INVESTMENT PROPOSAL :
PET recycling to bottle to bottle

1. Brief description of project.

1.1. General

The raw material for all packaging plastics is ethylene. Ethylene is a gas derived from natural gas or from a fraction of crude oil that has a composition similar to natural gas. Both natural gas and crude oil are products of fossils and are therefore not renewable.
Once ethylene has been produced, it is combined with solvents, co monomers, additives, and other chemicals that will participate in the planned chemical reactions. The mixture is then subjected to a chemical reaction called "polymerization" that creates long-chain molecules. ("Mono" means "one" and "poly" means "many," so a "monomer" is a single molecule — like ethylene — that can be bound with other molecules into a "polymer.") The new polymer is extruded, pelletized, or flaked; the product is called a "resin." Resin is sold, re-extruded, and made into containers, films, and other products.
Only six resin types were used to make more than 92% of plastic packages.7 Their names and common uses are shown in the following table:

Table 1: Plastic Packaging; Resin type; Uses

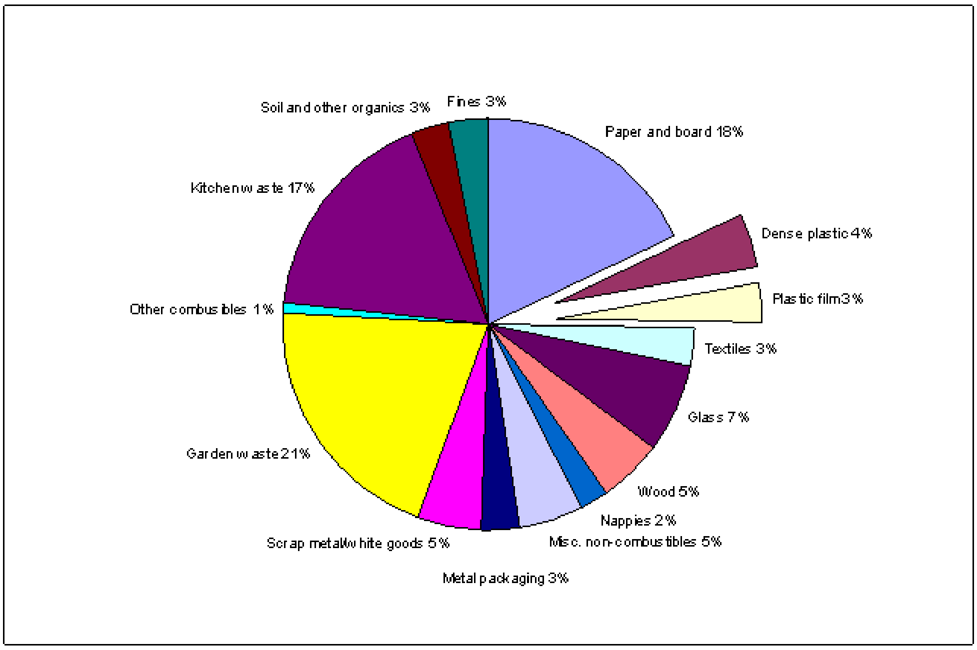
Recycling Code	Plastic Type	Common Uses
#1	**Polyethylene Terephthalate (PET)**	soft drink containers
#2	**High Density Polyethylene (HDPE)**	milk crates milk jugs and beverage bottles soft plastic margarine tubs
#3	**Polyvinyl Chloride (PVC)**	auto parts inflatable toys insulation pipes phonograph records shampoo bottles shower curtains some food containers
#4	**Low Density Polyethylene (LDPE)**	trash bags and other films
#5	**Polypropylene**	auto parts housewares pipes screw-on caps toys yogurt and margarine tubs
#6	**Polystyrene**	hot food containers packing materials plastic utensils wall tiles

A number 7 on a plastic container indicates "other," which typically means a combination of two or more of the six main resin types.
The use of plastics is increasing in almost all sectors of the economy, but the most rapid growth is in packaging. Globally, improved economic conditions tend to promote increased consumption and a corresponding increase in packaging. Analysts predict steady increases in the sales of most packaging plastics, particularly PET, for the foreseeable future.
A thermoplastic homo-polyester, PET is a tough material used mostly in the food packaging industry. PET can be either amorphous or crystalline; however, most applications require semi or full crystallization to take advantage of the dramatic increase in strength and toughness at high temperatures. Inherent viscosity (I.V.) is directly proportional to molecular weight, therefore, the higher the I.V. the tougher the end product. Control of

acetaldehyde (AA) levels in bottle grade materials is of primary importance. PET is very hygroscopic and unstable in the presence of H_2O; therefore, it must be dried intensively before processing.

1.2. Reusing concept

Reusing containers is one of the most effective and inexpensive ways to reduce the environmental impact of packaging. Some plastic containers can be made durable enough to be refilled and reused about 25 times before becoming too damaged for reuse. Refilling and reusing plastic containers directly reduces the demand for disposable plastic.
Accordingly, lowering demand for single-use containers reduces waste and energy consumption. Based on 2005 data, if glass and PET bottles were refilled and reused 25–35 times, the overall weight of beer and soft drink container waste would be reduced by 73.6%. Significant reductions in waste and energy consumption can be achieved with just 7–8 reuses of a single bottle.



One toxicity study investigating the use of PET for refillable bottles tested various toxic substances to see if they would be absorbed into the PET plastic during one use, then released in the next use. After test substances were removed and the plastic washed, the bottles were filled with food, and the contents were analyzed. The analysis showed that none of the test substances was absorbed into the PET. This study concluded that PET could be considered as a practical candidate for refillable containers. As discussed above, migration of additives from the PET itself is still a problem.

As applied to plastic packaging, primary reprocessing produces new packaging; secondary reprocessing produces new items that are usually not practically recyclable themselves because of reduced polymer purity and the lack of collection infrastructure; tertiary reprocessing uses high heat or industrial chemicals to break plastic products into their chemical components, some of which can then, in theory, be made into new products.

