Biomass gasification

Trade and Industry

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Abstract

The biomass gasification is the converting process of solid fuel to gaseous fuel. The main products of gasification are: CO, H2, CO2 and CnHm etc. The temperature of gasification process is realized in 500-1000 ºC, and the oxygen concentration should always be less than the required amount for the burning. Appropriate technology to use landfill gases is CHP plant, which characterized by high efficiency, low emissions, high flexibility and stability, as well as through the fluid gasification. That accomplished through theoretical modelling of the quantity of gas, experimental measurements of landfill, opening of gas landfills, construction of network gas collection and installation of CHP plant. Fluid layer gasification also enables more efficient work with different fuel humidity, different quality and different size. The first step is to build the plant and then the same can be transferred to other landfills. Kosovo landfills represent a huge potential and opportunity to produce electricity from landfill gas. If that gas will not be used it will disperse on the atmosphere. The usage biogas and biogas technologies will enable the preservation of natural resources, protection of biodiversity, develop economy and will impact on environmental protection.

Introduction

Waste management situation in Kosovo currently is quite unenviable and the amount of waste in Kosovo is growing and their management, including infrastructure is not at the required level. Lack of a functional system for waste management, have had negative effects on the environment; water, air, soil and human health.

Table 1. The total amount of waste in some states

	Austria	Denmark	Slovenia	Croatia	Kosovo
The number of residents (million)	8.1	5.4	2	4.45	2.3
The total amount of waste (million Tone)	48.6	13	8.4	12.6	4.715
The total amount of waste for one resident (Kg)	600	240.7	420	284	748.25
The total amount of municipal waste (million Tone/year)	3.1	3.1	0.8	1.2	0.4
The total amount of municipal waste for one resident (Kg)	383	574	400	270	192

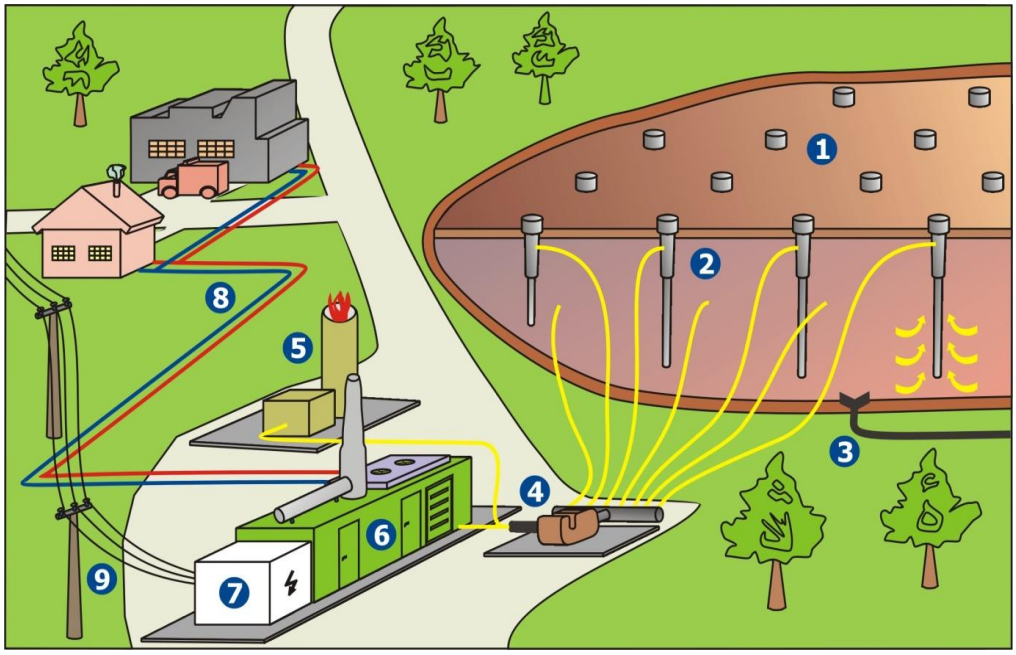
Table 2. Treatment and deposition of waste in some states

	Austria	Denmark	Slovenia	Croatia	Kosovo
Collected waste for recycling	34.3%	14%	10%	10%	9%
Collected waste for biological treatment	21.7%	-	12%	1%	1%
Collected waste for burning	16%	81%	-	-	-
Collected waste for landfill	27.2%	5%	73%	89%	90%

