The Importance of Advanced Technology in Biomass Energy Production : Case Study, the Burning of Biomass Benefited after Distillation of the Sage in Albania

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Abstract

The biomass management on our days, is shaping a special interest in Albania. The importance of it is increasing on the new generation technology for renewable energy, which its production is constantly increasing. Among the main objectives of The Albania International Energy Strategy for 2018-2030, it's also the encouragement for implementation methods that less negative impact to the clime, such as renewable energy sources (RES). In Albania biomass represents a considerable source that has not yet been fully utilized.

On this letter, is going to be present the most advance technology that is used now, for burning the waste after the distillation of sage that has been tested on AlbKalustyan, Maminas Durrës factory

Easy methods for the burning of biomass that is used for energy purposes, such as heat and electricity production are:

- Boilers with fixed conveyors

- Mobile grill boilers

- Boliers with food from below

- Fluidized bed technology

This article addresses the arguments that Fluidized bed technology is the most appropriate and is an efficient technology for burning biomass in general and especially residues after distillation of the sage.

Essential factors that give rise to the application of this technology in the energy industry are:

1. The use of this technology is able to efficiently burn low calorific fuel.

2. Low burning pollution, avoiding the need for expensive equipment for gas leakage.

KEYWORDS: Biomass, electricity, the source of renewable energy.

1. Introduction

Problem Spreading

The Energetic Situation in Albania

The primary energy consuming in Albania in year 2014 was 2060 ktoe, in year 2015 was 2219 ktoe, in year 2016 was 2309 ktoe, while output in 2014 was 2014 ktoe, in

2015 it was 2117 ktoe, in 2016 it was 2013 ktoe, the difference was covered by export. (1 ktoe = 11630000 kWh)

The primary energy supply in Albania is dominated by oil, hydro power plants and imported electricity. Figure 1 shows which imports of petroleum products, electricity and a small amount of stone coal account for 64.8% of all primary energy consumption. Figure 2 shows that the transport sector consumes the largest amount of energy, followed by the residential sector and the industry sector.

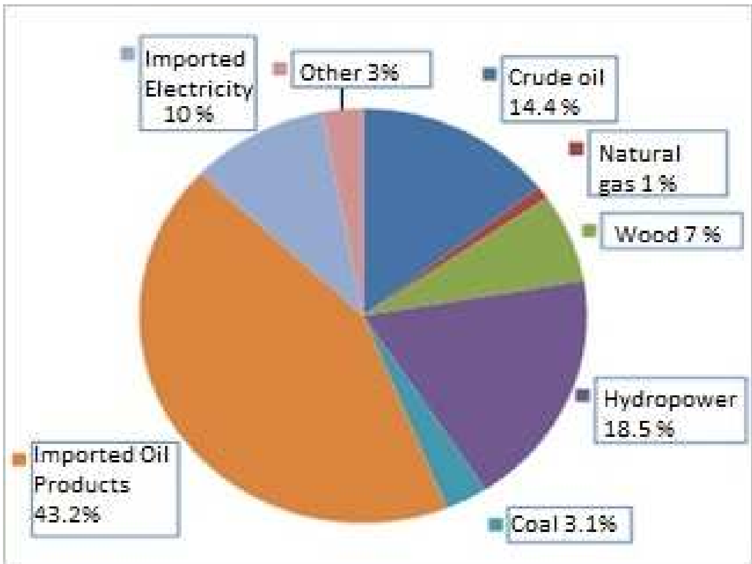

Figure 1 (Type of energy used)

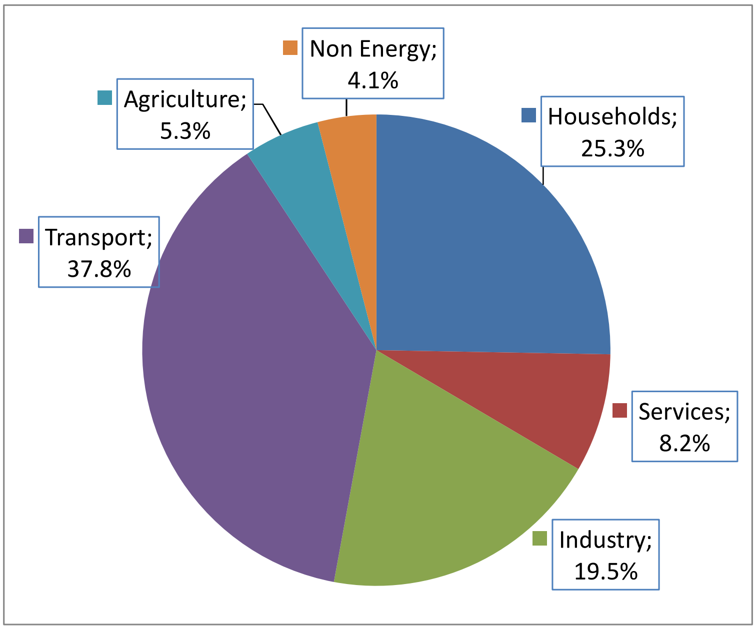

Figure 2 (Energy consumers)