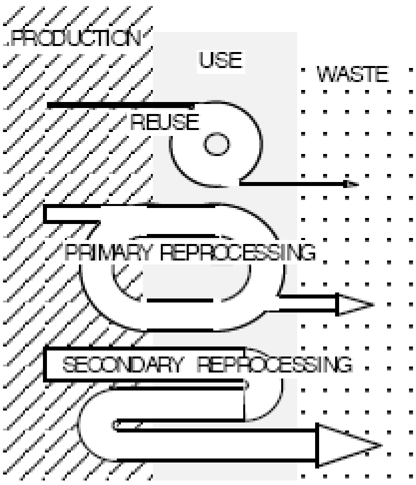
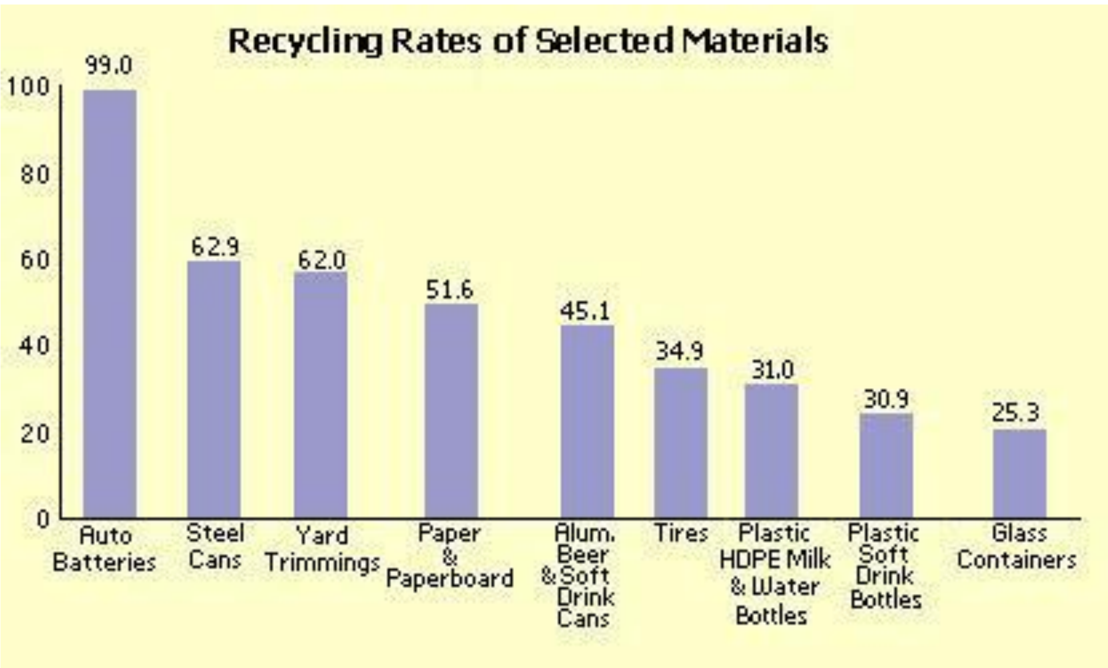


Figure 1: Comparison of Material Flows with Alternative Disposal Schemes

In theory, all six of the six resin types used to make packaging plastics are candidates for primary reprocessing. In reality, however, primary reprocessing is rare.
Two chemical properties make it difficult. One is plastic's sensitivity to heat and handling. Plastic molecules are long and flexible, and they change structurally when subjected to thermal and mechanical stress during melting and extrusion. The molecules interconnect and stiffen, and the plastic becomes weak and brittle. This type of degradation is called "heat history" in the plastics recycling trade. The deterioration accumulates with each reprocessing and is irreversible.
The second chemical property that makes primary reprocessing difficult is that plastics are very susceptible to contamination. If sorting is imperfect, resins may mix with other kinds of organic debris when melted.
Mixing leads to defects and disruptions in the molecular structure which, in turn, leads to degraded properties. In some cases, contamination leads to the total breakdown of the polymer. For example, even trace amounts of polyvinyl chloride (PVC) destroy polyethylene when the two are melted together.
With plastics, however, potential contaminants are more plentiful and much more difficult to control. Separating plastics is particularly problematic because there is little variation in physical properties (such as density and solubility) to use in sorting. Also, the six basic types of plastic resin include multiple grades and colors within each resin type, and often several resin types are used to make a single container.
Primary plastics reprocessing is therefore strongly limited by the chemical properties of the material. Reprocessors that make plastic containers out of other plastic containers typically blend virgin resin with the recycled resin to boost the product's performance. One study reported that it is possible to make containers with recycled contents of up to 50%, if the reclaimed containers used are themselves made of pure virgin resin. At least one blow-molder was also able to produce a 100%-recycled content bottle with the desired properties using a particular blend of postconsumer resins. However; large-scale reprocessors have found that using more than 15% to 25% of post-consumer feedstock reduced the strength of their containers.



1.3. Recycling PET

PET recycling seems feasible in two aspects: one is that is the market need and second this market need is just at the same direction with the environmental request to reduce the waste materials in the land fields or the waste in general.

The PET recycling produces PET resin to be used for bottle to bottle, fiber and film forming. These are the end processes of the PET recycle if we do not consider to process it further in secondary and tertiary processes described briefly above.

Our project is considering the PET recycling for the final product to the bottle to bottle. The project itself would be realized in the following steps:

1. Collection of the PET bottles and process to PET bottle bales,
2. Process of PET bottle bales to PET flakes;
3. Process the PET flakes to PET granules;
4. Process the PET granules to PET bottles;

Each step is cost evaluated and the feasibility in each process is estimated. The first phase that is the collection of the PET bottles would start first in order to create the raw material to be processed in the next steps. Although the total cost investment is estimated to be around 2.5-3 million euro, the project itself would utilize the financing step by step and have promising parameters to be financed by crediting itself.

The total project itself is considered to be realized in three stages: the first stage of preparing the PET flakes to the food grade quality (that includes step 1 and 2), the second stage that process PET flakes to PET granules through the process of change of intrinsic viscosity known as IV factor and PET crystallization and cut to granules, and the final stage that makes PET bottles from granules obtained from the second stage and additional virgin material.

Albania, Kosovo and Macedonia are collecting PET bottles but they do not process it further. Only in Albania there is a potential of being collected about 6000 ton of PET bottles, which is only a small part of the PET bottles that waste. In Albanian market is a supply of more than 300 ton/month that sales outside and Kosovo with Macedonia provide together more than 400 ton/month. The actual estimated supply in Albania is 3600 ton/year.

2. Sponsorship, management & technical assistance:

2.1. History and business of sponsors, including financial information.

In Albania the PET recycling is not introduced yet. According to statistical data there could be about 6000 ton/year of PET bottles that could be collected. The municipality still is not encouraging the collection of the trash materials in separate trash bins although a tax for cleaning garbage is collected. If partially this tax could be used to finance this project or similar recycling projects, the local government could be a target sponsor for such activity.

2.2. Proposed management arrangements and names and curricula vitae of managers.

The PET recycling requires 2.5 – 3 million euros to cover all the stages of recycling and process RPET to bottle to bottle. The private company "Henry 2000" is a well known company in sanitarian materials being a leader in this types of supply provided through imports from China and other countries as well as by having in the regional market the brand names products of the company. The regional sale market includes Albania, Kosova, Montenegro, Macedonia and extends as well in EC countries like Italy and France.

Mr.Ylli Xhakollari, is the owner of the company "Henry 2000" and owns it as a single owner. During 15 years of work the company is increased rapidly having a capital of some million Euros and the share of the sanitarian goods about 80%. The total capital cost of company is estimated to be worth of 8 million euro.

