THE YEARBOOK OF THE „GH.ZANE" INSTITUTE OF ECONOMIC RESEARCH
VOL. 23, ISSUE 1, 63-72, 2014

IULIAN CUCOŞ[1] The progress of ideas

RESEARCH ON THE IMPACT OF TECHNICAL, ECONOMIC AND ENVIRONMENTAL IMPACT OF ENERGY MANAGEMENT SYSTEMS FOR INTEGRATED WASTE

Abstract:
The scientific study aims to analyze the technical and economic processes, management methods specific knowledge society manifested in the integrated systems for energy management of waste, determine the environmental impact of waste energy recovery activities and propose some innovative technical solutions minimize this impact. Another objective of this paper is to establish regularities and economic implications of energy management for achieving waste electrical and thermal energy from renewable cheap thereby reducing the final cost price of energy and changing technologies that exploit renewable superior.
Keywords: *waste, energy, management, pyrolysis, plasma processing, knowledge-based society*

1. Introduction to specific management methods applied knowledge society mainframe systems for waste processing.

Knowledge society appears as forms of collaborative work between individuals in order to achieve higher goals than those that can be achieved individually. Activities carried transforms society of individual tasks in large projects that require large teams where members have technical skills and specialized social economic [1].

Knowledge economy is the main pillar of the knowledge society, the concepts of knowledge, the development, the interaction between the various components of society should be taken into account in a global vision, with knowledge of information are the main forces of the modern economy [3,4] .

The dynamics of individual and business are aggregated to the macroeconomic effects, defining behavioral change business development, changes in governments are called upon to respond to the application of legal and institutional frameworks use new stimulus specific policies and management [2].

Management study management processes and management relations to the discovery of principles and laws that govern the design and management tools to enable the objectives in terms of efficiency.

Management activity determines the future state of the system (business / organization) and has the following functions:

- forecasting determines the future state of the system by forecasting which is a quantitative and qualitative study on the future strategy for establishing a set of rules that determine the way to be followed and planning which involves developing an action plan;
- organization activity that leads to the creation of a system architecture is based on a structure of elements, and is a process that is a sequence of activities;

[1] PhD Fellow, SOP HRD/159/1.5/S/133675 Project, Romanian Academy Iasi Branch. E-mail: i_cucos@yahoo.com
Aknowledgement: This paper is supported by the Sector Operational Programme Human Resources Development (SOP HRD), financed from the European Social Fund and by the Romanian Government under the contract number POSDRU/159/1.5/133675

- forwarding, is the use of means non coercitive for staff involvement through staff training requires the acquisition of specific operations, motivation by creating the desire for action and command is the order that triggered the action;

- coordination is the introduction of additional orders requiring harmonization of conflicts, synchronization by keeping pace and balance for finding new proportions;

- control present the state goals and has the following components: preventive identifying symptoms in the process force objectives, audit includes indirect control over the company's objectives;

- evaluation of the activities to the objectives initially set by measuring achievements, comparing achievement of original objectives, determining the causes of interference, making corrections for removing negative cases. Function must have a corrective, but with as much as a preventive with high adaptability.

Waste management raises very complex undertaking requiring coordinated action at the local level to the regional civil society cooperation with local authorities, government representatives and also cooperation between countries to find the best method of waste management that to minimize their impact on the environment is important to report to the appropriate scale of time and space and of course be taken into account cumulative effects.

General principles of waste management are concentrated in the so-called "waste management hierarchy", the main priorities are prevention of waste and reduce their harmfulness in case you can not achieve neither waste should be reused, recycled or used as source of energy (incineration) and finally waste must be disposed of safely.

The waste hierarchy as presented in the Framework Directive 2008/98 / EC on waste, as applicable order of priority.