From 2009 until 2014. the consuming of energy in Albania increased from 1871ktoe on 2060ktoe, an increasing around 10,13%, but the increasing was not stable over the years. Like is shown on figure 3, the final consummation of energy in Albania grew around 2009 and 2011, before it decreased on 2012, coincided with a slowdown in the Albanian economy. This was mainly due to rising demand for housing. Power consumption rose sharply in 2014, driven mainly by the mechanical and steel industry sectors.

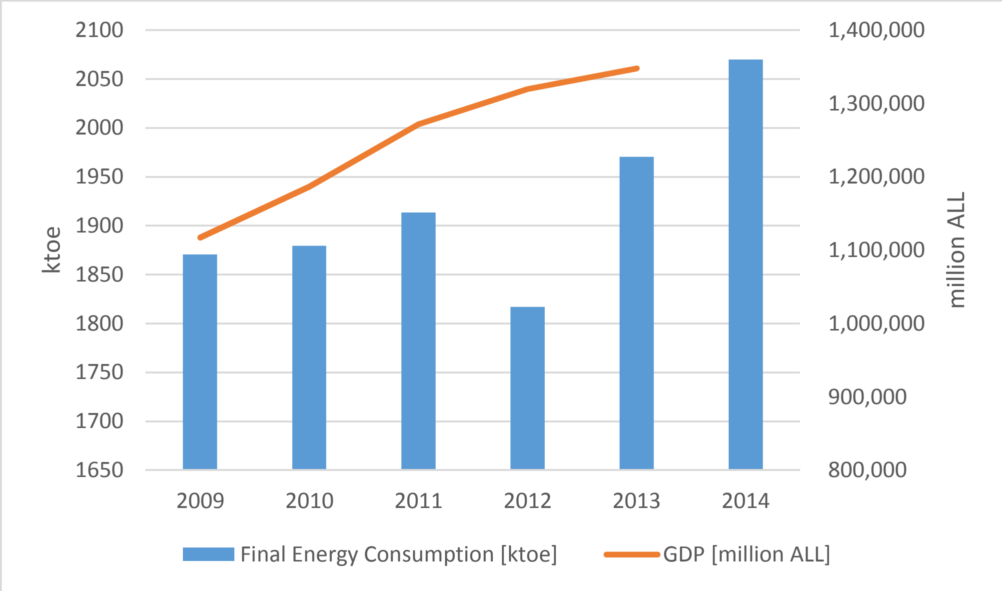

Figure 3 Final energy consumption data (Source: Albanian Energy Balance Sheet 2009-2014, AKBN; INSTAT)

2. MATERIALS AND METHODS

2.1. Main concepts in the field of renewable energy

Renewable energies are the energies that are derived not from processed fossil fuels. This kind of energy aims to be as clean and less harmful to the environment. Alternative sources from which this kind of energy can be generated are wind, solar radiation, water, biomass, etc.

Renewable energies are classified as:

- Hydropower
- Wind energy parks
- Photovoltaic Parks
- Geothermal Resources
- Biomass

2.2 Energy Sector Trends in Albania

Fulfilment of economic developments in different sectors and the increasing level of energy consumption per capita;

Improving the energy intensity trend;

Increasing the security of energy supply by improving energy efficiency, increasing the share of renewable energy sources and other conventional energy sources, and enhancing regional cooperation and integration.

In addition to the above challenges, three future challenges for the Albanian energy system are the achievement of the RES objective in 2020 and beyond, the EE target for reducing the final energy use and the target for reducing GHG emissions.

2.3 Energy Policy Scenarios related to the use of renewable energies

The renewable energy source (RES): This scenario guarantees Albania to meet the commitments of the Energy Community Treaty by achieving the target of 38% of the contribution of renewable energies versus the total in 2020 by implementing the National Action Plan for Renewable Energy.