Considering the environmental impact of introducing the PET recycling, the company would like to be involved and realize this project based in the analyze of success story of the company management.

2.3. Description of technical arrangements and other external assistance (management, production, marketing, finance, etc.).

The company has finalized the feasibility study of the project. During this study the company is consulted with engineers and technicians as well as with organisms that are responsible for environment like Ministry of Environment and Regional Agency of Environment, and the local government.

Regarding the technological process and equipments the company has made contacts and offer requirements to the leader companies in producing technological PET recycling lines in EC and in China. The selection of the best offer is made for the lowest evaluated offer that meets both bottle to bottle requirements as well as environmental requirements.

The product from the first stage of the project is PET flakes that are on demand from markets in EC and Asia. On this stage seems that the product would be sold successfully and cover in reasonable time the initial investment and generate funds for developing the next stages of the project.

The financing of the whole project would require 2.5 – 3 million euros in three stages that are PET recycling to PET flakes food quality, PET flakes crystallized to PET pellets and PET pellets extruded to bottle flacons and bottles for food purpose. This is the complete recycle of PET to bottle to bottle processes. The company would like to start first with the PET recycling to PET flakes that meet the first grade quality. This product is highly required in the market and also creates a good link for the second and third step of the whole project. Because the company is big and in the present business it operates in the high rate of the cash flow, crediting by the bank is the first option in developing the project stages. Therefore the company is looking to the banks and other financial institutions that would like to be involved with credit financing in the project.

3. Market & sales:

3.1. Basic market orientation: local, national, regional, or export.

The latest data from PET recycling EU organisation Petcore shows that 40% of all PET bottles introduced to the European marketplace were collected for recycling in 2007 – a 20% increase on the previous year. The association says that European post sorting PET collection reached 1.13m tonnes last year. Petcore said there was an overall estimated total mechanical reclamation capacity in the European region of 1.2m tonnes in 2008, with approximately 100,000 tpa of extra capacity planned.

In Albania the collection of PET bottles has started and is located to two or three companies that simply collect, pre select and process used PET bottles to PET bottle bales with max 300 kg/m^3. Bales are wired by metal wire or strap and make a shape of minimum dimensions 700x800x700 mm up to the maximum 800x1200x1000 mm. According to ITC (International Trade Statistics) the value of waste plastics of all kinds in Albania for years 2001-2005 was 3.29, 4.35, 4.39, 3.18 and 2.03 million dollars. And in all sorts of plastics PET and HDPE covers about 95% of the total quantity.

Tirana, Durresi, Vlora, Shkodra, Fieri, Elbasani, Korca are the cities with most consume of soda water and all the commodities packed in the PET bottle. In these cities we have calculated that will get 90% of PET recycled bottles.

The bottle collection is managed basically in the city waste land fields. Is less collection made in the clean PET recycled that would be collected directly in the main consumers place.

All the PET bottle collectors export their product to Bulgaria and Italy.

3.2. Projected production volumes, unit prices, sales objectives, and market share of proposed venture.

Considering that the rate of PET collection is still unknown and comparing with the data of the EU hitting to 40% collection rate, the capacity of the PET flake line would be 800-1000 kg/hour. Assuming 50 weeks of work on 24/24 for 7 days, and the efficiency of 80%, the line capacity is optimized to be 1000 kg/hour that is an input of 5000 ton/year or output of 4000 ton PET flakes of food grade.
a. The units prices considered for the first phase, collecting PET bottles and process to PET flakes are:

- PET bottles in bail	300 USD/ton
- working labor	50 USD/ton
- electricity	50 USD/ton
- depreciation cost	20 USD/ton
- total cost	420 USD/ton

b. The unit prices considered for the second phase, processing PET flakes in granules and viscosity change are:

- PET flakes	600 USD/ton
- working labor	10 USD/ton
- electricity	50 USD/ton
- depreciation cost	40 USD/ton
- total cost	700 USD/ton

c. The unit prices considered for the second phase, processing PET granules to PET bottels are:

- PET granule 1000 USD/ton
- working labor 10 USD/ton
- electricity 50 USD/ton
- depreciation cost 40 USD/ton
- total cost 1100 USD/ton

Sales objectives are based on the market price search of products such PET bales, PET flakes, PET granules and PET bottles. On our project these objectives are evaluated for each step along with net profit.

a. First phase: PET flakes

- PET flakes cost 420 USD/ton
- PET flakes sell 600 USD/ton
- Net difference 180 USD/ton

b. Second phase: PET granule

- PET granule cost 420 USD/ton
- PET granule sell 700 USD/ton
- Net difference 280 USD/ton

c. Third phase: PET bottle cylinder

- PET bottle cylinder cost 1100 USD/ton
- PET bottle cylinder sell 2000 USD/ton
- Net difference 900 USD/ton

Prices for recycled PET will continue to be tied very strongly to the fate of virgin PET. In the coming decades, the PET industry will have to choose among several options for meeting the apparent persistent rise in PET use: by adding virgin capacity, by participating in recovering more discarded PET, or by some combination of the two. Continued low recovery rates for PET may force states and governments to add pressure in making that decision.

3.3 Potential users of products and distribution channels to be used.

There are potential users of PET recycled products for each phase. In recycling the smallest net difference stays in PET bottle collection to make PET bottle bails. Because the market supply of the EU is up to 40% with PET recycled the demand from PET flakes producers byes the PET bottle bails. The project would start first accumulating PET bottle bails to prepare the market and be prepared for the shortage of supply during production.

Because of cost expensive processes of producing virgin PET material and the ecological laws that obliges the countries to process their waste, the investment for establishing PET recycling to PET flakes are feasible. Potential users of PET flakes are the EU countries like Italy and Germany that already are working in third phase of PET processing by changing intrinsic viscosity (IV) and crystallization of recycled PET flakes to the final product such as PET granule and PET bottle cylinders. COCA COLA and PEPSI are the main companies that consume huge quantities of PET recycled material to make new bottles for their production.

In Albania we see potential users of our final product the mineral and soda water companies that are always in need for confectioning their product in bottles. Also the increase of the local production of beer makes stronger demand in the local market for the plastic bottles made with PET.

The evaluation of the offer and demand for PET resine in the region, EU and China makes the sale of the products in each phase feasible.

3.4. Present sources of supply for products.

Present sources of supply we have considered to start are the waste collectors working in the land fields of the main cities of Albania. Beside other materials they collect and bail PET bottles. Through the network sale that our company has established in long working years, the company is planning to provide in the main collection places the pressing and bailing machines. The same scheme we plan to use for the regional collecting. There are companies in Kosovo and Macedonia already collecting and interested to sale their product. Also in Greece, Thessaloniki seems to be an interesting source until the Albanian market of the PET collection would go stronger.

