ALPHA-OMEGA
WASTE PLASTICS
TO
CLEAN FUEL
FOR
TRANSPORTATION
OR PRODUCTION OF
ELECTRICITY

ALPHA OMEGA ECOLOGICAL SOLUTIONS

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INTRODUCTION

Plastic is one of the most useful, durable and ubiquitous materials known to man, it permeates every sphere of human life. It protects and stores our food; it transports our goods; we brush our teeth with it; we can find it in our refrigerators, cars, computers and mobile phones; we can thank it for our shower curtains, our plumbing and the flooring we walk on. In short, it's everywhere, sustaining our way of life to the extent that we struggle to imagine life without it.

We now consume around 100 million tons of plastic annually, compared to five million tons in the 1950s. To put that into perspective, one ton of plastic represents around 20,000 two-liter bottles of water or 120,000 carrier bags, according to the British Web site Waste Online. The estimates of how many plastic bags used annually vary wildly from 500 billion to anywhere up to 1 trillion. Even taking the more conservative estimate of 500 billion still roughly translates as 1 million every minute, according to www.reusablebags.com As for plastic bottles, Earth Policy Institute estimates that in 2004 the global consumption of bottled water alone was 154 billion liters.

By recycling 1 plastic bottle not only saves anywhere from 100 to 1000 years in the landfill but also saves the environment from the emissions in producing new bottles as well as the oil used to produce that bottle.

For every 1 ton of plastic that is recycled we save the equivalent of 2 people’s energy use for 1 year, the amount of water used by 1 person in 2 month's time and almost 1 metric tonne of oil.
The objective of this “Project Proposal Document” is to inform interested parties of technology that is “State of the Art” that would address the “urgent need” in Greece to ecologically and environmentally convert all waste plastic generated into a “clean, green fuel” for either transportation or for the co-generation of electricity, which not only conforms to the protocols of the “Kyoto Protocol”, but also due to the advanced technology of “converting waste plastic to fuels” there is a possibility of getting Carbon credits for every tonne of plastic diverted from landfills. 1.14 Certificates of Emission Reduction (CERs) are earned. This would allow the companies operating such technology the ability of offering forward purchase of all carbon credits, which are produced on site where the host country has ratified the Kyoto Protocols, which Greece has.

PLASTIC TO FUEL
GREEN TECHNOLOGY

In considering the respective volumes of “waste plastic” generated in Greece, (based upon various studies that have been conducted in Greece by various Universities and NGOs see Waste Plastic In Greece), the multiple benefits that would be derived including financial are a “green – win-win” scenario.

WASTE PLASTICS IN GREECE

Plastic is widely used in each and every corner of the world and the world plastic consumption is estimated around 200 Million Tons per year. Plastic by nature, is non-biodegradable and remain as plastic for the next million years. About 30% of the world plastic has been recycled and the remaining was either incinerated or dumped in landfill.

In normal circumstances, it is identified that 30% of the plastic is disposed off together with MSW – Municipal Solid Waste. A waste of natural resources and not every one of us knows that waste plastic – which is widely available in any country, can be a good and alternative energy source if converted into liquid hydrocarbon fuel.
In the offices of the **Ecological Recycling Society** in central Athens, they have compiled significant data in regards to waste plastic in Greece.

Every year one billion plastic drinking water bottles are thrown away in Greece, along with one billion soft drinks bottles and yet another billion plastic containers for cleaning fluids. Almost one-fifth of the entire waste produced by this country is plastic, and yet just 1% of it is recycled.

Considering that not a single kilogram of plastic is land filled in Switzerland, while Greece missed its European Union target to recycle a simple 15 percent of its plastic packaging waste.

According to current EU statistics compiled by the association of plastic manufacturers in Europe, “**Plastics Europe**”, the report highlighted Greece's position as the most wasteful European country in the management of plastic waste.

Under the EU Directive (Waste Framework Directive), on 17 June the European Parliament adopted a resolution on the Waste Framework Directive. Once this has been rubber-stamped by the Council of Ministers it will become law, closing a process which started back in 2003.

This law will be good for the environment and good for plastics. The Directive marks an important step towards improved resource efficiency and the reduction of landfill in Europe, thus decreasing greenhouse gas emissions and protecting the climate. A recent study by the Prognos research institute showed that diverting calorific waste from landfill across Europe could save up to 27% of the EU’s 2020 CO2 emissions reduction target, and in regards to Greece this could make up to 9% of the country’s emissions reduction target, which it needs.

This legislation recognises the importance of waste as a valuable resource. Calorific waste is a valuable and energy-rich resource that must not be land filled. It will especially help conserve natural resources by:

- Classifying feedstock recycling as recycling, not recovery
- Giving authorities the freedom to apply the waste hierarchy flexibly and choose the best waste management option for their situation
- Classifying efficient incineration as recovery, not disposal

Plastic waste represents the loss of both material and energy resources. Because excessive plastic waste generation is a symptom of inefficient production processes, low durability of goods and unsustainable consumption patterns, waste quantities can be considered an indicator of how efficiently society uses raw materials.
The key environmental impacts of plastic waste can be summarised as:

1. use of land for landfills and leaching of harmful substances (nutrients, toxics, etc.) from landfills;
2. air pollution and toxic residues from incinerators;
3. water pollution and generation of secondary waste streams from recycling plants;
4. increased road transport

All data on plastic waste in Greece is associated with numerical discrepancies, but it is estimated that Greece is managing to recycle only 30,000 of the 300,000 tonnes of plastic packaging waste produced, leaving a major resource untapped. Therefore the overall aim and priority of our “Project Proposal” for Greece is waste prevention by using the latest technology of “Plastics to Fuel”.