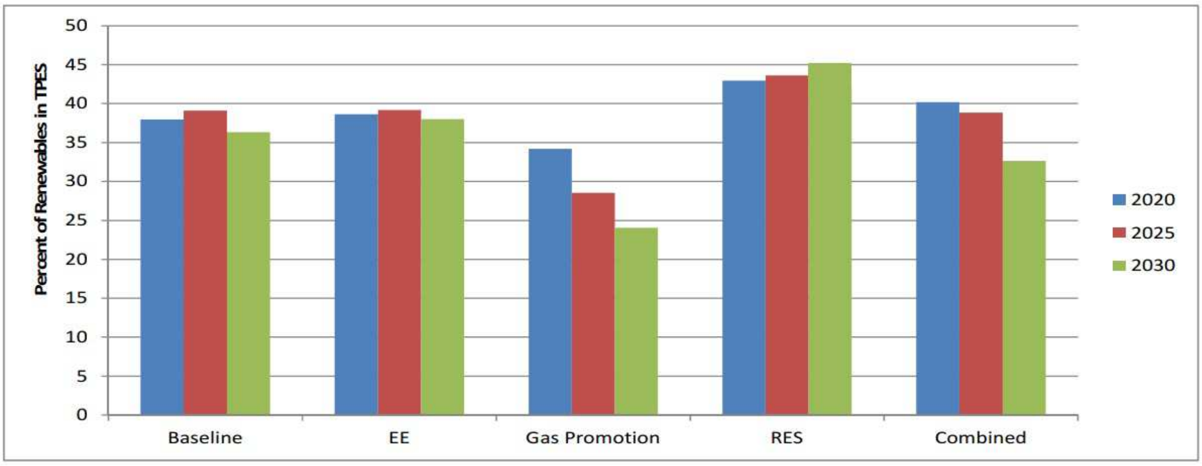

Figure 4 (The volume of RES that is going to have until year 2030)

Table 1. The share of renewable energy sources in primary energy supply. (Source: National Energy Strategy 2017-2030)

Year/% Scenarios	Percentage		
	2020	2025	2030
Base	37.98	39.09	36.33
EE	38.65	39.16	38.00
Gas Promotion	34.20	28.54	24.04
RES	42.95	43.64	45.03
Combined	26.35	28.97	26.87

2.4 Renewable energy

Table 2. The energy provided by renewable energy sources that cover the thermal energy demand (ktoe)

Year/ktoe	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Fire wood	195	217	233	249	265	280	296	295	295	294	295	295	295	298	300	303	306
Solar Energy	12	17	20	24	28	33	38	40	43	46	49	53	56	60	64	69	74
Biodiesel	29	66	75	83	92	100	108	117	125	133	142	150	159	167	175	184	192
Biomass / pellet	-	2	5	8	11	15	19	22	26	30	34	38	42	46	50	54	59
Residues of agricultural crops	-	3	6	9	12	15	17	20	22	23	25	26	27	28	28	29	29

2.5 Biomass sources that can be used for energy purposes

Table 3. Biomass sources (Source: International Renewable Energy Agency 2017)

Rural Resources	Urban Resources
Forest waste, wood	Urban wastes, wood packaging etc.
Agricultural residues from corn crops, grain harvest residues	Solid waste from sewage purification
Barriers and trees	Gas landfill
Biogas from animal extracts	Solid urban waste

3. Results and Discussion

3.1 The processes of transformation of the sage biomass

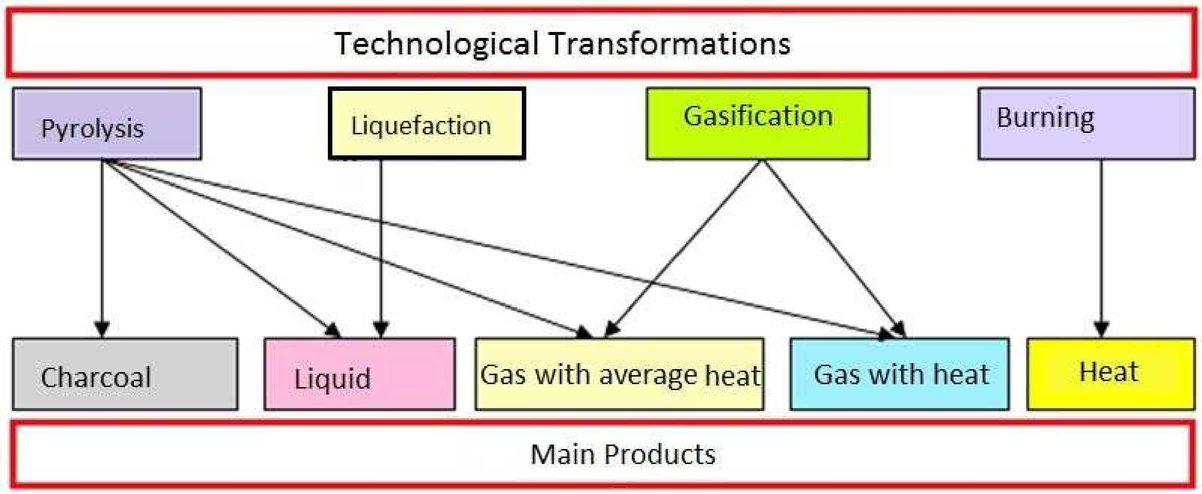

Figure 5 Thermochemical transformation processes and main products. (Bridgwater, 1993)