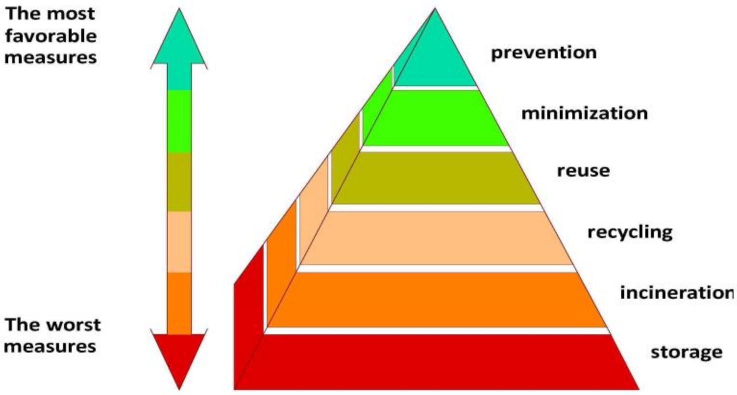

Fig. 1 Pyramid priorities in waste management

In the legislation and policies to prevent waste management identified the following descending order of priority:

- *Prevention of waste production* is a top priority in their management hierarchy, increased economic activity means an increase in waste generation, waste prevention objectives are reduction, reduction of hazardous substances in material flows and increasing resource efficiency.

Prevention should be applied primarily high-volume waste streams, hazardous waste and waste containing hazardous household waste reduction, however, is a much more complicated task because it involves reducing consumption in general, and changing patterns of consumption, which in turn, requires making changes in habits and lifestyle of the people.

At the national level were initiated programs enroll in preventing or reducing waste, legislative initiatives and pilot programs, however, are insufficient for the impact to be visible, requiring awareness of the importance and practices relating to waste prevention;

- *Preparation for reuse involves checking, cleaning or recovery* by which products or components of products that have become waste are prepared for reuse, without any pretreatment operations;
- *Recycling* is the recovery operation whereby materials are reprocessed into products, materials or substances and are used for the same purpose for which it was designed for another purpose, it includes the reprocessing of organic material but does not include energy recovery and conversion to be used as fuels or for backfilling operations.

Material recycling involves replacing the use of primary resources from waste materials, but recycling itself requires a number of previous activities: collection, transport waste, intermediate processing involving sorting, crushing and compacting etc.

- *Energy recovery from waste and other recovery activities* are various operations that waste is used to replace other material that would have been used to perform a particular function, or waste being prepared to meet that function.

Waste combustion technologies have been developed over time from simple waste disposal facilities, the facilities for obtaining energy from waste and the introduction of new emission control technology, which is a method that is gaining increasingly more interest-ing strategies manage- waste.

Obtaining energy from waste (Waste to Energy - WTE) involves burning waste and uses waste energy content to produce electricity or heat and electricity to obtain the heat being used (recovered and exported) for various services (heating, hot water supply).

Another method of energy recovery incineration of waste is defined as waste combustion operation with the primary purpose of generating energy or material products, which usually wastes are used as fuel or additional heat treatment of waste for disposal .

- *Disposal of waste in landfills*, the ecological disposal is the least desirable option in the waste management hierarchy, it continues to be the most common method of waste disposal in some countries, despite the fact that it has the most negative effect on environment and human health.

Currently, environmental policies rely increasingly more on addressing the full life cycle, which seeks and takes into account the negative impacts of the use of materials and energy throughout the entire life of the product.

EU Thematic Strategy on the sustainable use of natural resources is a good illustration of the way, taking into account the life cycle of a product, avoid impacts move from one stage of life to another product environmental impact is taken into account throughout the entire life cycle of products and services in order to avoid or minimize environmental load displacement between the different phases of the life cycle and from one phase to another.

Waste management planning is an important tool for the implementation of policies and regulations related to waste that may reveal incentives to divert waste from landfill to recycling and waste resources exploitation content.

The main elements in waste management planning are:

- involvement of stakeholders in the general public in the process of waste management planning;
- setting specific targets economic sectors, specific flows of waste and waste treatment;
- improved statistics on the generation, transport and waste treatment industries and relevant waste streams;
- planning and allocation of responsibilities to ensure sufficient treatment capacity;
- defining responsibilities and its inclusion in the plan, together with a description of ways and means of implementation.