Advantages of biomass gasification are: use of biomass, gas production, which can be used for various purposes, and the production of gasification products that are less harmful to the environment than when these products obtained by pyrolysis of raw fossil fuels (oil and coal). The gasification process developed in the temperature 500-1000 ° C. Biomass, also known by the name of organic mass, can be found almost everywhere in nature. Plants, agricultural products, the leaves of trees in the forest, industrial and household organic waste etc. are the main sources of biomass. Depending on the physical and chemical properties of biomass can be used in many ways. Biomass can digest anaerobic (in the absence of oxygen) to create biogas and produce electricity and heat, or it can be used to produce vapour and electricity, or it can be burned in special furnaces to produce heat, or it can be directly converted into fuel to drive vehicles. In particular, cattle waste and pig manure, chicken fly-blow, corn silage and barley, other agricultural products, remains in food processing etc. Renewable energy sources are more suitable for the production of electricity and heat in ecological and economic way through anaerobic digestion. Household waste, commercial and industrial composed of organic and inorganic materials, such as food waste, grass, tree branches, paper, textiles, plastics etc. In developed countries is common practice to recycle and reduce or even prevent the creation of waste, but unfortunately these practices are not so prevalent in developing countries as well as in our country. Regardless modern recycling practices, nevertheless large amounts of waste end up in landfills. Landfills also represent a huge potential and opportunity to produce electricity from landfill gas. If that gas will not be used it will disperse on the atmosphere.

1. Gasification of biomass from landfills

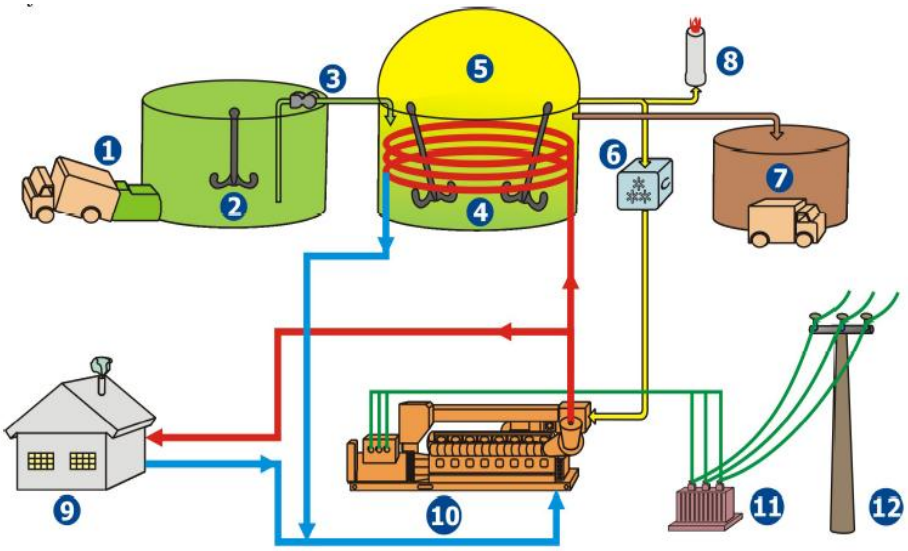
Landfills are geological and geographically regions and appropriate to locate waste. Modern landfills are usually from foundation (concrete, clay or plastic), drainage system, collection system landfill gas and CHP plant. After putting the first waste to landfill covered special sections and then closes the whole landfill. Immediately after the closing of the landfill must begin construction planning system for the collection and utilization of landfill gas in order to avoid or at least reduce the risks from landfill gas from the initial stage.



Picture 1. Landfill

1 - Waste; 2 - Gas wells, 3 - Drainage system; 4 - System for the collection and use of gas; 5 - Flaming 6 - Container with cogeneration plant 7 - Transformer 8 - Water pipes; 9 - Networking for the distribution of electricity

Modern biogas plants are usually from a previous tank in which the collection and processing of biomass, a fermenting in which biomass is mixed and heated to create favourable conditions for bacteria to digest biomass, biogas holder, a final tank in which the collected waste biomass, a compressor which increases the pressure of biogas from 20-to 80-200mbar 30mbar, a cooling gas which remove moisture contained in biogas, a CHP plant which burns and produces electricity biogas the heat, a fiery and a transformer.



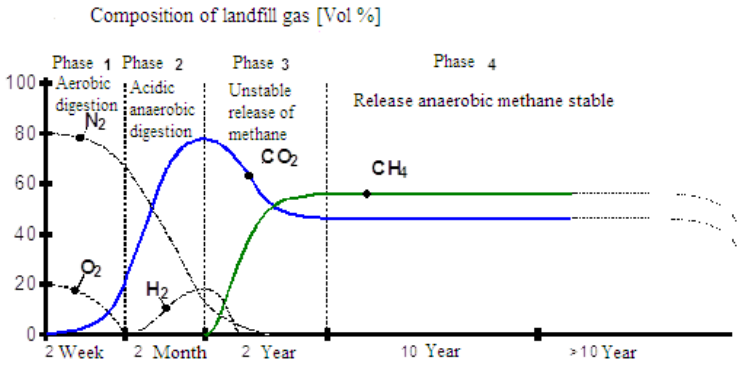
Picture 2. Biogas plant

1 - Biomass 2 - Preliminary tank 3 - Pumps 4 - Fermenter, 5 - Biogas tank 6 - Unit for initial treatment of biogas; 7 - Final tank waste biomass, 8 - Flaming, 4, 9 - Customers heat: 10 - CHP plant; 11 - Transformer, 12 - Network for the distribution of electricity