Table 4. Biochemical and thermochemical process of biomass

Thermochemical processes	
Burning	**Burning is the complete oxidation of CO2 and H2O fuels.**
Gasification	**The gasification process can be defined as the thermal decomposition of the biomass substance (partial combustion in an environment with low oxygen content).**
Pyrolysis	**Pyrolysis is the thermal degradation of carbonate materials in the absence of an external oxidizing agent and occurs at temperatures of 400-800°C. Pyrolysis products include gases, juices and solid charcoal**
Liquefaction	**Liquefaction is a thermochemical transformation of biomass at liquid phase at low temperatures (250-350 ° C) and high pressure (100-200 bar).**
Biochemical processes	
Anaerobic process	**It is a process of decomposition of biological materials and favored by the conditions of relatively high temperatures, moisture and lack of air. Products are mainly methane gas and carbon dioxide**

3.2 Advanced biomass energy utilization technologies

Direct biomass burning for energy production is a mature and available technology in the market and can be applied in a wide range of several MW to 100 MW or more and is the most common form of energy production from biomass .

- There are two main ways of using biomass for energy purposes:

1) Biomass burning to produce technological steam;
2) Use of steam on a steam turbine, which is then used for generating electricity.

- The two most common forms of boilers are

1) Boilers with fixed or movable conveyors
2) Fluidized bedding, fuel can be entirely biomass or biomass can be combined with other solid coal or fuel (EPA, 2008).

3.3 Boilers with fixed conveyors

Boilers with fixed conveyors can be used with manual operation. They are suitable for small combustion systems (<1.0 MWth). Between fixed tapes, flat straps are more usable, they have larger surface area and air dispersion more uniformly. These types of boilers are suitable for combustion of high volatility fuels. The maximum temperature of the area is very close to the grid surface. Air combustion is partly utilized inside the bed and partly in the combustion chamber to burn volatile matter. Burning in a griddle can lead to different dispersions of flying ash from fuel. (Nussbaumer,1998).

Figure 6 Boiler with fixed conveyor në fabrikën AlbKalustyan, Maminas Durrës

3.4 Mobile Grill Boilers

Mobile grill boilers, just like boilers with fixed conveyors, are suitable for high humidity biomass, ranging in size and high ash content. Wood mixtures can be used, while mixing of wood with straw, cereals and herbs can not be due to various behaviors during combustion, low humidity and low melting point. (Obernberger,1998)

Transport of the object on the grill should be as homogeneous and light as possible in order to keep the coat of grass as smooth and homogeneous as possible to avoid the formation of "cavities", the formation of unburned particles.