Product life cycle, from resource extraction to production and consumption to waste disposal is shown in the following figure:

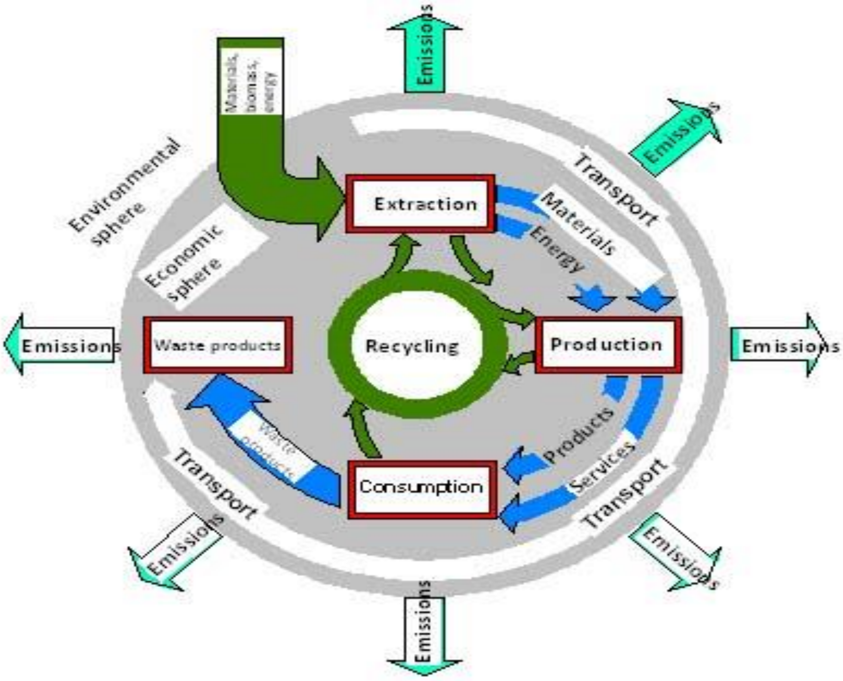

Fig. 2 Life cycle from extraction to production, consumption and waste

2. Methodology and objectives in the research

The main objective of the research is the study of technical processes and economic relations manifested in the integrated systems management for managing waste energy.

In the context of increased global energy crisis to find new sources of electricity and heat is a priority for European research, waste by using them in the production of electricity and heat is a valuable alternative to the use of coal or natural gas.

The first secondary objective is to determine the environmental impact of waste energy recovery activities and propose innovative technical solutions to minimize this impact. Suggested homework through research and legalities permit identification of technical and economic principles that govern processes, developing new methods and techniques to increase the competitiveness of energy-waste processing facilities.

Waste has a negative impact on the environment, finding and innovative methods and technologies for destruction and use of energy is a priority for research.

The second secondary objective is to establish regularities and economic implications of energy management of waste electrical and thermal energy to obtain a cheap renewable source reduces the cost price of energy and high recovery technologies change profoundly positive implications in daily life and politics financial families in villages and towns.

Methods of achieving knowledge in energy and light are different theoretical developments and additions, and natural phenomena, social, economic target is in a continuous transformation, are distinguished by shape, frequency or intensity of expression, cohesive or interdependencies.

Energy management, applied in a company, whose main objective is to ensure a judicious and efficient use of energy to maximize profits by minimizing energy costs, increasing in this way the market competitiveness of the company.

Secondary endpoints resulting from the application of energy management program, refer to:

- increasing energy efficiency and reducing energy consumption in order to reduce costs;
- achieving better communication between departments, the specific energy issues and their responsibility on energy management;
- the development and use of a continuous monitoring system energy consumption, reporting of consumption and development of specific strategies to optimize their consumption;
- finding the best ways to increase financial savings from energy efficiency investments in specific production processes by applying the best solutions known worldwide;
- development interests of all employees in energy efficiency and educating them through specific programs to reduce energy losses;
- ensuring food safety in power installations.

Experiences in the analysis of many energy management programs implemented in various sectors has shown that:

- can obtain energy and money savings of 5-15% in a very short time, costs minimal or no cost, just by applying an aggressive energy management;
- can obtain energy and money savings of up to 30% lower cost and medium with a short payback period, the application of such measures is frequent;
- by making expensive cost investment in modern technology and equipment can get 50-70% savings, payback periods in these cases reaching up to 5-6 years.

