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Review Article

RENEWABLE ENERGYSOURCES APPLICABLE IN THE REGION OF KERMAN

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ABSTRACT
Nowadays, preservation of natural resources and optimizing the energy consumption are of the priorities of countries major managements. On the other hand, due to diminishing fossil fuel resources, human are seeking for suitable and affordable resources as alternatives to them. Using new resources not only supplies a part of required energy, but also it will reduce environmental and hygiene problems caused by producing wastes.

Keywords: *Waste, Energy Extraction, Incineration, Landfill, Biogas, Wind Energy, Solar Energy, Geothermal Energy*

INTRODUCTION
Nowadays, natural resources saving have been changed to one of the most important human concerns. Toward this end, increasing growth of energy consumption is of the most important human challenges. On the one hand, excessive utilization of common energy resources is leading to eradication of these resources. On the other hand, the pollution caused by using these resources is a threat for the environment. Therefore, humans are trying to find new resources to fulfill their needs in addition to preserving the environment. One of the novel resources of energy is producing energy using wastes. This production method is important since it is supplying a part of human required energy as well as reducing health and environmental problems caused by incorrect management of the wastes. In addition, it helps save the natural resources. Currently, there are various technologies and methods to process, purify, and dispose wastes. In some of these methods, energy production has the first priority while in some of them waste elimination has got the first priority. Overall, following technologies are currently used around the world (Omrani, 1995).
Thermochemical methods for producing energy including Landfill, Gasification & Pyrolysis, Plasma, RDF and Biological methods for destroying wastes including Incinerator, Compost, Biogas, Solar energy, Wind and Geothermal energies.

Novel Resource Able to be implemented in the Province of Kerman
The Technology of Producing Energy Using Urban Wastes
As animal and plant wastes steam, methane gas is produced. This method is common in China, India, and so forth. One of the techniques is making a pit for storing cow wastes. Then, some bacteria are added. As a result of bacteria reproduction, methane gas will be produced. Biogas is produced by microorganisms' dissociative anaerobic reactions which are in the environment of organic materials. These environments can be marshes and swamps and also the gas produced is known as the swamp gas. This gas is produced as a result of organic and biologic materials anaerobic decomposition by alive microorganisms and it is why this gas is called Biogas. Biogas is made of three compounds which are HI methane, carbon dioxide, and hydrogen sulfide. The major flammable compound of Biogas is methane which makes 60 to 70 percent of Biogas. Methane is an odorless and colorless gas which if 1 cubic foot of that burns, 252 kcal thermal energy will be produced which is a significant amount compared to other fuels. The two other compounds are toxic especially, hydrogen sulfide which its amount is little. One of the important merits of methane to other gases is that the toxic and dangerous gas of carbon monoxide will not be released as it burns thus, it can be used as a safe and healthy gas at home. As previously mentioned, 60 to 70 percent of biogas is made of methane and thus, this high percentage of methane has made the biogas to an excellent

resource of renewable energies which can be used as an alternative to the natural gas and other fossil fuels. These days, biogas is used to heat boilers, generators motors for producing electricity, and cooking at homes. Using the technology of biogas production has not become public in Iran yet and it is still in laboratory level. However, this technology has been widely noticed in the countries of Western Europe, Southeast of Asia particularly, China and India. These countries have fulfilled their fuel need using this technology. Sweden is one the best countries to use biogas for its transportation industry and it is forecasted that 40% of its transportation demands will be furnished using biogas by the year 2050. According to this report, the cost of producing biogas is more frugal than production of petrol. It is that production cost of one cubic meter biogas including its production, modification, and aggression is 3.5 to 4.5 SEK which is 70% of petrol cost in Sweden. Studies indicate that the rate of Carbon monoxide pollution which increases greenhouse gas will decrease by 65 to 85 percent, if biogas is used in transportation industry. Particular bacteria are able to perform the decomposition and anaerobic reaction of organic materials to produce biogas. This group of bacteria is capable of breaking and decomposing the simple and complex organic materials which leads to production of biogas. They are from mesophilic bacteria and approximately like heat which can live under the temperature of 75 to 100 degrees Fahrenheit.