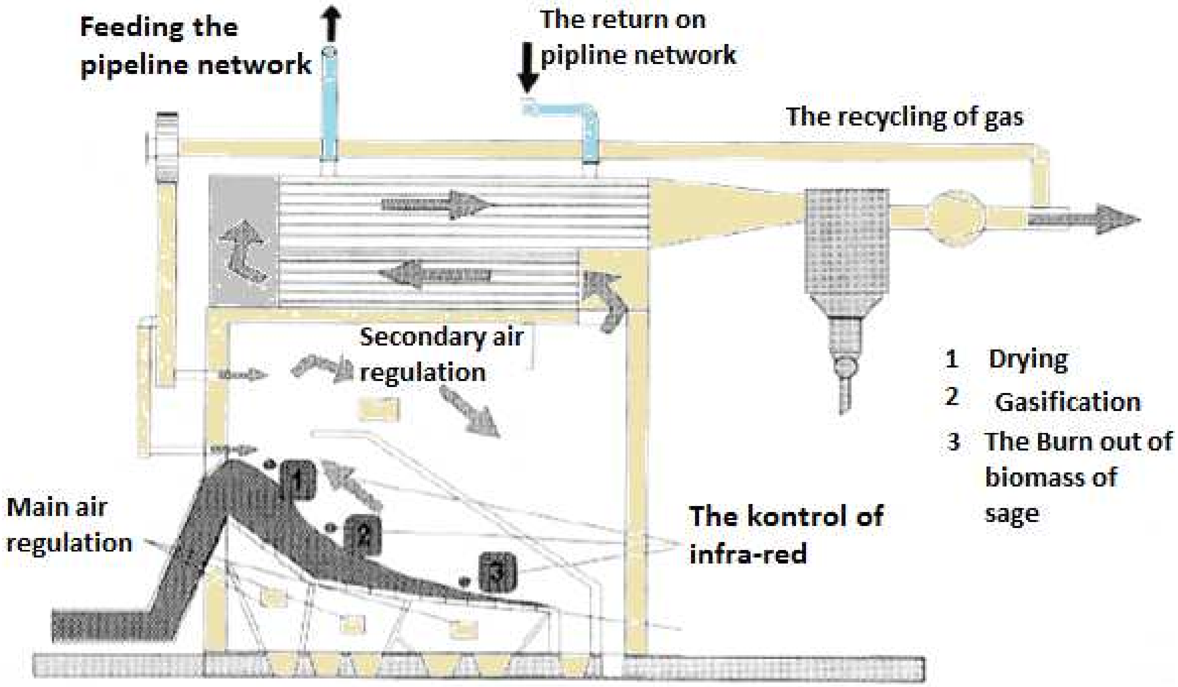

Figure 6. Schematic presentation of the mobile grill with moving forward. (Obernberger, 1998)

3.5 Boliers with food from below

This type of bolier has the combustion zone in the upper part of the base and the first material, such as biomass, is supplied below:

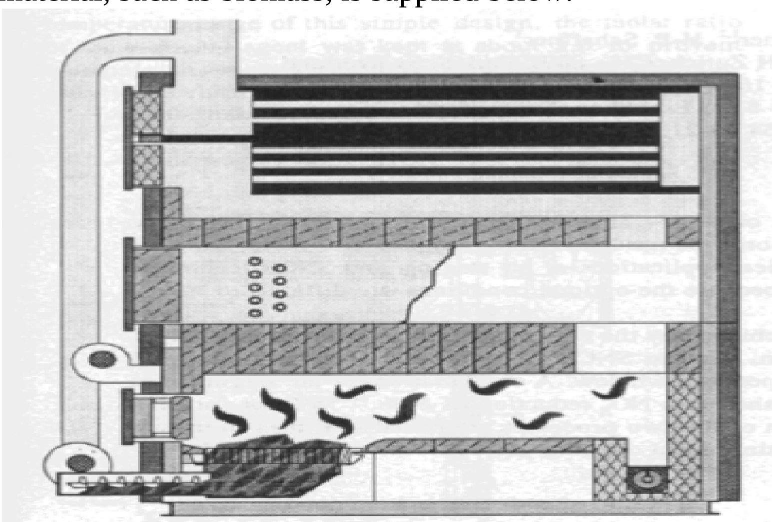

Figure 7. Schematic representation of a new boiler with food from below. (Obernberger, 1997)

These bolier are suitable only for small systems (over a nominal capacity of 6 MWh) and for low-ash biomass fuels. High percentage of grain biomass requires efficient ash removal systems. (Obernberger,1997).

3.6 Fluidized bed technology

The main factors that gave impetus to the application of this technology in the energy industry are:

● First, using this technology it is possible to combine low energy calorific fuel efficiency, both in the mining industry, the chemical industry and biomass.

● Secondly, an advantage of this technique is that it low combustion pollution, without the need for expensive gas cleaning equipment. (UNIDO, 2009).

Fluidized bed technology

Depending on the velocity of the air flow through the fluid bed, this technology can be divided into the following two categories:

Boiling fluid boilers (slowly),

Floating fluidized bed boilers.

- **<u>Boiling fluid boilers</u>**

The air velocity in the powdered bed is lower, since the size of the boiler bed is in the opposite ratio to the air velocity passing through the bed, the grille surface and a high power boiler will be great.

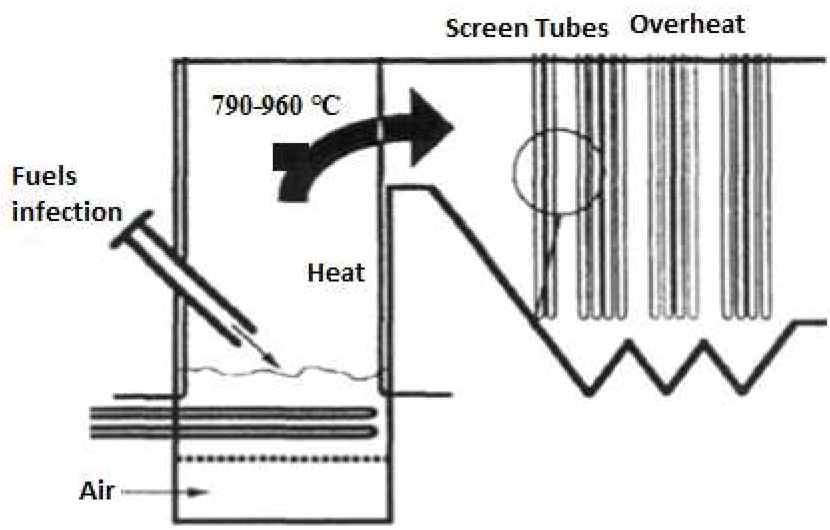

Figure 8. Schematic representation of boiling fluid boilers. (Obernberger, 1997)

This technology is used for plants with a nominal capacity greater than 10 MW. The mainly sandy bed is located in the final part of the boiler. The sand is about 1.0 mm in diameter, the air velocity fluctuates between 1.0 m / s and 2.5 m / s. Secondary air is inserted between holes in the shape of horizontal sprays constructed in such a way as to ensure a high efficiency of combustion of combustion during the combustion process.