Implementation of integrated energy management waste affords the following technical and economic and social benefits:

- *improve environmental quality* by limiting global warming by reducing CO_2 emissions from fossil fuel combustion is one of the main factors to disorder global climate, greenhouse effect due to the emergence and growth temperature, the direct effects of to disorder the entire ecosystem, reducing energy consumption and energy production from renewable, non-polluting, as applied to a larger scale, can contribute significantly to reducing and limiting global warming and reducing acid rain from burning fossil fuels for energy production , containing in addition to CO_2 emissions and nitrogen oxide and sulfur, in combination with water vapor clouds lead to the occurrence of acid rain.
- *improving economic competitiveness by reducing production costs*, energy costs are an important element in cost structure of most products resulting from production processes, reduce energy consumption ultimately lead to lower production costs and thus to increase the competitiveness of products.

Modern principles of integrated energy management systems to process waste energy are:

- reducing the intensity of energy consumption by applying energy efficiency programs in the field of waste processing, energy intensity per unit of product will decrease, which will lead to a significant increase market competitiveness of the product, energy intensity in Romania is among the most major European space, as results from the comparative energy intensity with other countries in the European area;
- social benefits by applying energy efficiency programs has a social aspect by redistributing working capital effectively involved in monitoring the implementation of these programs;
- improving energy security by reducing imports of localities fuel (oil, gas, coal);
- reducing vulnerability to lack of energy, any tendency of growth leads to an increase in energy intensity, thereby causing an increase in import dependency impact on the national economy and especially political and strategic risks caused by reliance on a single supplier of natural gas and oil prices upward because of developments.

Scientific debate on sustainable development has highlighted three basic rules of management, these rules were originally formulated management of economically, in order to provide the basis of a sustainable resource, but were made to specify the size ecological sustainability [7]:

- the use of renewable resources should not exceed the renewal and / or the rate of regeneration.
- use of non-renewable resources should not exceed the rate at which resources are developed substituted (should be limited to a level that can be replaced either by physically or functionally equivalent renewable or consumption may be offset by increased productivity of renewable resources or non-renewable).
- outputs of substances in the environment (pollution) should not exceed the assimilative capacity of the environment ("absorption capacity").

These management rules can be found in various social policy documents, using these three basic rules of management allowed the development of operational activity commodity defined as the carrying capacity of resources, something that defines the structure and size of the industrial metabolism of the European Union, industrial activity can be continued long term without damaging the natural functions (Target Material Flow Balance).

The structure of economic management under the minimum requirements listed above includes three basic elements:

- raw material supply energy from natural resources will rely heavily on biomass cultivation;
- increasing extensive economic sphere is about to end and evolves toward a steady flow increase - decrease production stock will be minimized;
- extraction of non-renewable natural resources will be minimized use of these resources will depend heavily on recycled materials.

3. Integrated energy management of waste

Collection of waste and biomass from the public and businesses can achieve integrated points placement as containers for recyclable materials (glass, paper and plastic) and box pallets for biomass is in a common collection of material lifting recoverable fractions thus effectively organized. The collection is type "collection by collecting points".

Technical and economic analyzes clearly show that the availability of citizens to bring recyclable materials from collection bins decreases significantly with increasing length of the road to collection containers.

It is proposed to separate household waste since housing in different fractions: domestic organic waste (wet), paper, cardboard, glass and plastics, biomass, excluding hazardous waste and other bulky waste (furniture, appliances, etc.) will be removed upon request.

Selective collection and sorting to be done in such a way as to obtain a higher purity of the material and thus a quality class.

The transport of waste is performed when compacting garbage waste and other special means for waste biomass.

The collected waste will be transported for processing by sorting / baling, economic and energy recovery or composting storage platform.

Waste sorting and recovery is performed in primary sorting station is designed to prepare primary sorting and recovery of packaging waste as PET, plastics (PVC, polyethylene), glass, wood or metal.

Until recovery bales recyclable products are stored in the finished goods warehouse platform that can not exploit waste collects in containers located at the end of the strip and transported as non-recyclable waste composting platform.

Biomass wastes are land filled in areas designated, covered, surrounded by walls and fences so as not to be scattered by the wind or animals.

Depending on the technological requirements for processing classical or plasma pyrolysis the waste will be transported to waste energy conversion facility.

Physics and energy conversion and biomass waste.