Researches show that in temperature of 95 degrees Fahrenheit, the bacteria have the maximum enzyme activity to degrade organic materials and produce biogas. Concerning this issue, Biomass production is ceased in winter since the weather gets cold. The other optimal condition for biogas production is the reaction environment to be alkaline (PH=7-8). The plant and domestic animals wastes and organic materials are degraded in two steps and then they will change into biogas and biomass by bacteria. Biogas has numerous usages and biomass can be used as organic fertilizer as well. In the first step of this biologic reaction, wastes are changed into organic acids by the anaerobic bacteria then in the second step, another group of bacteria decompose the organic acids which results in production of biogas mainly made of methane.

Biogas device can be used in rural regions, agricultural, husbandry, and slaughtering complexes to produce biogas. Building this device is simple and it is made of the following parts.

Fermentation tank: It is the main part of the biogas unit. It is normally in cylindrical shape and made of bricks or concrete. This tank can be partially or thoroughly built under the ground. The wastes would be kept for one or two months after entering the tank. During this period, the organic wastes will be decamped in anaerobic conditions as the result of bacteria activities. The result of this decomposition is production of biogas and a little biomass. The process is done by constantly evacuating the biomass and adding new wastes throughout the year.

Gas chamber: This chamber is placed as a lid on the upper part of the fermentation tank whether floating or fixed and also, it can be made of concrete or metal. Gases produced in fermentation tank are located in the lower part of this lid and they can be transferred to consumption point through piping. It is important to avoid gas pressure increase in this chamber. Therefore, pressure gauge can be installed in the camber to control the gas pressure.

In anaerobic great digesters method (biogas), wastes will be mixed with latex, sewage sludge, and other things after their decomposition and crushing. Then, they will be anaerobically transferred to chambers with higher temperature. After that, they will be digested and finally, the produced gas will be transmitted to generator system after the purification to produce electricity. The cost of these systems is lower than waste incineration. In anaerobic digestion of organic compounds, chain's large molecules are broken down and changed into simpler ones. The result of this process is a flammable gas called biogas. This gas is mainly made of methane and carbon dioxide, as well as small amounts of impurities such as hydrogen sulfide, water vapor, nitrogen gas, and so forth. This gas mixture has the heating value of 20 MJ per 1 cubic meter therefore, if they are converted into electricity using available motors, 1.5 to 2 kW electricity can be extracted per 1 cubic meter. Biogas production mechanism is divided into three phases. In the first step, Complex and insoluble organic materials will be changed to soluble compounds using hydrolyze. In the second phase, organic soluble compounds are broken by acid making bacteria therefore, organic acids

are produced. In the third step, all of the produced organic compounds and acids in acid making phase will be changed into acetate and finally, they would be converted to biogas by methane making bacteria.

Incineration

Waste incineration is another solution for wastes disposal. Incinerators are defined as a kind of units which oxidize wastes using heat and therefore, they reduce carbonic materials. The outputs of waste incinerators are carbon, water, ash, and heat produced by burning. Furthermore, weather pollutants such as sulfur compounds, nitrogen gas, halogens, and heavy metals (such as cadmium, mercury, and etc.) can be other outputs of burning. In some situations, waste burning is considered as one of the most appropriate means of managing residuals.

Incinerators are divided into two general categories and each of them consists of various systems.

1. The system of generating ash and heat by burning all of the wastes including mass burning, modular, and fuel systems in addition to a floating bed capable of eliminating sewage sludge.
2. Burning a part of wastes including gas maker, waste pyrolysis and carbonization.

The Alternative Fuel of RDF

In this system, first the wastes are divided in a way that the components containing energy such as plastics, rubber, wood, leather and fabrics and also a part of wet wastes enter the system.Then, drying system, dries the entered wastes roughly for them to be suitable for the burning system. The product has the capability of burning in RDF-fired power plants or cements kilns which reduce the use of fossil fuels in cement kilns by 50% (Harati *et al.*, 2012).

Landfill with Gas Recovery

After burying house wastes in absence of oxygen, the organic part of buried wastes will be fermented and gas compounds of methane, dioxide carbon, and hydrogen will produced in addition to a little chlorine and fluorine compounds as well as a small amount of moisture. Usually, gas production starts two month after burying and it continues for 100 years.

In order to produce gas in this method, gas extracting wells are excavated in various distances in terms of each other then, the perforated polyethylene pipes are placed after that, they are filled with sand. Afterwards, the well lid would be completely isolated from the outer environment and faucet system will placed on that. Gas collecting and transferring pipesare connected and then, the produced gas will enter the electricity generation system after passing through dehumidifying system in addition to elimination of its corrosive gases. The electricity generation system can be diesel generators, wind turbines, and micro turbines. Furthermore, the steam and heat produced in the boiler can be directly used by burning the burying center gas or injecting to the local natural gas network.

