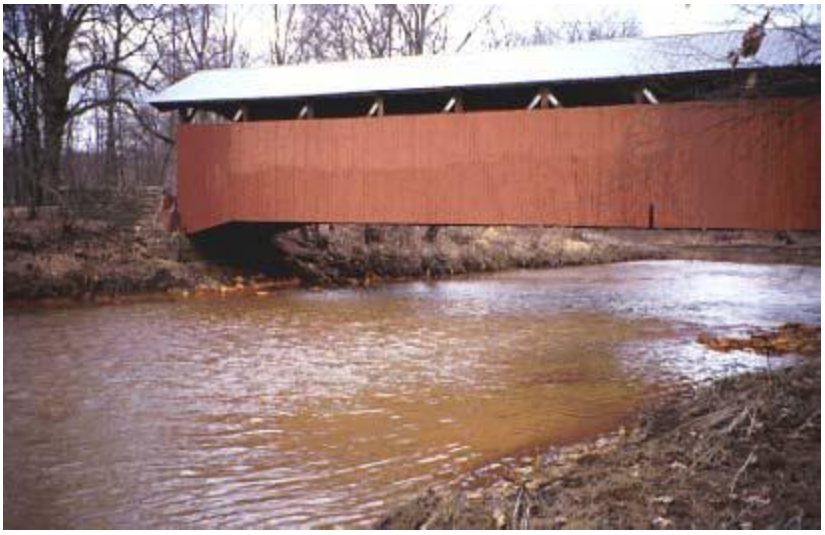
For more than 20 years the United States Environmental Protection Agency (USEPA) has permitted the land application of **Class B Biosolids**. *The Centers For Disease Control And Prevention*, The *Occupational Health And Safety Administration* (OSHA), and several additional private groups have recommended against this continuing practice. When Class A or Class B Biosolids that contain heavy metals are applied to cropland, heavy metals uptake occurs mostly within the root system with progressively lesser uptake occurring throughout the entire plant pathway to the food product itself. The uptake occurs at acidic, neutral, and basic (alkaline) pH values as well as other growing conditions such as moisture adjustments and macro nutrient applications.

Using the **Class A Biosolids Digestate** as a soil amendment for use in landscaping or greenhouse activities is specifically permitted by the USEPA because of its Class A Biosolids Status (Section Three, Par. 3.1 EPA/831-B-93-0026, Land Application of Sewage Sludge, December, 1991). The soil amendment therefore becomes the ultimate fate of the heavy metals. When using the Class A Biosolids digestate as a soil amendment in the greenhouse growing of vegetable oil crops, the vegetable oil can be subsequently refined into biodiesel through transesterification. Heavy metals do not participate in the transesterication process and are therefore left over in the associated wastes. The transesterification process results in soapstock and glycerin wastes. All wastes associated with biodiesel refining are routinely returned to the digester to produce additional renewable energy. The associated vegetable oil crop residues are also routinely returned to the digester to produce additional renewable energy. The soil amendment therefore becomes the ultimate fate of the heavy metals.
When using the Class A Biosolids Digestate as a soil amendment in the greenhouse growing of food crops, the organic food products will be marketed at a discount from retail. Evidence that food products produced on sewage sludge applied land are

harmful to human health does not exist (Section Three, Par. 3.1 EPA/831-B-93-0026, Land Application of Sewage Sludge, December, 1991, and Food Standards Agency, Research Programme Annual Report, 2001). Using the digestate soil amendment, regardless of the heavy metals content (pollutant load), is specifically permitted by the USEPA because of its Class A Biosolids Status. The soil amendment therefore becomes the fully and automatically permitted ultimate fate of heavy metals**. Use of the two-phase thermophilic anaerobic digester organic fertilizer (digestate) for the greenhouse production of organic food crops therefore represents a environmentally proper and agriculturally beneficial use of this co-product of the waste-to-energy technology.**