3.5. Future competition and possibility that market may be satisfied by substitute products.

Bottling of liquid food materials uses mainly the confection in PET bottles, glass bottles and tetra pack. However, tetra pack could not be used for confectioning liquids such are water, gas water, juices, Coca Cola and Pepsi, food oils, etc, where the visibility of the color and clearance of the liquid counts on the taste and selection of the buyer. Therefore tetra pack also for the future seems to be no competitor.

However, in question is the use of the PET versus the glass. The technical studies show that the energy consumed to make glass confection or PET confection are quite equally. Beside the glass bottles are technically recycled only by washing and not reforming like PET resins. Development and research made for PET recycling is providing more energy efficient technologies like Vacurema, that process the recycled PET resins in the friction reactors for increasing the intrinsic viscosity and crystallize in the proper length of polymer.

3.6. Tariff protection or import restrictions affecting products.

In Albania there are no tariff protection laws or import affecting products. The EU countries have forbidden the import of PET bailed bottles. The European Community first introduced measures on the management of packaging waste in the early 1980s. Directive 85/339/EEC (no longer in force) covered the packaging of liquid beverage containers intended for human consumption. The directive however was quite vague and, as a consequence, diverging national legislation appeared in several Member States. In 1992, the European Commission came forward with a Proposal for a Council of the European Union directive on Packaging and Packaging Waste and finally, in December 1994, directive 94/62/EC was adopted.

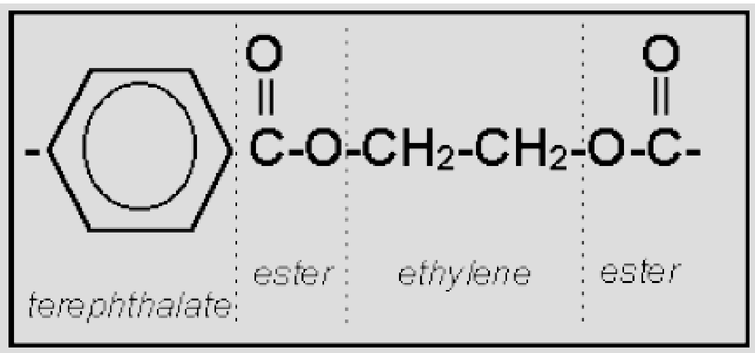
In December 2001, the European Commission put forward a proposal revising the EU Packaging and Packaging Waste regulations. After many discussions between the European Council and the European Parliament, the proposal was agreed in December 2003 and the Packaging Directive was finally amended in February 2004. The Directive is now referred at with the following code: 2004/12/EC.

3.7 Critical factors that determine market potential.

4. Technical feasibility, manpower, raw material resources & environment:

4.1 Brief description of manufacturing process.

PET (also named PETE) is a kind of polyester material for fiber, injection molded parts, as well as blow-molded bottles and jars. Special grades are offered with the required properties for the different applications.



Chemical formula of PET resine

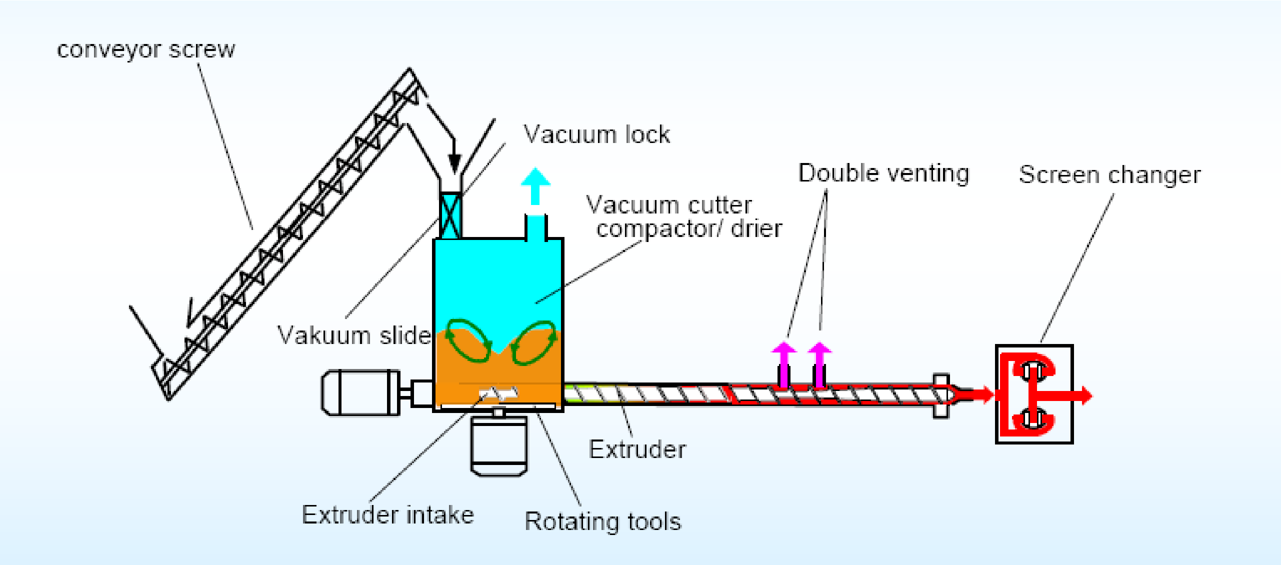
PET is linear thermoplastic (long-chain molecule consists of repeating units shown as figure right), white but bluish resin made from terephthalic acid and ethylene glycol through poly-condensation. PET is supplied by the resin manufacturers in the form of small pellets, each about 0.05 gram. PET came into prominence in the 1950s

as a textile material. Its strength, temperature tolerance and wear-resistance made it an ideal replacement for, or addition to natural fibers such as silk, cotton and wool.
It has good antiosmosis, low water absorbability and good toughness. PET film's tensile strength is similar with aluminum film's, and is three times that of PC and PA film. PET film is transparent. It's tensile strength can reach 1/3~1/2 of steel's if dealed by oriented draw. It's the toughest thermoplastic film. It will be burnt with yellow flame and will burst when burning. And it will continue burning when away from fire.
Unlike simple polymers such as polyethylene, PET is not made by a single stage process, but by the reaction between two chemicals, purified terephthalic acid (PTA) and ethylene glycol (EG). The availability of the first of these has dictated the supply of PET resin in the past, but new capacity coming on stream this year will ensure more than adequate supplies to meet the growing uses of PET over the coming years. Related polyesters are polybutylene terephthalate (PBT) used mainly for engineering applications, and polyethylene naphthalate (PEN). The latter offers significant performance improvements over PET, particularly in terms of barrier properties and heat tolerance. Since PEN can be blended with PET a range of new 'alloys' is becoming available for special packaging applications.

The process of PET recycling is made in three phases. The first phase has two steps: the processes of collecting PET bottles and process them to PET bottle bails through processes of selection for the material and the color and the second step transforming bails to PET flakes. Three types of selection are made in PET bail process; bottles without color (transparent bottles), bottles with blue and green color, and dark bottles. Then the bottles are pressed and bailed in the standard size of bails for transportation.