In this technology, some combustible particles are burned at the reactor base while the rest is burned in the fluid bed to keep the temperature at the desired limits of 800 ° C to 900 ° C. In most cases it is necessary to place the heat transfer surface on the reactor bed.

One of the advantages of this technology is that the amount of ash removed directly from the boiler is bigger than the circulating bolling boiler. Another advantage of this boiler is their flexibility in terms of particle size and humidity content in biomass. (Obernberger,1997)

- Floating fluidized bed boilers

This combustion technology is widely accepted as an advanced technology for the combustion of various biomass substances in an environmentally acceptable way. (Basu, 1991)

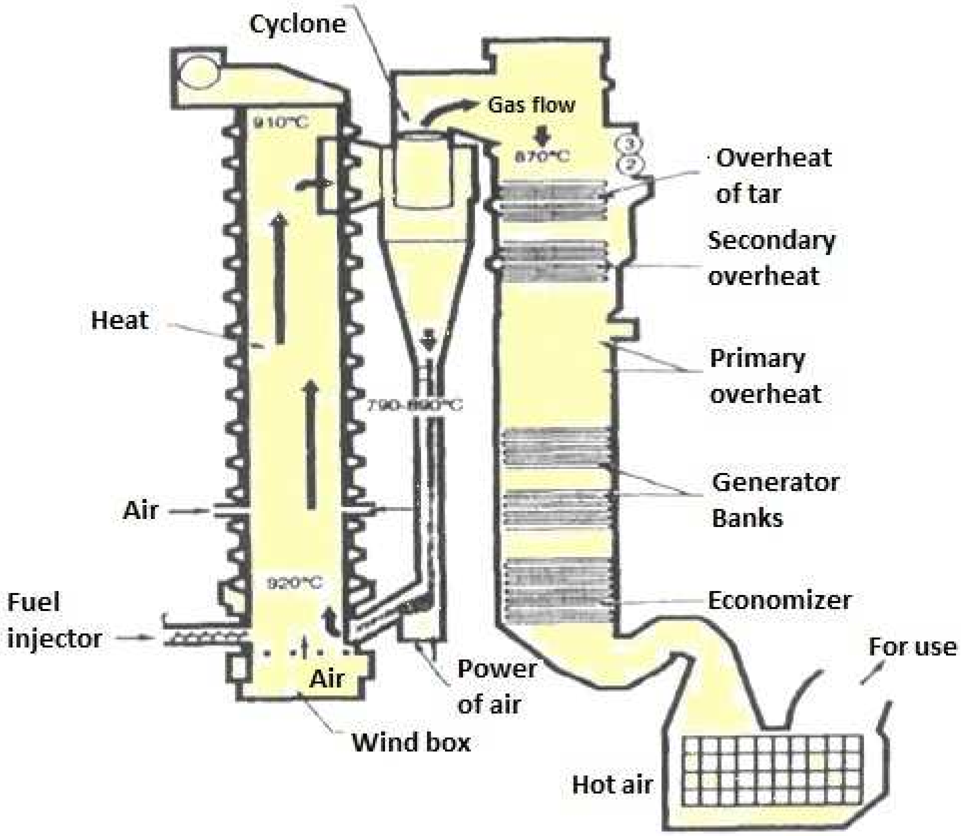

Figure 9. Schematic representation of Circulating fluidic Source: (Basu,1991)

Powder speed 5 m/s - 10 m/s.
Particle size 0.2 mm - 0.4 mm.
The base temperature is around 800°C ÷ 900°C and is controlled by an external heat exchanger by cooling the recycled sand or from the water-cooled walls.
High turbulence of the system leads to transmission better heat which is the advantage with regard to the stable conditions of the combustion process.

3.7 Some data related to the cost of biomass use plants for energy purposes

The total cost of biomass-generating energy technologies depends on the type of technology used and is different from one country to another.

- The total cost of boiler installations is between 1880 USD/kW ÷ 4260 USD/kW
- With fluidized base is 2170 USD/kW and 4500 USD/kW.
- The anaerobic cost systems are in the amounts of 2570 USD/kW and 6100 USD/kW.
- Gasification technologies, such as fixed and fluidized base rockers, cost 2140 USD/kW ÷ 5700 USD/kW.
- Gas production from the landfill cost 1920 USD/kW - 2440 USD/kW.
- The cost of CHP plants is much higher than that of plants built only for electricity.