Waste Elimination and Energy Extraction using Plasma Method

Plasma method is the most effective way to completely sever organic and non-organiccomponentsto reach their initial compounds for recycling. Gas maker is the most important component of plasma which can encompass several curved cressets. With a direct current between the curved cresset's cathode and anode, an environment will be created with the temperature of 5000 degrees Celsius. Plasma gas maker is an environment which lacks oxygen therefore, no combustion happens there. As a result, it is not a waste incineration or combustive system. Having the core temperature of 10000 degreesCelsius, plasma, is able to break the toxic compounds in thousandth of a second thus, no lateral materials or pollutant gases will be produced after the process. These high temperatures to break the molecules in organic materials for them to be converted to base gases can be produced only by plasma. In addition, non-organic materials are simultaneously made like dross scoria which will be changed to neutral non-emulsion glassy materials after cooling. The gas produced by organic materials gas making is mainly made of monoxide and hydrogen. The hydrochloric acid, halogens, and sulfuric materials in the ingredients (solid wastes) will be converted into chloric acid and hydrogen sulfide, respectively (Anik, 1996).

Solar Energy

Solar energy is the most extensive energy resource in the world. In order to use this resource, it is essential to find a way to convert this dispersed energy to electricity with low cost and high efficiency. Following strategies are common to convert solar energy to electricity.

Photovoltaic System

These are normally solid and fixed equipment. Solar heat systems use focused light to heat the liquid which its steam is used to rotate a turbine (Rahimi, 2012).

Solar power plants are divided into three categories based on their concentrators which are Parabolic Trough Collectors, C.R.S, and Dish sterling power plants (This technology is less used in solar power plants, however; they have more non-power plant usages (Vesilind *et al.*, 2002).

Solar Water Heater

The most suitable places to implement solar energy are houses. In most of the cases, a large portion of warm water is supplied by solar energy. However, for some cases this technology is not suitable for supplying warm water such as in high apartments; forestall regions, houses not placed in appropriate regions, and places with low sun radiations. Despite this fact, 60% of warm water for houses can be supplied through solar energy. Nowadays, the technology of solar water heaters has extensively developed.

Space Heater

Space heater needs a significant amount of energy especially in cool places. Therefore, this energy could be provided by solar energy. However, this work is not quite easy and all the buildings are not appropriate as well. Despite the warm water system for houses, there are numerous designs for other systems such as weather, water, and patio systems.

Industrial Steam Production

Usually, steam used in industries is in range of 300 to 500 degrees Fahrenheit. Such a temperature can be provided by concentrators. There are plenty of means for this issue, however; it is not clear which is the best. Energy saving is one of the main issues in these systems. There is no simple and low-cost system to save heat in this range.

Electricity Generation using Solar Cells

Solar cell is a device which can produce electricity using solar energy. These cells can be installed in an artificial satellite out of the atmosphere of the earth where they are usually out the reach of shadows. The energy comes from the sun will be converted to microwaves and then, they would be sent to the earth. After that, microwaves will be changed to electricity.

Electricity Production by Thermal Conversion

Steam produced by solar energy can rotate an electricity generator turbine to produce electricity current. This work can be done with different methods.

Hydrogen Production in Nuclear Reactors

Energy saving is one of the main problems to developing and using solar energy in high temperatures. The ultimate goal is to decompose water and produce hydrogen using solar energy. This work can be done using catalyzer in reactors in high temperature or using electrolyze. The hydrogen produced can be stored for a long period of time and transferred by pipes. Fuel cells can convert hydrogen to electricity with high efficiency.

Long period storing requires big and voluminous tanks and by this method, solar energy canbe stored for one season for it to be used in cold seasons. Due tothe availability of long period storing equipment, it would be highly economical for regions and towns which mostly use solar energy. Reusing and storing solar energy is slightly different in active and inactive systems. In active systems, storage source can be placed far from the consumption point since the energy can be converted in desired place and used in other regions. However, in inactive systems, the produced heat should be used in the same place and it cannot be moved to another places. Thus, the storage tank is a component of attracting system therefore, in this state; the storage resource can be water tanks, floors, or heavy walls with high thermal capacity. The sun radiating energy shouldbe converted for it to be stored (Kerry *et al.*, 2002).