Currently, in the EU and worldwide, there are many researches on bio-gas production using waste from industry, agriculture and forestry or household waste. It requires neutralization process organic waste by heat treatment plasma theoretical and technical depth to be in Romania.

Organic content of municipal solid waste, industrial, agricultural and forestry largely conditions the choice of techniques for neutralizing their use allows plasma waste management regardless of their degree of contamination and no additional mechanical or biological treatment.

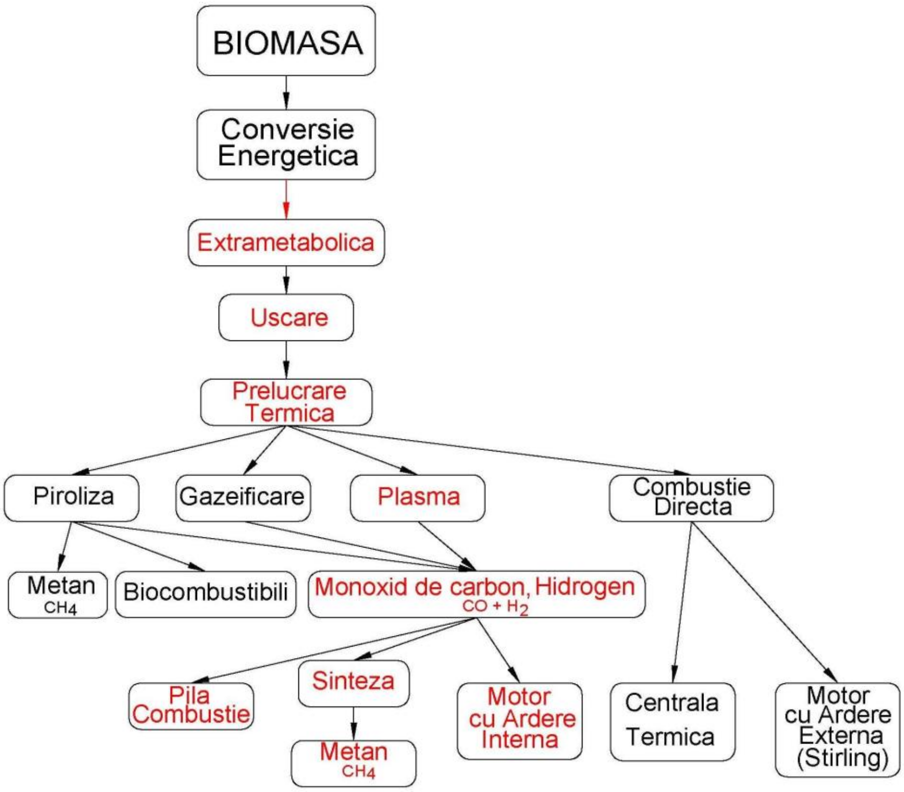

Fig. 3 Scheme of modern technologies for processing waste biomass

In modern management of waste, waste energy conversion and physical burden of treating his residual waste that can not be recovered, so as to reach:

- inert residual waste, minimize emissions to air and water;
- destruction of harmful organic materials, the concentration of inorganic materials;
- reduce the volume and mass of waste deposited;
- using the calorific value of residual waste in order to protect energy resources and obtain electricity and heat;
- transfer of residual waste in secondary raw materials in order to protect other resource materials.

The main methods of thermo chemical treatment of waste are:

- direct combustion - heat production;
- the gasification - is obtained by a gas mixture of H2, CO, CH2;
- pyrolysis - thermal process taking place in the absence of oxygen, producing heat and combustible gases, CH4, CO, H2, C obtained from cellulose at 700 0C which results: $C_6H_{10}O_2 \rightarrow CH_4 + 2CO + 3H_2O + 3C$;

- plasma gasification - results in a vitrified mineral and waste gases such as CH3, CO2, H2 can be used as fuel gas or fuel synthesis.

Thermal conversion of waste and biomass by plasma gasification is a fourth generation at the top level technology.

Plasma is the term given to a gas that has become ionized. Gas atoms ionized gas is formed which have lost one or more electrons and become electrically charged.

The interaction of the electric discharge gas and process gas temperature increases to a value significantly greater than 5500 °C.