  (Source : International Renewable Energy Agency 2017)

3.8 Some data on the growth of the sage and low calorific power in Albania

● The spread of sage cultivation (Salvia Officinalis) in Albania according to the surface is given in the figure below, where it is noted that the northern part of Albania and the southern part of the country have the most widespread spread of sage production in Albania.

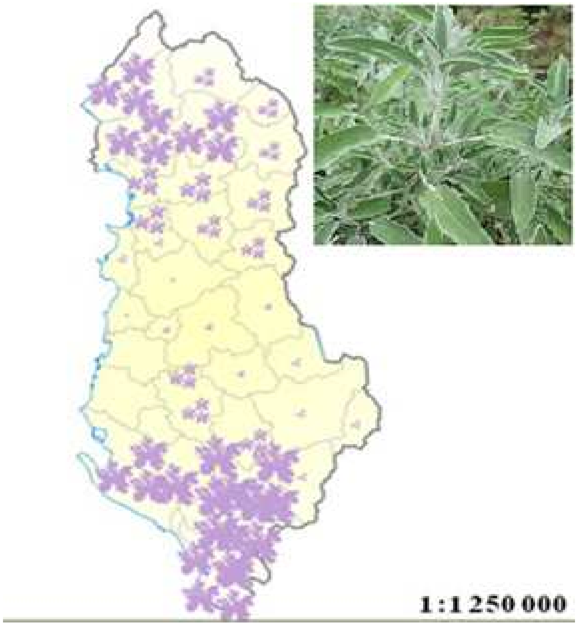

Figure 10. Areas of cultivation of sage plant in Albania. (F.Pazari 2014)

Regions that cultivate more sage are, Shkodër, Vlorë, Gjirokastër and Berat. Observation and experimentation is carried out by me at the factory premises of "AlbKalustyan" Maminas, Durrës, where oil and aromatic essences are produced from medicinal plants.

Figure 11. View of the factory of "AlbKalustyan" Maminas, Durrës. (September 2017)

The sage biomass at the AlbKalustyan plant is obtained after distillation of the sage for its oil production.

By means of the Junker Method I have experimented and extracted Low Calorific Power on the biomass of different types of sage depending on the country of cultivation and harvest time. To get this data I used the Calcimeter Junker Equipment of the Energy Laboratory at Polytechnic University of Tirana.

The following figures show the diagrams of the values of Low Calorific Power values that I have derived from the measurements for the spring and fall harvest of the sage in 2017 by the regions of Albania where the shore is cultivated.