The main methods to store solar energy are thermal, chemical, mechanical, and electrical.

The various ways to store thermal energy in the buildings are sensible temperature, invisible temperature, and a combination of both thermal storing through sensible temperature which means hoarding heat or cold in liquid or solid materials or finally, a mixture of the two methods through increasing or decreasing

the temperature of the matter thus, to achieve this goal *materials with high thermal* capacity should be used.

Chemical Storing

In this reserving system, some materials are used which produce gas as they get very hot. This gas will engage in reversible interaction with lower temperature. Sometimes, the second interaction can be in form of the gas reshaping from steam to saturate or vice versa. These methods can be followed to store thermal energy in large buildings.

Mechanical Storing

Radiating energy can be stored in forms of kinetic or potential energy. In the first state flywheels can be used and in the second state, compressed air or water in high altitude can be used. Flywheels consist of wheel, compressor, expander pump, and turbine. Hoarding in flywheels is for a short period. This system is suitable for environment. Compressed air can be stored in underground tanks and this method has the capability of long period storing. In this system, electrical energy is entered and it will be returned. The problems to this system are high air pressure and compressor sound. In home uses, steel tanks can be used to store the compressed air. For a long period of time, water has been transferred to high altitudes and its energy has been used. The water is pumped to water tanks through windmills and then it will be used.

Electrical Storage

In this method, electrical energy produced by sun radiation is preserved in rechargeable batteries. These batteries are able to be combined with photovoltaicsystems or wind generators. Normally, batteries have lead poles and they are placed in sulfuric acid. They work properly in the room temperature. Therefore, despite other systems, batteries do not need thermal insulation for storage. The other way for storage is using compressed hydrogen resulted from water electrolyze. However, hydrogen can be produced by other means such as thermochemical (high temperature of solar energy), photochemical, and biological closed circuit. But, it is easier and more affordable to produce hydrogen using water electrolyze. The hydrogen produced can be stored in form of cold liquid or compressed gas in steel tanks.Storing hydrogen in this way needs tensioned tanks and compressors. In addition, safety should be highly considered.

Wind Energy

Wind is one of the solar energy symbols. In fact, it is moving weather and a small part of sun radiation which reaches the atmosphere from outside and it is constantly changing to wind energy. As the earth and its atmosphere gets hotter unequally,convection currents are created. In addition, relative movement of the atmosphere in accordance to the earth movement can produce wind.

Using wind turbines can be more useful rather than other renewable energy resources for the following reasons.

Their reasonable price compared to other forms of novel energies, helping to increase employment, and preventing environment polluting. In developed countries such as Germany, Denmark, the US, Spain, Australia, England, and so many other countries, small and big wind turbine are made in addition to having plans for further researches and using wind energy as much as possible to produce electricity in some units with power of several megawatts. Due to windward regions in Iran, building and designing windmills were common 2000 years BC. Nowadays, there is a suitable platform for extending wind turbines use as well. Wind generators can be appropriate for gas and steam power plants. Studies for wind energy potential estimation in Iran showed that only in 26 regions (containing over 45 appropriate sites) the nominal capacity was approximately 6500 Mw considering an overall efficiency of 33%. However, currently, the nominal capacity of all the power plants in the country is 34000 Mw. In wind turbines, first, wind energy is changed to mechanical energy and then it will be changed to electrical energy.

The usable potential for wind energy is 110 EJ (Exa-joule) (Every EJ is equal to 1018 joule) which is 40% of installed capacity in the world until late 2003.

The advantages to utilize this energy are no fuel requirement, supplying a portion of required electricity, relatively being less compared to fossil energy in a long period of time, bringing variety to energy resources, creating a stable energy system, high capability for maneuvering in exploiting (from several to so many megawatts), no water requirement, and having no pollution for the environment.

These days, the height for wind towers reaches 70 meters which can produce 1.5 Mw electricity. However, installing more powerful rotors in these installations can dramatically reduce the energy cost produced by this non-fossil resource.

Two types of Darrius Horizontal-Axis Wind (HAWT) Turbine and Vertical-Axis Wind Turbine (VAWT)are moved by aerodynamic force and produce energy. Wind turbines with horizontal-axis are the most conventional units to be made. Wind turbines with vertical-axis are old windmills which first were made by Iranians roughly 200 years BC and they were used to millgrains. The two turbines above are made of the following parts.