Plasma torches can be supplied with various process gases from chemical compositions air, oxygen, nitrogen, argon and the like. This flexibility allows adaptation plasma system for different applications.

Plasma waste treatment technology increases the energy produced by the second process gas to ten times longer than conventional combustion of waste.

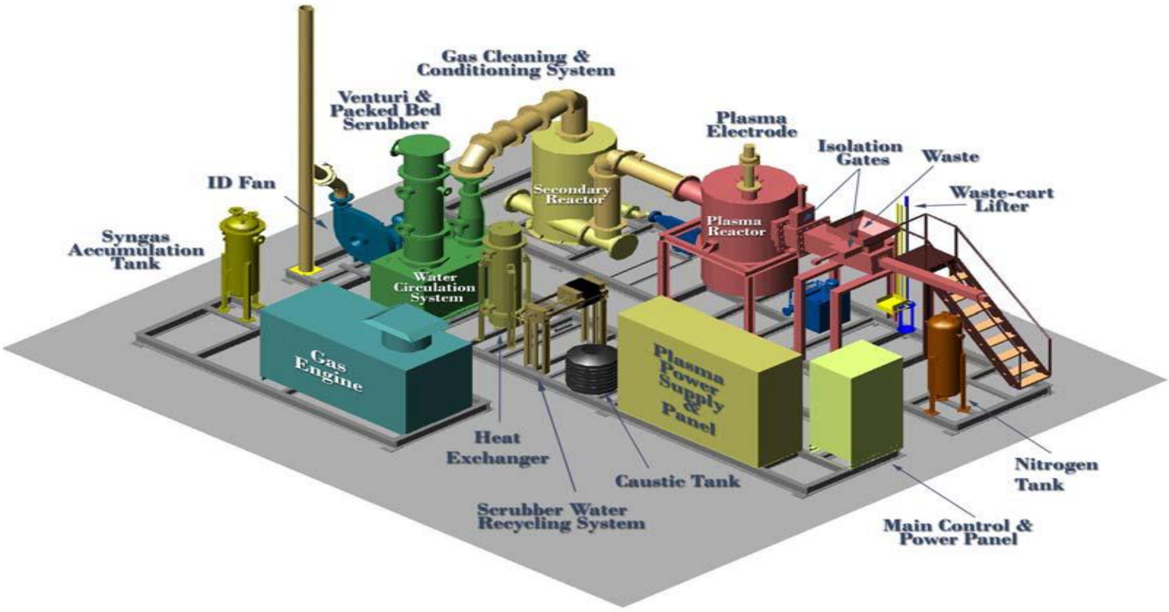

Fig. 4 The Plasma gasifying waste

Gasification is a process that converts carbonaceous materials, such as coal, petroleum coke, municipal solid waste or biomass, in a synthesis gas consisting mainly of carbon monoxide and hydrogen. Gasification occurs when a carbon-containing raw material is exposed to high temperature and/or pressure, in the presence of controlled amounts of oxygen.

The synthesis gas may be used as a fuel to generate electricity or steam or can be used as a base precursor in the chemical process for the production of high energy value.

Plasma technology is a very efficient heating process, the machine can operate with a minimum of maintenance in different industrial environments.

Plasma torch provides a high degree of flexibility to the combustion burner, since it allows control of the temperature, independently of the flow of fuel and oxygen from the process.

In general, the greater the temperature difference between the heat source and the material to be heated, the faster you can get syngas.

Plasma gasification and vitrification reactor is a combination of a moving bed gasifier type with a plasma torch.

The benefits of this type of reactor waste plasma are:

- the ability to accept a wide range of fuels with limited preprocessing requirements;

- operation at ambient pressure allows simple supply and maintenance systems online plasma torch;
- low gas velocities in order to allow greater flexibility and expensive treatments to remove starting material;
- ecological function as synthesis gas that is created has very small amounts of NOx, SOx, dioxins and furans;
- inorganic components are converted into molten slag, which is removed in the vitrification product safe for use as a construction aggregate;
- high reliability plasma torches have no moving parts, consumables are easily replaced by maintenance personnel;
- lower costs of capital and operating as air is used as oxidant.