2. Biomass gasification products

By placing the waste in landfills begins gradual biological digestion of organic waste half or in the presence (aerobic) or absence (anaerobic) of oxygen. At the landfills these these two processes take place at the same time. During aerobic digestion (deeply <5-10 m) released carbon dioxide and water vapour, and during anaerobic digestion (deeply > 10 m) released carbon dioxide, water vapour and methane.

The composition of landfill gas during various phases is illustrated in picture 3 as follows:



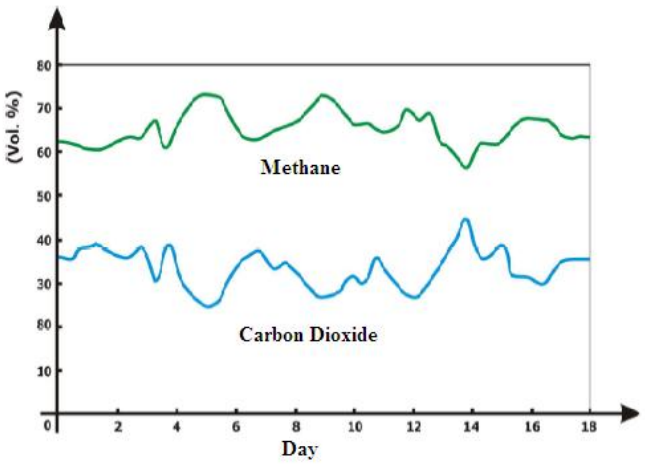
Picture 3**:** Creating methane and gases at different periods

In the first phase, acid forming bacteria transform complex materials such as cellulose, fats, proteins and carbohydrates into simple organic acids.

In the second phase anaerobic bacteria ferment organic acids and transform them into carbon dioxide, methane and water vapour. At this stage bacteria are completely anaerobic, even smaller amounts of oxygen are toxic to them.

The third phase of digestion begins when waste landfill gas is released in large quantities. The third phase stabilizes after approximately 3-4 months. The amounts of methane released steady within 2-3 years and then begins the fourth phase.

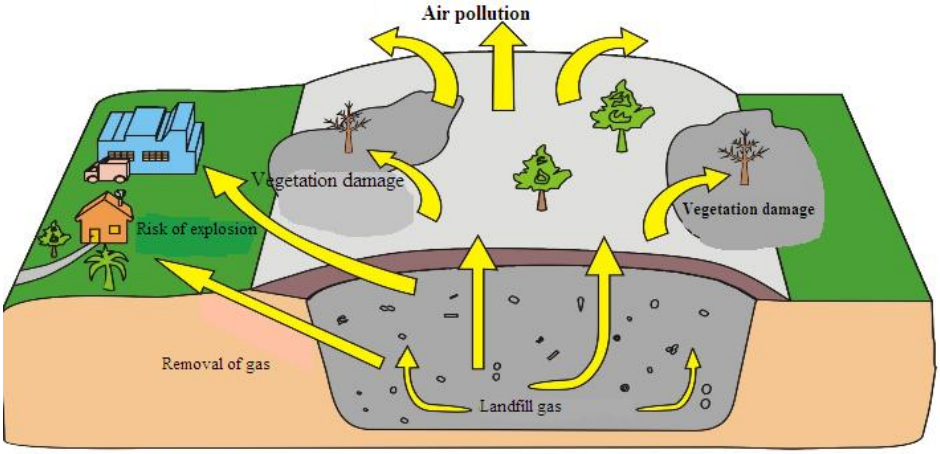
During the fourth stage released the largest amount of methane. As the amount of methane as well as its composition remain approximately constant under constant conditions. To speed up the biological digestion of organic waste and thereby increase the production of methane, landfill waters relapse in the landfill. For this purpose, a certain amount of water can be added if necessary to landfill. Depending on the amount of organic waste, releasing gas usually consists from the methane (30-45 %), carbon dioxide (30-50 %), nitrogen (5-20 %) small amount of oxygen (1-3 %) and several mixtures (other organic compounds). Biomass can be digested in the presence of moisture and heat, and in the absence of oxygen. The process of digestion, also called anaerobic digestion, can occur naturally or under controlled conditions of a fermenter. During anaerobic digestion of biodegradable substances biomass converted into fatty acids by acid forming bacteria while methane forming bacteria transform fatty acids into methane. Some substances cannot decompose in to the biomass so they go directly to the final tank and can be used as biological fertilizers. Depending on the rate of digestion of biomass, there are two types of anaerobic digestion: digestion mesophyll (the stay period of fermenting biomass is within 20-30 days, while the process temperature is 32-38 ° C) and thermophiles digestion (the stay period of fermenting biomass is within 10-12 days, while the process temperature is 50-55 ° C). Which of these two processes is more appropriate for a specific project depends on several factors. Mesophyll digestion can be realized more easily and plant is cheaper, while at thermophile digestion quantity of biogas is highest, period of residence of biomass in fermenter is shorter, fermenter is smaller but the process temperature is higher and the plant is more expensive.