Percentage of Municipal Waste by Country In The EU

:SOURCE European Environmental Agency
Recycling/Recovery of Packaging Waste by Country In The EU

Source: European Environmental Agency

http://maps.grida.no/go/graphic/greece_greenhouse_gas_emissions_cop7
TYPES OF PLASTIC THAT CAN BE USED IN THE SYSTEM

Mixed waste plastic is widely available through the following sectors & channel in ALL OVER THE WORLD.

3. Municipal Solid Waste (MSW).
THE MANUFACTURING PROCESS AND PRODUCTION OF THE PROCESS

Mixed Waste Plastic

Drying Process  Sorting Process

Melting Process  Add Catalyst

Reacting Process

Liquid Hydrocarbon Fuel  LPG - Gas

Coke - Residue

Power / Energy
Descriptions of Automatic Industrial Continuous Waste Plastic Pyrolysis Production Line

The automatic industrial continuous waste plastic pyrolysis production line utilizes advanced technology and equipment which can pyrolyze waste plastic into liquid fuel oil and minimum non-condensable gas through a patented pyrolytic reaction. The design of the whole technological process and equipment is "state of the art" with the whole production process taking place in a hermetic environment and thus eliminating the environment pollution, while realizing energy recycling and achieving environmental, social and economic benefit.

The whole production line can be divided into ten sections:
1. Waste plastic shredding system;
2. Raw material pre-heating system;
3. Remote fixed temperature heating system;
4. HCL absorbing system;
5. Raw material distribution system;
6. Continuous pyrolysis system
7. Exhaust purification system
8. Gas purification system;
9. Waste residue decontamination processing system;
10. Control system

The waste plastic, after a coarse shredding, will be automatically and continuously sent to the preheating system via an automatic feeder. The material will be primarily heated at this stage so as to separate HCL from the material using a primary neutralization treatment, whereby the PVC plastic of low melting point will be pyrolyzed first.

The material, after preheating, will be sent to the continuous pyrolysis reactor and then distributed by a mechanical distribution system. The remote fixed temperature heating system will supply heat for the pyrolysis reactor and the pyrolysis reaction will be finished with the action of a high efficient catalyst.

The pyrolysised oil-gas, is then pumped to the fractionating tower, whereby secondary catalysis takes place with the utilization of a fixed bed. The secondary catalyst achieves the de-waxing etc., with the balance being turned into high quality diesel and gasoline for transport vehicle, vessels etc.

Small amounts of non-condensable gas will be recycled to the pyrolysis system for heating once it has been purified by a gas clarification system. Gas produced after combustion will be discharged within the required standard after purification by the gas clarification system.
Small amounts of solid residue after raw material pyrolysis will be automatically and continuously discharged out of pyrolysis reactor, the carbon content in the residue will supply the heat source needed for the technology and the remaining inorganic component will be made into construction material. The whole technology is safe and environmentally-friendly, and realizing harmless treatment.

The automatic continuous waste plastic pyrolysis production line has the following characteristics that are not available in other systems:

1. The accurate remote fixed temperature heating system will keep the pyrolysis temperature error between ±1℃.

2. The sole material distribution system can evenly distribute every kilogram of raw material on the surface of the moving high enthalpy solid heat medium of 10-12M. Therefore the actual heating area is greatly increased; heating for pyrolysis material is extremely even. Thorny problems such as low heat transfer efficiency and coking existing in any other technique and equipment are radically solved.

3. Exclusive and perfect HCL absorbing disposal system.

4. Built in technological adaptation of the system allows no need to sort out and clean the waste plastic. The adoption of catalysis pyrolysis technique in two steps leads to a high oil yield rate without unwanted substances such as lead, nitrogen and other matters, which in turn produces a high quality fuel oil which can meet the requirement for automotive fuels.

5. Flexible Operation and low operation cost.

6. The production is fully automated industrial continuous production and the productivity is efficient.

7. Non-condensable gas produced after purification can be totally recycled to the heating system for heating.

8. The temperature and air quantity of the gas clarification system can be automatically adjusted and controlled. The gas adsorbent has strong adsorbability and can eliminate all contaminants in the gas, such as H₂S, Cl₂, CO, SO₂, SO₃, NOₓ, CS₂, NH₃, oil and other organic compounds and solid particulates. Therefore the emission parameters will meet the emission standard of any country.

With characters of continuous production, high automatic heat, high production efficiency, excellent safety performance, environmental performance, social benefit and economic benefit, the automatic industrial continuous waste plastic pyrolysis production line not only eliminates white
pollution but also yields an oil product of high calorific value, therefore, our system can be widely applied in industrial production.