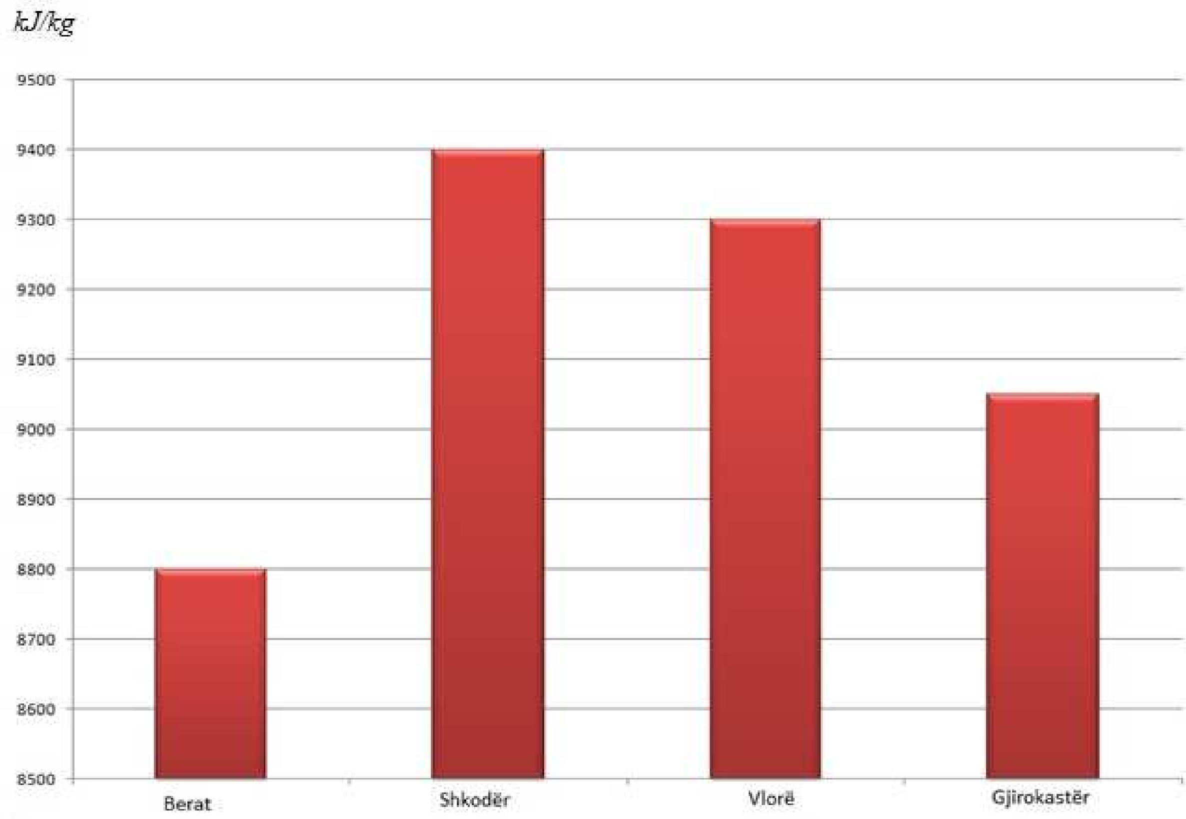

Figure 11. Low Calorific Power diagram according to the regions of Albania for spring harvest

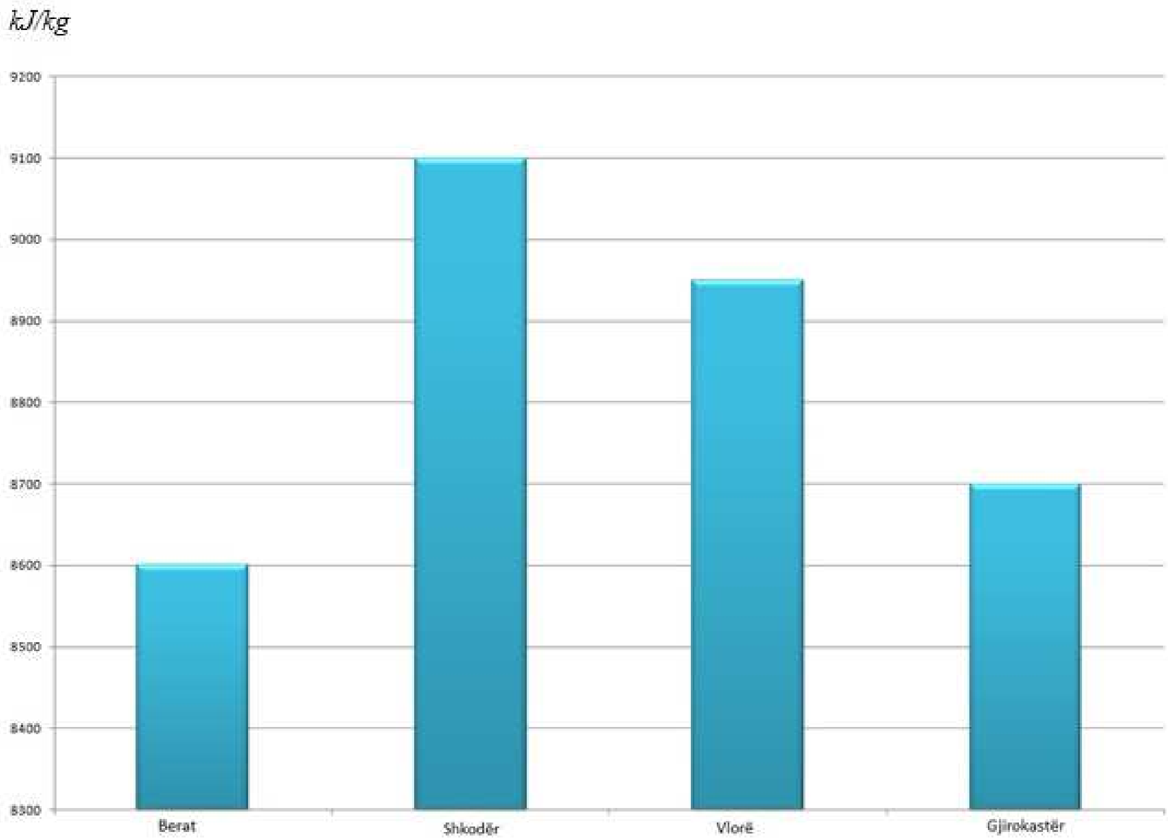

Figure 12. Low Calorific Powerline by Albanian regions for autumn harvest

4. Conclusions

Fluidized bed technology is the most appropriate and is an efficient technology for burning biomass in general and especially residues after distillation of the sage.

The advantages of this technology are high burning fuel with low calorific power and low pollution causing this burning, avoiding the need for expensive equipment for gas leakage.

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