- Rotor or the rotating part containing the fliers, shaft, and the hub.
- Dynamic system consists of gearbox, electricity generator, and breaking mechanism.
- Breaking system retentive tower.
- Control and safety systems.
- Other parts including electrical, constructive, and service connectors.

Nowadays, wind turbines with powers of 250 to 500 Kw with diameters of 25 to 35 meters are commercially available. HAWTs for producing electricity are placed in direction of wind and have 2 or 3 fliers. VAWTs mostly have two fliers. Fliers can be made of fiberglass reinforced by polyester, multi-layer wood, aluminum, or steel. Fiberglass fliers reinforced with polyester are light and put less weight force on the bearings. Multi-layer wood fliers have high tiring capacity due to wood good tolerance. Most of the Vertical-axis wind turbine builders use reinforced aluminum fliers (Kerry *et al.,* 1994).

Wind Power Plant in the Sky

Instead of installing turbines on the ground, they are floated in 15000 to 45000 meters. There is a device which is called flying electric generator (FEG). This device will stay floating in the air like a kite and the winds with the speed of 200 mile/hour rotate its fliers. The produced electrical current will be sent to the ground station by a cable. It is feasible to have 600 devices which each of them can produce 20 Mw electricity.

Water Energy

Like wind and sun, water is one of the natural energy resources. The water energy is because of its movement and velocity. With damming against the lakes' water, we can store kinetic energy in form of potential energy and use it for different purposes.

Geothermal Energy

The earth core in approximate depth of 6400 km with roughly the temperature of 4000 degreesCelsius functions as a thermal resource and leads to creation of dross materials with temperature of 650 to 1200 degree Celsius in depth of 80 to 100 km from the earth surface. On the average, the amount of heat radiation which is constant process is equal to 82 mw per surface unit. Therefore, considering the total area of the earth, the total wasted energy from its surface is 42 million megawatts. In fact, this unusual amount of heat is the main cause for geological phenomena such as volcanic activities, earthquakes, existence of mountain ranges orogenic activities and movement of tectonic plates which has changed the earth to a dynamic system and continuously brings alternations to it. Nowadays according to the available technologies, only a small part of this resource is harnessed and can be used economically. Thus, geothermal energy is the thermal energy which can be extracted from the earth's solid crust. Despite other renewable energies, geothermal energy is a stable energy resource with 100% availability which can be used 24 hours a day throughout a year.

Geothermal energy is used in two sections of power plant (indirect) and non-power plant (direct) usages. Currently, generating electricity using geothermal resources is done in 22 countries of the world which the total nominal power of these power plants electricity production is over 8000 megawatts. However, in more than 64 countries of the world with total installed capacity of 15000 megawatts, the heat produced by energy resource is used in non-power plant usages. In geothermal power plants, instant fluid vaporizationnormally extracted through depth of the earth and geothermal wells in two phases of liquid and steam will be transferred to separation chamber which leads the steam and liquid phases to be split. The separated steam enters the turbine and rotates its fliers. As a result, fliers will rotate the turbine and

consequently, they will rotate the generator shaft which leads to creation of positive and negative poles in the generator and subsequently, producing electricity.

In geothermal power plants with binary circulation, separating tank is not needed since the extracted warm water enters the heat exchanger and its heat will be transferred to another fluid which is normally isopentane and it has lower boiling point in comparison with water. In this process isopentane will be changed into steam and transferred to the turbine which in this phase the turbine and generator can produce electricity.Direct usages of geothermal energy can be building hydrotherapy and touristic-entertainment centers, heating greenhouses, building centers for breeding Livestock and Poultry, avoiding the freezing of the pathways in cold seasons, and supplying the heating and cooling of buildings by geothermal heat pumps (Vesilind, 2002).

The Technologies of Hydrogen, Fuel Cell, and Biomass

Hydrogen can be considered as a clean fuel and a suitable alternative for conventional fuels in addition to its usage in the future as an energy carrier.Easy attainment from water, its roughly unique utilization, and intrinsic bioenvironmental effectiveness of hydrogen are the traits to make hydrogen exceptional. Hydrogen can be produced using all the initial energy resources and used in the whole fossil fuel usages**.**Particularly, hydrogen completes the renewable energy resources and make them accessible in any time and place for consumers to utilize. Due to initial resources using, hydrogen energy system is permanent, stable, indestructible, extensive, and renewable. As a result, it is prognosticated that in the near future, consuming hydrogen as anenergy carrier will be prevalent all around the world and hydrogen economy would be fixed (Vesilind, 2002).

