THEORETICAL APPROACHES OF BIO-ECONOMIC PERSPECTIVES FOR ROMANIAN ENTERPRISES

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Abstract: *Some scenarios show that in the near future competition will increase regarding the use of land, water and biological resources as the effects of climate change, population growth, migration, economic and policy trends. The mature and sustainable Bio-economy, under development worldwide, must offer global food security, improved nutrition and health, to create smart bio-based products and biofuels, to help agriculture, forestry, aquaculture and other ecosystems to adapt to climate change. The bio-economy concept represents „a vision for the future society" to become less dependent on fossil resources and to provide energy and added-value products. For Romania's economy this new approach can be a path to economic development for many sectors. Therefore, the objectives of this study are to identify the main bio-economic sectors for development of new or existing enterprises in Romania. This paper provides an overview of the bio-economy in Europe, and the benefits of it, and, we try to identify how the bio-economy can contribute to a sustainable development of enterprises in Romania. The method used was to identify and analyze the best practices used by countries that have a national strategy for the bio-economy sector and started the development in this field.*

Keywords: *bio-economy, bio-economy in Europe, best practices in bio-economy*

Introduction

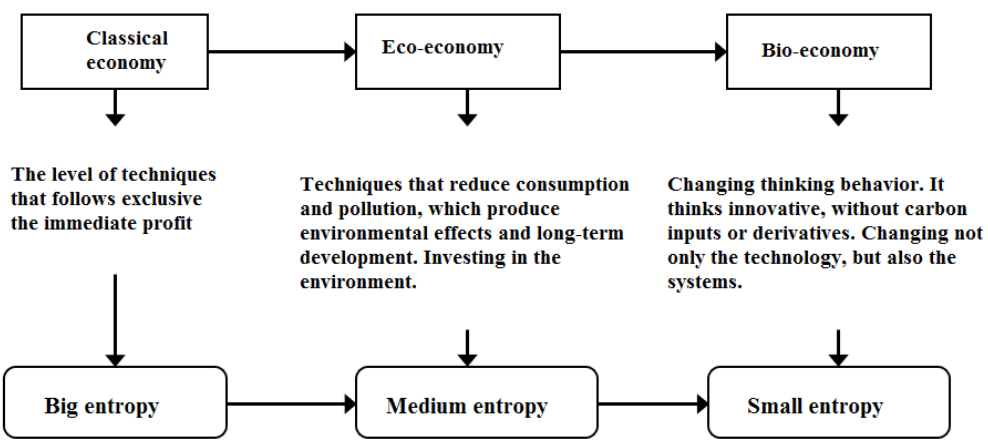
Academic, bio-economy is an economic theory developed by Nicholas Georgescu-Roegen in the early 1970s. In his view, is underlined the biological or "natural" basis of all the economic processes and hence of the human processes that led to the exhaustion natural resources of the planet.

It should be borne in mind that bio-economy should not be confused with the ecological economy, a separate discipline, and it is in full development to. Bio economy is an ancestor of it and it is necessary to be sought in earlier times than eco economy (Elodie G.T., 2013).

The Explanatory Dictionary (DEX) of the Romanian language offers a shorter definition and, in our opinion, incomplete. We quote: "*Bio-economy is the science that studies the economy of nature, of the biosphere. A science that studies the economy of society, as well as its effects on the biosphere.*" The same DEX does not provide any definition for the green economy or the eco-economy. In the view of the European Commission and the OECD, bio-economy is presented as "*a set of economic activities related to innovation, to production development and the use of biochemical products and processes*." The new strategy, developed inside the *Bio-economy project*, proposes, in the view of these institutions, the use of research and innovation to achieve the transition of our current carbon-based and other fossil-based economy towards a green, carbon-free and sustainable economy.

In our opinion, the shift from the classical economy to the bio-economy is done through eco-economy (Figure 1).