The second step is where the PET bail bottles are transformed to PET flakes. This process includes the sorting, pre washing, washing, cutting, separation of labels and PVC from the PET, drying and packaging PET flakes in the bags with around 1 ton per bag. This phase is important because the dirty and the PVC need to be cleared away in order that the PET flakes are in the food quality grade.
The process is a combination of conventional mechanical methods and chemical recycling. The prime material supplied to the plant consists of PET beverage bottles, sorted by colour. The bottles are supplied in the form of compressed bales, each containing between 3,000 and 5,000 bottles. Each bale is given an electronic identity in order to facilitate traceability in the material stream as well as automatic material storage and control. The bales are loaded onto a conveyor belt and unstrapped to free the bottles, which are fed to one of two shredders.
The material is shredded, in a dry state, down to a unified granule size. The resultant material is a mixture of PET, labels and closures, which must be separated. The plastic and paper labels are removed from the stream by an air blowing process. Any labels adhering to the PET with glue are subsequently removed by intensive washing. In the next stage polyolefins (closures) and PET are separated using the difference in their densities.
The cleaned and sorted PET flake is now coated with caustic soda as it passes through a special washer and dryer. The materials have to be dried as they enter the package unit.

The second step is to transform the PET flakes in to PET granules that has as nearest technical and chemical properties as the virgin PET. This is archived by processing the PET flakes in the grinding reactor that changes the intrinsic viscosity of recycled PET flakes by cutting and fractioning it. During this process is produced heat that helps the process of making material more viscous or in the other terms regenerating the length of polymer.
In the bottle industry, the length of the PET chains is usually described by the resin IV (Intrinsic Viscosity). Bottle grades have IV values of about 0.65 to 0.85 dL/g, or about 100-155 repeating units per chain. Most bottle grades of PET are copolymers, which means that a few percent of a modifier has been incorporated into the polymer chain. Copolymers are easier to injection mold because the crystallinity behavior is improved.
A remarkable transformation takes place when injection molded PET is stretched at the right temperatures and to the right extent. The long chains undergo strain-hardening and strain-induced crystallization, which gives the properly-made PET bottle exceptional clarity, resistance to internal pressure, uniform wall thickness, toughness, and a host of other features. To achieve these useful properties, however, care must be taken in choosing the right grade of resin, as well as the right perform and bottle designs, and good molding practices. The best way to recover the properties of the recycled PET is achieved using three reactors.



The scheme of the process of viscosity change and crystallization of PET

The system of change IV and crystallization in three stages

The third stage is processing the PET granules to make PET bottle cylinders or process further to bottles if the customer is nearby. The processes of this phase are as follows:
- Drying of PET
PET absorbs moisture from the atmosphere. This must be removed by a dehumidifying drying before processing.
- Plasticizing the PET
Dried PET pellets are compressed and melted by a rotating screw.
- Injection Molding the PET Preform
Molten PET is injected into the injection cavity and cooled rapidly to form a "preform? (The test tube- like form from which bottles are blown is known as a preform).
- Heating the PET Preform
The temperature of the preform is adjusted to the correct profile for blowing.
- Stretch Blow Molding the PET Container
The hot preform is simultaneously stretched and blown (thereby orienting the crystals of and strengthening the PET*) into a shaped blow mold to form a tough, lightweight container. PET that is heated to a temperature

where its chain-like molecules are sufficiently mobile to uncoil instead of breaking when extended, can be oriented by stretching. Stretching applied from two directions at right angles, as in stretch blow molding, gives biaxial orientation. Oriented PET contains closely packed chains aligned in the directions of stretch. The material is stronger because the molecules act together instead of individually. The tensile strength of oriented PET is several times that of the unstretched material and the impact strength, barrier and chemical resistance are also significantly improved, so bottles can be lighter without sacrificing performance.
- PET Container Ejector
The finished container is ejected.

4.2. Comments on special technical complexities and need for know-how and special skills.

As PET (bottle grade) is a kind of transparent, wear-resisting and corrosion-resisting plastics with high strength and smooth finish, it is widely used for PET bottles of mineral water, juice, edible oil, pharmaceuticals, cosmetics, etc.
PET products can be made crystallizable or non-crystallizable through controlling crystallization temperature and cooling speed. Usually it's crystallinity is 0~50%. The higher IV value, the slower crystallization speed.
The key factors that effect PET bottles' molding process and performance are crystallization and orientation. If PET’s moisture level is high, hydrolysis will happen while molding and it's IV value will drop which means products' quality be affected. The main characteristics are:
Melting Temperature: 254-256^{0}C
Crystallinity: >=45%
Carboxyl End Group: <=20mol/t
Acetaldehyde: <=3ppm (Ex-Work, related to drying & molding temperature)
For CSD bottle, <=9ppm required; for mineral water, <=4ppm required.
Density: 1.38~1.40g/mm3
Glass Temperature: 820C
In the bottle industry, the length of the PET chains is usually described by the resin IV (Intrinsic Viscosity). Bottle grades have IV values of about 0.65 to 0.85 dL/g, or about 100-155 repeating units per chain.
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Some grades of PET have other modifications to improve the bottle barrier properties, the reheat characteristics (for two-stage systems), or the generation of AA (acetaldehyde).

These qualities should be maintained and reformed during the good recycling process of PET. Therefore is important that the process is maintained and supervised by trained engineer in the field of recycling PET, chemical and physical analyses be performed in several steps of the process to assure the quality is meet and the workers should be trained especially in sorting and maintaining the correct technological parameters.

4.3. Possible suppliers of equipment.

Possible suppliers of equipments are found all over world. For the project several companies from EC, US and China are contacted and their offers are evaluated. The most sounded offers were received from the listed companies:

- Hangzhou Fuxing Environmental Protection Machinery Co.,ltd., China
- Zhangjiagang Raidsant MachineryCo., Ltd.,China
- Kunststoff-Recycling Systeme, Germany
- Herbold Meckesheim GmbH, Austria
- SOREMA DIVISION OF PREVIERO N. srl, Italy

4.4. Availability of manpower and of infrastructure facilities (transport and communications, power, water, etc.).

The PET recycling line on the capacity of 1000 kg/hour is expected to consume in the first phase energy 250 kw/hour, water 5 m3/hour, 15-18 persons divided in three shifts and covering the operation and maintenance.

In the last phase energy consumption would be 650 kw/hour, water 8 m3/hour, 18-20 persons divided in three shifts and covering the operation and maintenance.

These requirements require that the power supply, water supply and discharge of industrial water, and manpower to be in reasonable proximity with the PET recycle line.