**Basic requirements of the Production Plant Site**

*(Modelled on process capacity: 10,000 ton/year)*

1. The pyrolysis and clarification systems building: 50 meters (long) X 20 meters (wide) X 6 meters (high)

2. The receiving, shredding system and raw material area and warehouse depend on the individual requirements of customer.

3. Floor construction should be normal concrete horizontal ground with a H = 200 mm

**Note:**
- The pyrolysis production workshop should have sufficient ventilation.
- The raw material area and oil storage tank area should meet the local fire protection requirements.
- Requirements for cooling tower (pond) and other will be dependent upon local conditions.
Product yield rate, Quality and Gas Emission Standard

1. Product yield rate and quality (requirement for raw material moisture should be below 5%, and for impurity should be below 10%):
   Raw material source: waste plastic or PCP of domestic waste
   Fuel Oil yield rate:
   - PE: 60%-75%
   - PP: 65%-80%
   - PS: 70%-85%
   - PVC: 35%-40%

   The average oil yield rate for mixed waste plastic is around 70%, among it gasoline accounting for 35%; diesel accounting for 65%.

   Pyrolysis residue:
   - PE: 15 to 20%
   - PP: 15 to 20%
   - PS: 10 to 15%

   Mixed waste plastic is around 20%-30%

   The residue after been burned will be used for heating the reactor, with the final residue, which is an innocuous inorganic substance, can be made into high strength construction material.

   Non-condensable gas yield rate:
   - PE: 8 to 10%
   - PP: 8 to 10%
   - PS: 5% to 8%

   Mixed waste plastic is around 10%

   Emission tested by SGS shows that the emission indexes meet the Emission standard of air pollutant for coal-burning oil-burning gas-fired boilers GB13271-2001. (the attachments are gas test report from SGS and test report from National Center for Quality Supervision and Test of Environmental Protection Products)

Consumables and Cost

1. Catalyst:
   Complex low-temp pyrolysis catalyst independently developed by our company.

   A. The usage amount of catalytic catalyst needed for every 1 ton waste plastic is 3 KG. The price of catalyst is Euro 2.50/kg

   B. The usage amount of gas catalyst needed for every 1 ton oil is 1.5 KG-5 KG. The price of catalyst is Euro 23/kg (can be reused after reduction)

2. Water:
   Water for production is the recycled cooling water, there is no consumption besides evaporation
3. Electrical Power:
Installed gross capacity for 10,000-ton / y automatic industrial continuous waste plastic pyrolysis production line is 280KW, the practical electricity consumption per day is about 40%.

4. Labour: 6-10 persons

The Business Proposal

Alpha Omega Ecological Solutions have a strong interest in setting up facilities that converting waste plastics into liquid hydrocarbon fuel, totalling more than 10,000 MT/ year of waste plastics per day, based upon the following business plan of inception of the project.

1. Receiver Fees. A guaranteed long-term contractual fee paid by Local Government as a fee, charged for taking delivery of MSW. These fees are based on long-term contracts (about 5 years minimum) signed with the government (or) General Waste Collectors and Contractors.

2. Recyclables. Continuing and increasing demand for this commodity makes separation and collection of recyclables an important part of the revenue stream.

3. Sale of Fuel. Recovered fuel with the grade of C4 to C10 & C11 to C26 is easily marketable in local industries.

4. Power Generation. An option offered by Alpha Omega Ecological Solutions in association with our technology partner is the production of electricity by using the by-products like LPG and Liquid Hydrocarbon. These fuels drive an engine which is driving a generator. Where this option is exercised, there is an additional income stream from sale of electricity. 50 MT per day capacity plant will produce 25MW hour.

5. Carbon Credits. There is a possibility of getting Carbon credits for every tonne of organic MSW diverted from landfill (where it will generate methane gas). 1.14 Certificates of Emission Reduction (CERs) are earned.

Some companies are offering forward purchase of all carbon credits, which are produced on site where the host country has ratified the Kyoto Protocols.

Alpha Omega Ecological Solutions in association with our technology partner would like to tie up with strategic partners to own, build and operate PTF facilities in the Greece and other EU markets. The main contribution of Alpha Omega Ecological Solutions in association with our technology partner would be to supply of technology and know-how while the main contribution from the strategic partner would be financial and raw material resources.
The minimum ROI for the project is 25% per year which is guaranteed by the supplier of the plant - assuming the raw material cost is not more than Euro 0.12 per kg and raw material available regularly.

The **plant capitalization costs** for a 10,000 Mt/ year plant including all ancillary equipment, installed and commissioned (excluding land and civil works) will be **Euro Five Million (Euro 5,000,000.00)**

Assuming an optimum annual production of liquid fuels at 70% of impute of waste plastic and assuming whole sale value of liquid fuels at Euro 1.10 per liter, the plant will generate = 10,000 MT waste plastic to liquid fuels = 7,000,000 liters per year sold at 1.10 Euro per liter = an annual return of **EURO SEVEN MILLION SEVEN HUNDRED THOUSAND (EURO 7,700,000.00)**