(Author's Note: It has just recently been learned that Beethoven [Ludwig van Beethoven] of Symphony No. 5 fame [Opus 67 In C Minor] died [March 26, 1827] of lead poisoning resulting from his music composing habit of drinking wine from a pewter goblet. Lead is one of the heavy metals. The medical science of determining the harmful effects of heavy metals has been around for well over 50 years. The continuing public debate that **All Heavy Metals** are automatically harmful to human health appears to be based on rather simplistic non-technical concerns over the general use of chemicals in the agricultural marketplace rather than the systematic application of sound science. For example, the quite popular human vitamin *Centrum* contains Boron [B], Calcium [Ca], **Chromium** [**Cr**]**, Copper** [**Cu**]**,** Iodine [I], **Iron** [**Fe**]**,** Magnesium [Mg]**, Manganese** [**Mn**]**,** Molybdenum [Mo], **Nickel** [**Ni**], Potassium [K], Phosphorus [P], **Selenium** [**Se**]**,** Silicon [Si], **Tin** [**Sn**], **Vanadium** [**V**]**, a**nd **Zinc** [**Zn**] chemicals. There are some 23 heavy metals including Cr, Cu, Fe, Mn, Ni, Se, Sn, V, and Zn [Glanze, 1996]. The environmental and medical communities appear out of sync on the subject of heavy metals. The few heavy metals of Arsenic [As], Mercury [Hg], and Lead [Pb] have indeed caused death [Beethoven] under special circumstances. In general, heavy metals are extremely beneficial micronutrients within the agricultural marketplace.)

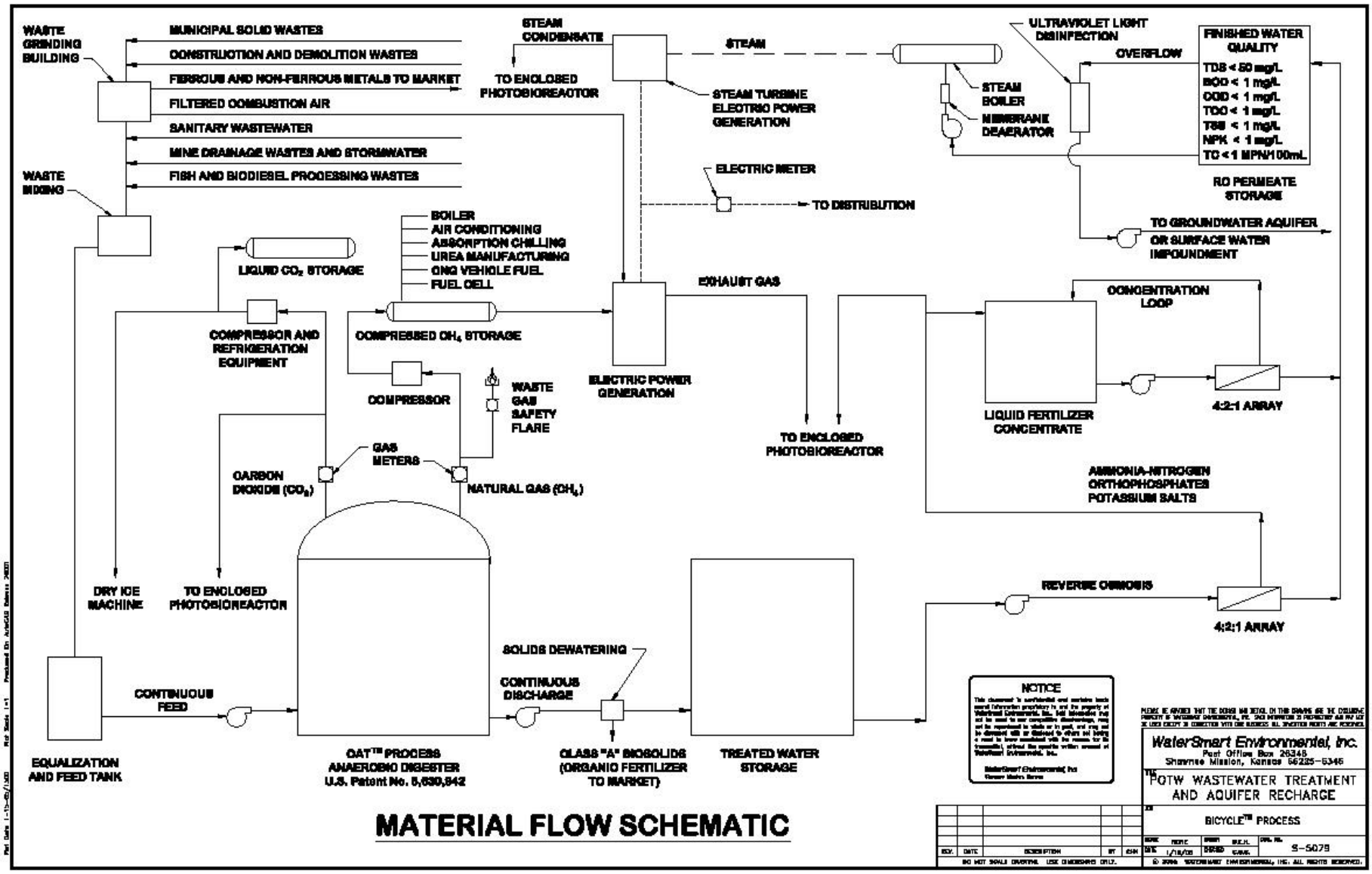
While achieving energy, food, fuels, and water independence, the proposed waste-to-energy technology can solve significant major problems such as aquifer depletion and acid mine drainage destruction. Acid mine drainage streams extend over 13,000 miles (Hadley, Snow 1974). Abandoned coal mines now number over 15,000 (many references). The devastation of the fresh water fishing is complete. Not too many fish like a pH of 3 nor do they enjoy iron pyrites. Makes them gag. If the acid mine drainage is managed as a liquid waste similar to, say, sanitary wastewater the proposed technology can convert the drainage into bottled water quality. Acid mine drainage can be used (diverted) along with sanitary wastewater to slurry mix ground up MSW in the production of electricity and other valuable co-products. The resulting RO water is then discharged back into the drainage stream resulting in an environment again suitable for fresh fish and other aquatic growths. Acid mine drainage streams frequently flow past municipalities. Municipalities generate MSW. The proposed site of acid mine drainage treatment is therefore near a community. Perhaps the same community that provides the miners. Just a thought. Acid mine drainage streams look like the following. Fish seem to prefer a better water quality. Maybe better trout fishing in Pennsylvania can be achieved someday with an intelligent global waste-to-energy policy that replaces the administration's current energy policy. A replacement policy that also produces less expensive energy, food, fuels, and water on a sustainable basis.