Layout of the PET recycling line placement

The placement location that company has considered is showed in the above map. The line would be 10 km from company headquarter and 17 km from Tirana. The settlement is already provided by the power electricity lines that are providing energy to the bricks and other factories of the zone. Water supply would be provided by well waters of the place or from the water supply of the zone. Discharge of treated industrial waters would be made in Lana River that is not more than 600 m from the designed placement. Workers would be hired in the nearby villages that are seeking for job opportunities.

4.5. Breakdown of projected operating costs by major categories of expenditures.

The working time of the PET recycle line to transform bottle to flakes in the food grade quality is given in the table:

Item	value
Working time in hours per year	8736
week no	52
week days	7
dayly hours	24
maintenance in hours	336
days/year	14
dayly hours	24
Total of working hours per year	8400
Personel	
shift personnel for three shifts	15
maintenance personel	1

The inputs for a PET line that process 1000 kg per hour and the chemicals used are presented in the following table:

Inputs	per hour	per year	units
PET recycled bottles (kg/h)	1000	8,400,000	kg
waste in the recycled PET bottels (%)	20	1,680,000	kg
HDPE in PET recycled bottles (%)	5	420,000	kg
waste disposal (kg/h)	200	1,680,000	kg
Energy (kw/kg)	0.25	2,100,000	kw
Industrial water (lter/kg)	3	25,200,000	liter
Waste water (liter/kg)	3	25,200,000	liter
Steam(kg product/kg steam)	0.7	5,880,000	kg
Chemical additives	1000 kg/kg	year inputs	
caustic sode (1000 kg product/kg sode)	20	168,000	kg
detergent (1000 kg product/kg detergent)	13	109,200	kg
foam stopper (1000 kg product/kg)	2	16,800	kg
TOTAL		294,000	kg

Based on the above tables of the working time, personnel, and normative (inputs) the cost tables are calculated:

Runing Costs	1000 kg/kg	Cost/year
Cost of PET recycled bottels(1000 kg)	$300.00	$2,520,000
Cost of HDPE recovered (1000 kg)	$400.00	$168,000
Cost of waste disposal (1000 kg)	$12.00	$20,160
Cost of energy (kw/h)	$0.13	$273,000
Cost of water (m3)	$0.50	$12,600
Cost of waste water treatment (m3)	$1.00	$25,200
Cost of steam (kg)	$0.03	$147,000
Cost of maintenance (% of investment)	3	$25,772
Cost of person (hourly cost)	$1.64	$71,832
Cost of maintenance (hourly cost)	$2.00	$672
Cost of caustic soda (price/liter)	$0.02	$67
Cost of detergent (price/liter)	$1.10	$120,120
Cost of foam stopper (price/liter)	$2.50	$42,000
Cost of packaging (price/1000 kg product)	$10.00	$84,000

The product is packed in the plastic bags that are filled approximately with 1000 kg of PET flakes in the bags that cost 10 USD/piece. Because the PET recycled bottles are dirty with remaining liquids and part of solid waste in contact with them, there is the loss on the output that reflects the waste materials removed from the PET bottles and flakes loss on washing process. We have calculated this factor by using the efficiency coefficient of 90%.

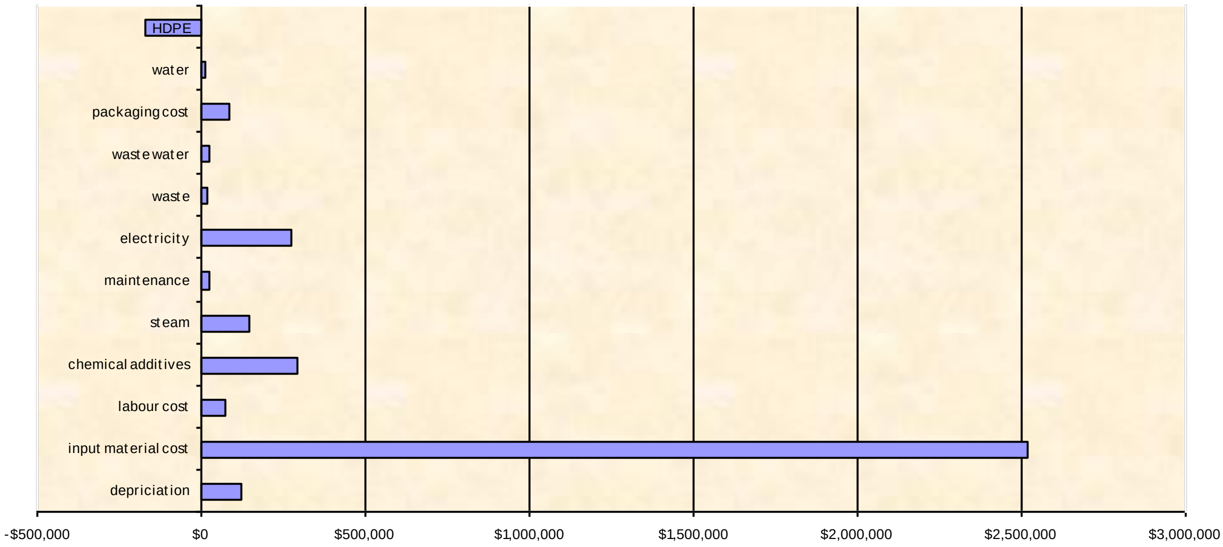
Furthermore we calculate the investment cost including all necessary investments. From investment value are calculated the depreciation values on each investment and the total investment. For the investments like the land, building and the PET line, in formula calculation the life span of 7 years is used for all and the scrap value or remaining value is considered zero. That modifies the formula of depreciation value calculation as the rate of total investment cost to the life span of seven years. The effect in the calculation would be that the depreciation value would be higher and the gross margin lower. However that would be a reasonable approximation considering the risk of investment. The following tables present such calculations:

Investment Cost	USD
Cost of land	$200,000
Cost of building	$350,000
Cost of the PET recycling line for flakes	$300,000
Cost of the PET recycling line ansambling(%)	$9,000
Cost of utilities	$80
TOTAL investment cost	$859,080
Depriciation cost	USD/year
Depriciation of land 50 years	$28,571.43
Depriciation of building 15 years	$50,000.00
Depreciation of PET line 7 years	$42,857.14
Depriciation of utilities 7 years	$11.43
TOTAL depriciation	$121,440.00

total cost	value	%
depriciation	$121,440	3.5
input material cost	$2,520,000	73.5
labour cost	$71,832	2.1
chemical additives	$294,000	8.6
steam	$147,000	4.3
maintenance	$25,772	0.8
electricity	$273,000	8.0
waste	$20,160	0.6
waste water	$25,200	0.7
packaging cost	$84,000	2.5
water	$12,600	0.4
HDPE	-$168,000	-4.9
total cost	$3,427,004	100.0

cost/kg	$0.41
production cost/kg	$0.11
sale	$4,536,000.00
gross margin	$1,108,995.60
year production	7560 ton

total production cost



4.6. Source, cost, and quality of raw material supply and relations with support industries.

The only sources for raw material supply that in our project is defined as PET used bottles are the waste collection companies and individual collectors. They operate both in the land field and with preselected waste in main consumers of the PET bottles. The cost of collecting PET used bottles from individual collectors is 200 USD/ton not bailed and preselected bottles and from the collection companies is 300 USD/ton for bailed bottles.