Figure 1: Model of bio-economy appearance



Source: authors

In the European Union vision, the term or concept of bio-economy implies an economy that uses biological resources from the soil and sea as well as waste as raw materials for food, animal feed and for industrial and energy production. It also includes the use of ecological processes for sustainable industrial sectors. For example, bio-waste has considerable potential as an alternative to chemical fertilizers or for conversion to bioenergy and can contribute to 2% of the EU's renewable energy target (Jennings, M. and Wcislo, M., 2012).

This statement cannot be accepted as a definition because he does not actually say what bio-economy is. On the other hand, the author commenting on the term confuses bio-economy with eco-economics, as dynamic processes such as those presented above, whereby from the left to the right there are strong transfers of knowledge of information, as a result of the research and innovations required on the whole process of transformation.

From a biophysical and economic point of view, the dynamic movement towards the bio-economy is carried out in accordance with the principle II of thermodynamics and entropy law. No other laws need to be invented, as is the case of many authors, probably mistranslated in Romanian - see the law of optimality, inappropriately formulated and incoherent, in which context many words are not found in Romanian dictionaries (Ghereş et al., 2010).

Based on these findings, we thought to provide the following definition: bio-economy is a particularly important science, which involves the theoretical reformulation of the concept about the human good, through the educational change of thought behavior on research and innovation, the implementation and development of an economies in which both material and energy resources do not involve fossil carbon and where all processes related to human life (economy, culture, health, consumption) are integrated with the environment.

The bio-economy requires a new way of life, in which the order of nature is found in the economy, the two functioning as a unitary one, in favor of man and nature. Respect for life will become an equally important phenomenon, both for man and for the rest of non-anthropic living creatures.

Solar energy is the only form of energy that makes life possible on Earth. In contact with the inorganic medium, solar energy induces a large amount of entropy, according to principle II of thermodynamics.

The bio-economics has the task of researching the relationship between solar energy and the living environment, especially the green living environment (plants), the only one that reduces entropy and stabilizes the sustainable order for the continuation of life on Earth and human good.

2. Good practices regarding bio-economy in the developed countries of Europe – Germany

In 2014, the German Federal Ministry for Food and Agriculture managed for the first time to develop an own view of the bio-economy transformation of own economy. The term used was a bio-based economy (BMEL, 2014).

The concept of bio-economy is defined as a natural substance circuit, covering all economic areas, renewable resources (such as plants, animals and micro-organisms), as well as their products, manufactured, processed and used, ie brought to the commercial field. In the category of inputs enters:

→ raw materials extracted from agriculture, forestry, aquaculture and fisheries economy;

→ productions obtained with help of microorganisms;

→ substances from the residues and residues of biological origin (food, fermentation drugs, etc.).

In addition to the use of these natural substances - raw materials, some biomass obtained sustainably, with a renewable energy source, are used in a cascade of uses to close their natural circuit.

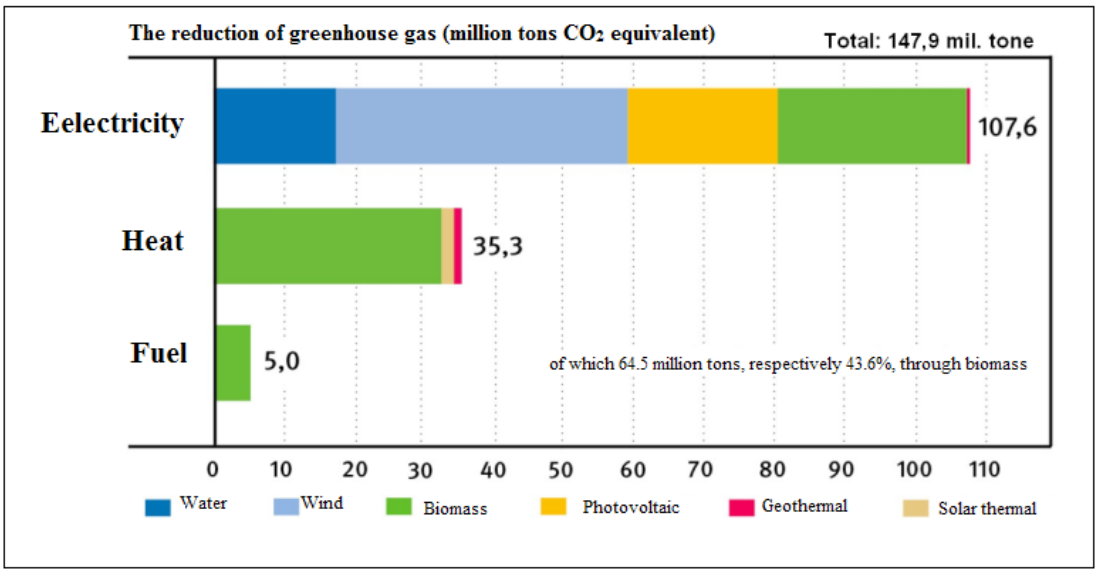
Renewable substances, by definition, are products obtained from the trophic chain, starting from photosynthesis but not interfering with the production of food. The substances, the renewable raw materials, are produced on an area of 2.3 million hectares in Germany, ie 20% of the German agricultural land. In addition, another 11 million hectares, or 33% of Germany's surface, are occupied by forests that produce wood for both of the industry and energy production too.