Sewage Biological Trickling Filtration for the Refinery

The process of natural purifying of sewage is used in controllable refining networks. This process known as refining in sludge stabilization pullis used in whole the world with various innovations for urban and industrial regions containing organic materials. Some of the systems in sludge stabilization pull are wrongly designed which possess undesired attributes. However, they can gain their capability by slight changes. Usually, this method has shown good usages. **Accel-o-Fac, and Aero-Fac** with low energy consumption and storing cost are able to provide desirable sewage. As it can be distinguished, the biology of these processes are so complex, however; the approximately clear design of the system has led to lower price in comparison with other designs.In the natural biology, organic materials are decomposed by bacterium biological organism which the three main phases are dependent to each other for food and growing. First with time and temperature determined, sewage materials and solid particles are digested in the sewage by aerobic bacteria dependent to oxygen. Released organic materials are used through anaerobic activities in laver by heterophilic bacteria and then, they will be changed to $CO_2$and new bacteria. Aerobic breathing changes the organic materials to new cellular materials and CO_2. After that, they will be in access of Algal photosynthesis.Seaweeds which is the main source of oxygen in production cell, produce the oxygen in the form of waste using photosynthesis. After that, mineral salt and CO_2 are their food resource. Solid organic materials which settle in the anaerobic laver are first digested through methane fermentation process by anaerobic bacteria and the process of putrefaction by natural bacteria. Natural bacteria placed in a thin layer exactly above the slush region, convert the more complex materials to simpler molecules such as organic acids. Anaerobic bacteria can be used as a food resource. These bacteria convert organic acids to CH, H_2S, NH_3, and CO_2 as well. In the design of this refinery, first, sewage passes through a channel in which all of the steps of trash taking, sand particles and fat particle taking are done. Then, the sewage will be transferred to the ventilating laver. In ventilating lavers, 2mg oxygen per liter is essential. The sewage will be ventilated and circulated for 6 to 8 hours or even more than that for the biological clots to remain floating. The overflow of ventilating lavers mixture is transferred to two final funnel-form settling pools for new bacteria clots to be settled. The total staying time for this stage is 4 to 6 hours.The ultimate overflow water will be transferred to chlorination part to become antiseptic for 30 minutes and finally, it would be transferred to Azolaveni farm for consumption. The active residual sludge will be transferred to ventilation part, sludge digester tank, or sludge bed based on the system requirement. Slop transferred to the sludge digester tank which is completely closed, will

be transferred to sludge bed after suitable period of time. Then, its sludge will be taken and the remaining sewage would be transferred to the systems starting point for its bacteria to be used for anaerobic activities. After that, sludge digester tank overflow enters the ventilation part. Consequently, Biogas produced in digester tank is transferred to the gas tank for consumption.

CONCLUSION AND FUTURE WORKS

Concerning the climate of Kerman province placed in hot and dry region with suitable wind flows, energy production from various resources such as solar energy, wind energy, geothermal energy, and extracting energy from urban wastes can be surveyed. It is obvious that this region has the potential of fossil resources such as collier, coke, oil and gas. Therefore, combined methods can be used to produce and utilize energy in this region. In addition, the province has different number of crops such as pistachio, walnut, citrus as well as animal wastes which have wastes usable for energy production. More researches are needed in this field for utilizing these resources.

REFERENCES

Anink David (1996). *Handbook of Sustainable Design* (London: James and James).
Harati AN, Abdollahzadeh R and Jamshidi R (2012). Analyzing production potential of RDF from wastes in landfills of Iran. *Journal of Environmental Science and Technology* **16**(3) 45-55.
Harati R, Jamshidi J and AbdollahiNasab A (2000). Landfill Gas Extraction Potential from Conventional Landfills-Case. *Environmental Issues Journal* **3**(3) 34-56.
Kerry L Hughes, Ann D Christy and Joe E (1994). Heimlich Science and Engineering Aspects Landfills. *Ohio University Journal* **3**(3) 45-65.
Omrani Gh (1995). Solid wastes. *Islamic Azad University Journal* **2**(3) 45-54.
Rahimi R (2012). The application of clean energies in optimizing the energy consumption. *The First National Conference on Clean and New Energies*.
Vesilind PA, Worrell W and Reinhart DR (2002). Solid waste Engineering Brooks/cloe, Pacific Grove. *Journal of Environmental Science and Technology* **5**(3) 32-45.