There is no relation between individual and companies that work in waste collection with industries of PET recycling in Albania. However, the PET bailed bottles collected in Albania until now in an amount of 300 ton/month are exported to PET recycling industries of China and Bulgaria.

4.7. Import restrictions on required raw materials.

There are no import restrictions in Albania for the raw materials in the recycled PET industry. Also the small market of PET bailed bottles is operating only with countries that do not have the import restrictions. The EU has the import restrictions for the raw materials that come from waste.

4.8. Proposed plant location in relation to suppliers, markets, infrastructure, and manpower.

The location the company has chosen to develop the PET recycle industry is between Tirana and Durresi. The distance of 17 km from Tirana and the distance of 10 km from company headquarters optimize the distance from suppliers. The location has already the infrastructure that allows transportation in and out for the raw materials and products as well as for access from workers and maintenance. Power supply and water supply are also in place. Villages in proximity would provide manpower that would be trained and paid according to the qualifications that meet the PET recycle production.

The first product that would be PET flakes would be shipped through Durresi port that is 23 km far from the location of the PET flakes line. Also the second product that would be PET granules would require the shipment. The request of the Asian markets and European markets guarantee the sale of these products.

4.9. Proposed plant size in comparison with other known plants.

The plant size is chosen by considering that the company is planning to develop the collection to provide up to 6000 ton of PET bailed bottles. The offers provided from PET line producing companies are listing the input rates from 400 kg/h to 3500 kg/h. For further increase is recommended adding a parallel line and double the production. The PET flake lines in EU are in the range of 1000 kg/h to 2000 kg/h and the more capacity is realized by adding the parallel lines. That scheme provide to be very efficient considering that in summer time it is a increase offer for the PET used bottles and in winter the quantity drops quite half.

The company has made the choice of using 1000 kg/h and having in the beginning an unused capacity of about 30% and during the time reduce it. Also is thought that this is the capacity that would fit for several years until in Albania the rate of recycling of PET increases.

4.10. Potential environmental issues and how these issues are addressed.

PET containers are 100% recyclable. However, it is not only their recyclability quality that makes them environmentally friendly. Being extremely light, they help diminish the formation of packaging waste while at the same time they reduce the emission of contaminants during their transport. Furthermore, since they require less fuel during transport, they also help saving energy.

In order to give birth to a new product, used PET containers must first and foremost be collected. Nowadays, the majority of European cities have set into place a collection scheme to recover recyclable items.

The second step into recovering used PET bottles entails collected material to be sent to a sorting plant where materials are separated according to their nature.

Recovered PET bottles are then punctured and baled (that is: compacted in a bundle) and are sent to a reclaimer. The reclaimer, is a factory that turns used bottles into PET flakes, the raw material at the base of recycled PET products. The first thing the reclaimer has to do is de-baling the bundles. To make sure the final product will be as pure as possible, the de-baled bottles are sorted once again then they are pre-washed and are shredded into flakes. The flakes are washed and dried in their turn, and then they are stocked and sold. It is when the flakes are sold that the actual recycling sets into action: the flakes, the raw material, are melted then manufactured into a new product.

The PET plastics recycle industry emphasizes the positive contributions that plastics make. The largest single use for plastics is packaging. Because packaging has a short lifespan, it makes up a large portion of the plastics waste stream.

In general, the data from World Environmental Protection Agency says that in the early 1990s about 80 percent of all municipal solid waste was sent to landfills, 10 percent was incinerated and 10 percent was recycled. While more and more plastic is being recycled, the EPA estimates that plastics make up about 20 percent of the solid waste that is land filled.

Most consumers think that the slow degradation of plastics is the primary reason that plastics should be recycled. However, research has shown that other waste, such as paper, wood and food wastes, also degrade very slowly in landfills.

The more serious problem with plastic waste concerns the additives contained in plastics. These additives include colorants, stabilizers and plasticizers that may include toxic components such as lead and cadmium. Studies indicate that plastics contribute 28 percent of all cadmium in municipal solid waste and about 2 percent of all lead. Researchers don't know whether these and other plastic additives contribute significantly to products leached from municipal landfills.

How toxic are plastics that are burned? Researchers don't know that, either. Plastics that contain heavy-metal-based additives may also contribute to the metal content of incinerator ash. The EPA is looking for substitutes for lead- and cadmium-based additives.

One additional concern relates to use of petroleum products. All plastics began their lives as petroleum. By increasing plastics recycling, scientists and engineers are able to reduce dependence on petroleum.

On concrete items in PET recycling the output waste are 20% of impurities as solid, paper, glue and remaining liquids in the bottle. The other waste is waste water that simply would clean up to the environmental parameters by filtration and pH change.

Thus the environmental impact of PET recycling is very positive because it removes the PET bottle from municipal waste, reducing the quantity of the hazards that would be produced if the material is leaved for slow degradation.

5. Investment requirements, project financing & returns:

5.1. Estimate of total project cost, broken down into land, construction, installed equipment, and working capital, indicating foreign exchange component.

The total project cost on three phases is presented in the table below:

No.	Project cost item	Value (USD)
Preparation	Land acquisition	200,000
	Construction of plant facility with future capacity to host three phases of the project (5000 m2)	350,000
First phase	Collection of PET bottles, bail PET bottles and create the collection network	50,000
	PET recycle line for flake production	390,000
Second phase	Construction for second phase	50,000
	PET recycle line processing flakes to change density and prepare granules of food quality.	910,000
Third phase	Construction for the third phase	30,000
	PET line for processing recycled granules to PET bottle cylinders that are used to make PET bottles	780,000
T O T A L		2,560,000

The foreign exchange is calculated to be 1 USD = 100 lek.

5.2. Proposed financial structure of venture, indicating expected sources and terms of equity and debt financing.

5.3. Type of IFC financing (loan, equity, quasi-equity, a combination of financial products, etc.) and amount.

5.4. Projected financial statement, information on profitability, and return on investment.

5.5. Critical factors determining profitability.

6. Government support & regulations:

6.1. Project in context of government economic development and investment program.

In the context to the Government economic development and investment program the project finds support in the national strategy program as part of the poverty reducing and life quality increasing because the project would provide the local development in the local area where the plant would be located. Beside in the phase of the creating the collection market of the PET bottles, the project would impact more in the pressure made for municipality regulations on collecting and processing wastes in the environmental way.
Ministry of Environment has addressed the issue of waste treatment on the document " Sectorial Strategy of Environment" published in 2007 where the chapter 1.2.11. is dedicated to the urban waste and emphasizing in the ways to deal with urban wastes by processing the post consumer waste in environmental technologies. (Riciklimi i mbeturinave është i pakët. Metoda kryesore për trajtimin e mbetjeve është ajo vëndmbulimeve (landfill) ndonëse duhet theksuar se këto vendmbulime nuk janë të ndërtuara në mënyrën e duhur nga ana inxhinierike dhe shkaktojnë ndotje të vazhdueshme të mjedisit.)