The effects of Acid Mine Drainage (AMD) on Shamokin Creek approximately 13 miles downstream of the last mine discharge. This location is 3 miles from its confluence with the Susquehanna River.

Successful treatment begins with the construction of a building near the stream and community. The building will house power generation equipment, biodiesel production equipment, fish farming and processing equipment, equipment to compress natural gas, food production and processing equipment, dry ice manufacturing equipment, MSW grinding equipment, and a two-phase thermophilic anaerobic digester on the main floor. The basement of the building will contain fresh fish farming capabilities. The second and third floors will be dedicated to greenhouse farming utilizing the digestate from the digester. The design will permit the addition of more floors over time. Unemployed miners will be solicited for employment.

An engineering drawing showing the entire process of waste-to-energy is shown below:



MATERIAL FLOW SCHEMATIC

Integrated And Holistic Waste Processing And Recycling With Associated Value Added Products Production And Marketing

Acid Mine Drainage Wastes
Animal Processing Wastes
Animal Production Wastes
Biodiesel Refining Wastes
Construction & Demolition Wastes
Crop Processing Wastes
Crop Production Wastes
Dead Animal Wastes
Dumpster Wastes
Fish Farming Wastes
Fish Processing Wastes
Food Wastes
Medical Wastes
Municipal Solid Wastes
Stormwaters
Sanitary Wastewater
Unknown Wastes

⇨

Two-Phase Thermophilic Anaerobic Digestion

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Carbon Dioxide Gas
Methane Gas
Organic Fertilizer (Digestate)
Liquid Fertilizer Concentrate
Reverse Osmosis (RO) Water

Biodiesel Transportation Fuel To Local Market
Microalgae To Local Market
Compressed Natural Gas (CNG) Transportation Fuel To Local Market
Natural Gas (Methane) Heating Fuel To Local Market
Electricity To Local Market
Processed Fish To Local Market
Processed Crops To Local Market
Processed Animals To Local Market

Carbon Dioxide Gas To Microalgae Production
Combustion Generator Gases To Microalgae Production
Liquid Fertilizer Concentrate To Microalgae Production
Organic Fertilizer To Greenhouse
Reverse Osmosis (RO) Water Of Bottled Water Quality To:

- **Aquifer Restoration**
- **Boiler Water Make-Up**
- **Chesapeake Bay**
- **Discharge**
- **Fish Farming**
- **Irrigation**
- **Livestock Drinking Water**