

WASTE RECYCLING AND FUEL GAS GENERATING TECHNOLOGY

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Currently usual kinds of solid carbonaceous waste are rather utilised at landfills, i.e. waste is burned. However, instead of expensive technologies that combust waste, we would like to offer a cheap technology that recycles carbonaceous waste to a fuel gas, which then can be immediately used as a fuel for trucks' engines or for electric generators.

Our technology is based on the old method of production of a generator gas by means of heating of waste in a gas-generator unit. The method was developed in Germany and France in 1930s and improved in 1950s in the USSR. In our technology we have developed previous ideas of Ukrainian scientists and introduced our own know-how.

Our companies offer a technology that allows a customer to recycle:

- natural dry waste (*wooden chips, straw, paper, cardboard, leaves, oil cakes, etc.*)
- plastic, rags, coal, rubber products
- tires

The product of the technology is a fuel gas usually called "generator gas", because the gas produced in the course of recycling of waste can be used as a fuel for engines of cars, trucks, and tractors, and can combust in modernised diesel generators that generate electricity.

Our gas-generator is designed to produce the generator gas from a solid fuel. The gas-generator consists of 1) a reactor chamber in which a solid fuel is heated and decomposed to gaseous fractions, 2) a filter unit in which gaseous fractions are purified and 3) a cooler in which the generator gas is cooled to a room temperature. In the reactor chamber the generator gas is formed at the incomplete combustion of solid fuels with limited access to air (28% - 35% of the total amount for the combustion of fuel).

The whole gas-generator can be installed on a movable platform or can be embedded to the frame of a truck. Here are pictures of old Soviet trucks (ZIS-13, 1936 and GAZ-42, 1939), which used gas-generating units for the production of fuel, i.e. generator gas, at the motion.



Here are pictures of a modern truck (France, 2005) and tractor (France, 2004), which use gas-generator units



If a gas-generator is installed on a truck, the truck's engine loses only 10 to 15 % of power that is generated at the combustion of conventional liquid fuel, such as diesel or petrol. One charging of a gas-generator unit installed on a vehicle by a solid fuel (usually it is around 70 kg) is enough to run 200 to 300 km.

Here is the recent picture of a truck ZIL-130 with the mobile power plant equipped with our gas-generator unit. A typical capacity of a mobile gas-generator unit equipped with power plant is 30 to 60 kW.



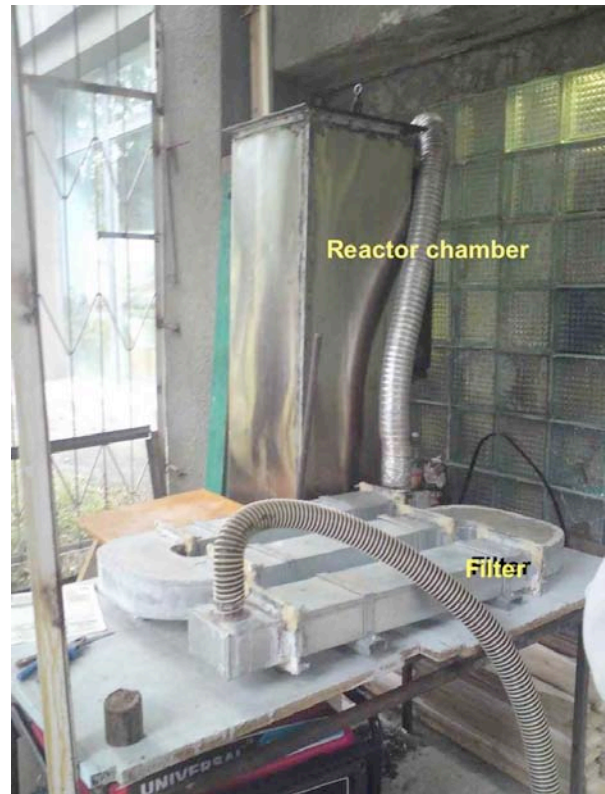
The composition of generator gas is: CO (27% to 33%), H₂ (11% to 15%), CO₂ (1.9% to 5.8%) and CH₄ (1.7% to 3.4%).

While combusting, the generator gas releases 7 to 8 MJ/m³ (or 1250 to 1450 Kcal/m³).

The exhaust of the engine operating on the generator gas is 5 times cleaner in comparison with conventional liquid fuels and other gases, in particular, a synthetic gas. The level of CO in exhaust is less than 0.4%; among other exhaust products prevail CO₂ and H₂O. Harmful products of combustion, such as Cl, are deposited in water filters from which they can easily be removed. The quantity of ash varies from 1 % (in the case of natural waste) to 4%(in the case of tires).

Requirements for the moisture of soil fuel: no more than 40%.

In the role of the gasifier, the gas-generator unit can function up to 8000 hours per year generating electricity and additional heat. A prototype of the gasifier designed to generate 5 kW of electric power is shown in the two figures below. The gasifier occupies a small space. For instance, a floor area needed for the gas-generator that provides with gas a power plant with capacity 30 kW is 2.5 m × 4.5 m; the same area is taken by the corresponding power plant, is 2.5 m × 4.5 m.



A solid wooden fuel in quantity 0.7 to 1 kg is enough to generate 1 kW of electricity. In the case of tires, 0.3 to 0.6 kg of waste is able to generate 1 kW. Plastic waste occupies an intermediate position.

The price for the installation of 1 kW of gasifier capacity including an attached power plant is 1100 Euros.

Having recycled 1 tonne of waste per day, one needs a gasifier with capacity about 100 kW, that is, recycling 1 tonne of waste the gasifier will generate electric power up to 100 kW.

Having recycled 10 tonnes of waste per day, one needs a gasifier with capacity about 1 MW. The floor area required for such gasifier is about 400 m². The gasifier can be built in a year; the price of the project is 1,100,000 Euros. If the plant will function 7000 hours per year, it will be repaid in 5 years (if we put for the cost of generating electricity 3 Euro cent per kW·hour).

P.S. Note that there is a possibility to install a gas-generating unit with capacity up to 0.5 MW on a movable platform.