And in several laws and regulations the Government of Albania, through Ministry of Environment encourages processing the recycle of waste with appropriate technologies. The technology our project presents is the approved one in the EU and fulfills all the environmental requirements.

6.2. Specific government incentives and support available to project.

6.3. Expected contribution of project to economic development.

6.4. Outline of government regulations on exchange controls and conditions of capital entry and repatriation.

7. Timetable envisaged for project preparation & completion.

No	Activity	Time
1	Land acquisition	January 2009
2	Building construction	February-May 2009
3	Start creating network of collection and collection	March 2009
4	Procure and finalize the contract for buying the line for processing PET bailed bottles to PET flakes	January 2009
5	Install and test the line for processing PET bailed bottles to PET flakes	May-June 2009
6	Start normal production of the PET flakes	July 2009
7	Create the network for buying bailed PET bottles from abroad (Kosovo, Makedonia and Greece) to complete the working capacity and sale network of the PET flakes in EU countries and China	March 2009
8	Evaluate the quantity/quality of production and check the year net profit	July 2010
9	Start preparation for second phase by evaluating the offers for processing PET flakes to PET granule	March 2010
10	Procure and finalize the contract for buying the line for processing PET flakes to PET granule	May 2010
11	Install and test the line for processing PET flakes to PET granule	June-July 2010
12	Create the sale network for PET granule	September 2010
13	Evaluate the quantity/quality of production and check the year net profit	July 2011
14	Procure and finalize the contract for buying the line for processing PET granule to PET bottle cylinders	May 2011
15	Install and test the line for processing PET flakes to PET granule	June-July 2011
16	Create the sale network for PET granule	September 2011
17	Evaluate the quantity/quality of production and check the year net profit	July 2012
18	Check and balance of the existing production capacities	September 2012
19	Check the prospective of the increase of collection/production	October 2012

COST CALCULATIONS FOR FIRST STAGE + SECOND STAGE

Item	value	value	value		
Working time in hours per year	8736	8736	8736		
week no	52	52	52		
week days	7	7	7		
dayly hours	24	24	24		
maintenance in hours	336	336	336		
days/year	14	14	14		
dayly hours	24	24	24		
Total of working hours per year	8400	8400	8400		
Personel					
shift personel for three shifts	15			6	6
maintenance personel	1			1	1
Inputs	hourly inputs	year inputs			
PET recycled bottels (kg/h)	1000	8,400,000	kg	1000	1000
waste in the recycled PET bottels (%)	20	168,000	kg		
HDPE in PET recycled bottels (%)	5	42,000	kg		
waste disposal (kg/h)	200	1,680,000	kg		
Energy (kw/kg)	0.25	2,100,000	kw	2,100,000	2,100,000
Industrial water (lter/kg)	3	25,200,000	liter	25,200,000	25,200,000
Waste water (liter/kg)	3	25,200,000	liter	25,200,000	25,200,000
Steam(kg product/kg steam)	0.7	5,880,000	kg		
Chemical additives	1000 kg/kg	year inputs			
caustic sode (1000 kg product/kg sode)	20	168,000	kg		
detergent (1000 kg product/kg detergent)	13	109,200	kg		
foam stopper (1000 kg product/kg)	2	16,800	kg		
TOTAL		294,000	kg		
Packing volume(kg)	1000				

Runing Costs	1000 kg/kg	year costs
Cost of PET recycled bottels(1000 kg)	$300.00	$2,520,000
Cost of HDPE recovered (1000 kg)	$400.00	$16,800
Cost of waste disposal (1000 kg)	$12.00	$20,160
Cost of energy (kw/h)	$0.13	$273,000
Cost of water (m3)	$0.50	$12,600
Cost of waste water treatment (m3)	$1.00	$25,200
Cost of steam (kg)	$0.03	$147,000
Cost of maintenance (3% of investment)		$28,553
Cost of person (hourly cost)	$1.64	$206,640
Cost of maintenance (hourly cost)	$2.00	$16,800
Cost of caustic sode (price/liter)	$0.02	$67
Cost of detergent (price/liter)	$1.10	$120,120
Cost of foam stopper (price/liter)	$2.50	$42,000
Cost of packaging (price/1000 kg product)	$10.00	$84,000

Investment Cost	**USD**	**USD**	**USD**
Cost of land	$200,000		
Cost of building	$350,000	$50,000	$30,000
Cost of the PET recycling line for flakes	$390,000	$910,000	$780,000
Cost of the PET recycling line ansambling(3%)	$11,700	$27,300	$23,400
Cost of utilities	$80	$20,000	$20,000
TOTAL investment cost	$951,780	$1,007,300	$853,400
Depriciation cost	**USD/year**	**USD/year**	**USD/year**
Depriciation of land 50 years	$28,571.43		
Depriciation of building 15 years	$50,000.00	$7,143	$4,286
Depreciation of PET line 7 years	$55,714.29	$130,000	$111,429
Depriciation of utilities 7 years	$11.43	$2,857	$2,857
TOTAL depriciation	$134,297.14	$140,000	$118,571
eficency	0.90	0.98	0.98
Sale price (1000 kg)	$600.00	$1,000	$2,000
Buying price(1000 kg)	$600.00		

total cost	**value**	**%**	**value**	**%**	**value**	**%**
depriciation	$134,297	3.6	$140,000	2	$118,571	2
input material cost	$2,520,000	67.6	$5,980,325	91	$6,544,000	92
labour cost	$206,640	5.5	$82,656	1	$82,656	1
chemical additives	$294,000	7.9	$0	0	$0	0
steam	$147,000	3.9	$0	0	$0	0
maintenance	$28,553	0.8	$30,219	0	$25,602	0
electricity	$273,000	7.3	$273,000	4	$273,000	4
waste	$20,160	0.5	$0	0	$0	0
waste water	$25,200	0.7	$25,200	0	$25,200	0
packaging cost	$84,000	2.3	$0	0	$0	0
water	$12,600	0.3	$12,600	0	$12,600	0
HDPE	-$16,800	-0.5	$0	0	$0	0
total cost	$3,728,651	100.0	$6,544,000	100	$7,081,630	100
cost/kg	$0.44		$0.78		$0.84	
production cost/kg	$0.14		0.07		0.06	

sale	$4,536,000		$8,232,000		$16,464,000.00	
gross margin	$807,349		$1,687,999.73		$9,382,370.30	
year production	7560	ton flakes	8232	ton pellet	8232	ton bottle cylinder