Picture 4. Creating methane

3. Ecological importance of biomass gasification

All current scientific publications prove that climate changes is caused by human activities such as burning of fossil fuels, sewage cleaning, waste disposal , etc. Methane as well and carbon dioxide as the main components of landfill gas are identified as" greenhouse GASES ", then these gases contribute enormously to the growth of the so-called "greenhouse Effect "."Greenhouse Effect "is an English expression that describes the heating of the earth's surface through reflecting sunlight from formed strata by so-called" greenhouse GASES ". In continuation of the efforts that the international community has undertaken recently, approved a series of measures to confront the existing ecological problems. Especially burning or energy utilization of methane has specific importance because methane is considered to be about 21 times more harmful to the environment than carbon dioxide.



Picture 5. Risks from the release of landfill gas

If the landfill gas is collected and used energetic it offers several advantages:

- Environmental protection from a dangerous gas (methane)
- Avoiding the unpleasant smell
- Improve air quality
- Reduction or elimination of risks to human health
- Replacement of fossil fuels (which emit more emissions) to produce electricity (and heat eventually)
- Additional financial income

If the landfill gas is released into the atmosphere in an uncontrolled way he presents serious risks:

- Landfill gas helps increase global warming
- Landfill gas slows or prevents the cultivation of new landfill because it not only damages vegetation recreate the landfill but it also affects other parts around
- Landfill gas can ignite easily migrate and, in that way he presents an explosion hazard for residential and industrial buildings near the landfill
- The landfill can pollute basic water etc.

Climate change is happening and is mainly due to the harmful gases (emissions) emitted by human activity. Adaptation of strategy for climate change is more than necessary since we are already faced with the consequences of these changes. This strategy should include various measures on how further to minimize the release of harmful gases, primarily methane, carbon dioxide, nitrogen oxides, etc. Knowing the benefits of

energy use that methane released from landfills and considering the dangers of methane, authorities should intensify their efforts to promote the realization of projects for landfills. So the environment will be protected by very dangerous pollutants such as methane. Waste management on farms and in the food industry (as sources of biomass) should serve as the basis for development and utilization of biomass in order to apply the existing best practices and encourage the application of modern ecological methods . View on perspective, biomass can take on value only if is not treated as "rubbish " that must be filed, but it should be view first and foremost as " real " and potential as part of an integrated management waste system. If biomass is processed under controlled conditions and used vigorous gas created it offers a number of advantages:

- Environmental protection from a dangerous gas (methane)
- Avoiding unpleasant smell
- Destruction of microbiological pathogens and weed wild
- Use of waste biomass for soil inputs
- Better management of waste on farms and in food industry
- Protection of biodiversity (variety of nature)
- Replacement of fossil fuels to produce electricity and heat
- Additional financial income from the sale of electricity (and heat eventually)
- Reducing local unemployment and increased economic prosperity etc.

If biomass is untreated or deposited properly, it poses serious risks:

- Contamination of soil and water
- Increased health risks for humans and animals
- Biogas easily switches permanent risk for explosions etc.

4. Summary

Landfills represent both, challenge and great opportunity. They can provide a large amount of renewable energy if they are designed and managed well, but methane is created poses a serious risk if is not collected and burned or used vigorous. Estimating the benefits of using energy that is released from methane landfills, and considering the dangers of methane, authorities together with landfill operators should intensify their efforts in order to promote more successful realization of projects of landfill. In that way the environment will be protected by a very dangerous pollutant such as methane. The scientific community have consensus that climate change are taking place with a very fast speed and that it represents a serious ecological threat to the present time as well as for future generations. The first signs of this change are being presented in various forms. Large parts of the snow in the Arctic are converted into land and glaciers worldwide are melting. Floods, droughts and storms are becoming common. Greater use of biogas technologies will preserve natural resources and to protect global biodiversity of nature.

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