4. Conclusions on embedded systems equipped with plasma energy management of waste and biomass

Raw materials and energy inputs in economic activity, the volume and nature of the waste obtained from industrial activity and changes in stocks of finished goods are factors environmental pressures.

Limited knowledge of specific environmental impacts of raw materials used in manufacturing process and causal links between manufacturing technologies, materials and energy resources, and inability to obtain and analyze this information on medium and long term can lead to reasoning that a strategy economic development based on precaution intended to reduce the volume of resource flows through resource recovery and better use of renewable raw materials coupled with the use of alternative energy sources based on energy waste will reduce the impact of economic activity on the environment.

Technical and Economic Assessment scientifically volumes of raw materials and energy used in economic activity is conducted at an appropriate level and requires laborious research and further analysis.

Flow analysis raw materials and energy in the EU and acceding countries and the collection and analysis of information about the volume and interdependencies between various sources of non-renewable and renewable raw materials and how industrial waste energy recovery allows the development Improved economic activities in Europe.

These macro-information can provide some features of the general industrial production and further analysis focused on specific environmental and economic impacts of different sources of energy and raw materials and cause-effect relationships can refine your results by allowing optimization of business processes.

Plasma gasification is a clean and efficient option to convert various raw materials into energy in an environmentally responsible manner.

The plasma gasification process, heat is used to break the molecular structure of any material containing carbon, municipal solid waste, tires, hazardous waste, biomass, river sediments, coal and petroleum coke, and convert them into gas synthesis, which can be used to generate electricity and heat.

Gasification occurs in an oxygen-poor environment so that raw materials are vaporized, not burned.

Due to the high operating temperatures in the plasma gasification observed:
- ash appears to require treatment or disposal in a landfill;
- metals and non-combustible inorganic materials are melted in a medium type slag that can be used to recover metals or construction aggregate;
- plasma gasification facility will have very low emissions of NOx, SOx, dioxins and furans;

- plasma gasification process CO_2 can be captured and used in various industrial purposes.

ACKNOWLEDGEMENT:

This paper is supported by the Sectorial Operational Programme Human Resources Development (SOP HDR), financed from the European Social Fund and by the Romanian Government under the contract number POSDRU/159/1.5/133675.

References.

[1]. Ion Ivan, Marius Popa Dragos Palaghia, Vintilă Bogdan Mihai Doinea - Peculiarities of the economic crisis in the knowledge society Theoretical and Applied Economics Volume XVIII (2011), No. 2 (555), p. 11-32

[2]. Caragea Alexandru Radu Gheorghiu, GEOMIN Turlea - Knowledge Economy in Romania Assessment recent advances. Jams. Policy recommendations.

[3]. Brancovan Romulus, Adrian-Paul Iliescu, Radu Mihail Solcan Management of Knowledge, University of Bucharest, 2007;

[4]. Dinu, M., Socol, C., Marinas, M. - Mechanisms of convergence and cohesion, Economic Publishing House, Bucharest, 2005

[5]. B.Bilitewski, G.Härdtle, K.Marek, A.Weissbach, H.Boeddicker - Waste management - Springer Edition;

[6]. F.McDougall, P.White, M.Franke, solid waste management P.Hundle -Integrated: A Life Cycle Inventory - Blackwell Science Edition;

[7]. Stephan Moll, Stefan Bringezu, Helmut Schütz - Project WP3c Cooperation with DG Environment - Thematic Strategy on the Sustainable Use of Resources - Zero Study: Resource Use in European Countries, An estimate of materials and waste streams in the Community, Including Imports and exports using the instrument of material flow analysis, European Topic Centre on Waste and material flows, March, 2003

[8]. INCDPM - ICIM Bucharest - Study on the methods and techniques of waste management

[9]. Action Plan for Energy Efficiency, Brussels, COM (2006) 545

[10]. Renewable Energy Road Map, Brussels, SEC (2006) 1719

[11]. Sustainable power generation from fossil fuels, Brussels, COM (2006) 843

[12]. A European Strategic Energy Technology Plan, Brussels, COM (2006) 847

[13]. An Energy Policy for Europe, Brussels, COM (2007)

[14]. Strategic research agenda for Europe's electricity networks of the future, Brussels, 2007

[15]. Romania's Energy Strategy 2007-2020.