Today and in the future, from these renewable photosynthetic substances can be obtained:

→ **Bioenergy**	- electrical current; - hot water; - steam; - fuels; - biogas.	Today, 30% of Germany's energy needs (Fig.2 and Fig.3)
→ **Chemical industry** (Total: 21,619 million tonnes, of which 2,719 million tonnes renewable, 18,900 million non-renewable)	- fats and oils; - starch; - sugars; - cellulose; - drugs; - other industrial uses.	2.719 mil. Tonnes, is about 13% of the total (Fig. 4)

→ **Wood industry** Forests area = 11.4 million ha = 31.4%	- construction timber; - shell; - by-products from the saw; - wood for industry; - old wood; - other wood-based substances.	The balance of wood at the level of 2010 is shown in Fig. 5.
→ **Industry of:** - plastics biomass; - bio advertising; -traditional, (woodworking workshops)	- natural fibers obtained from different plants - hemp, linen, jute, kenaf, sisal, abaca.	45.000 tonnes in the automotive industry

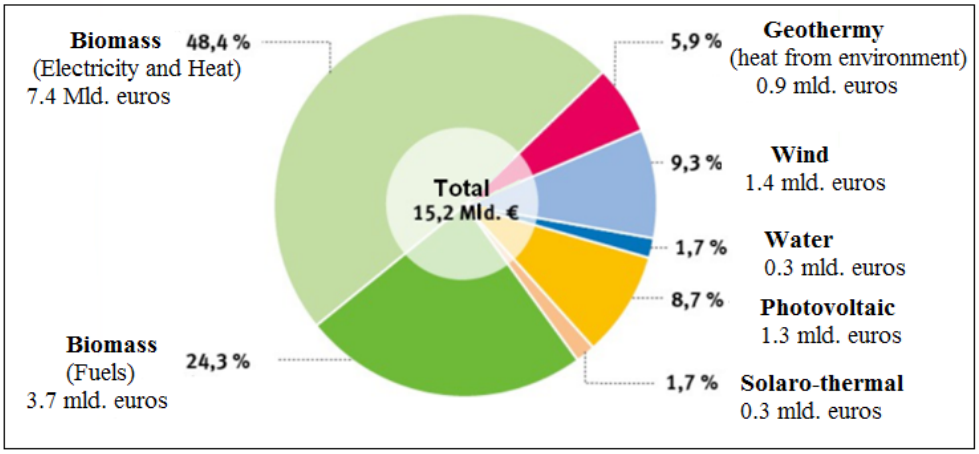
Figure 2: Reduction of greenhouse gas by using energy from renewable raw materials



Source: FNR, 2014

The total turnover of the companies producing bioenergy amounts to € 15.2 billion in 2013. The largest amount of money was obtained by using biomass (Figure 3).

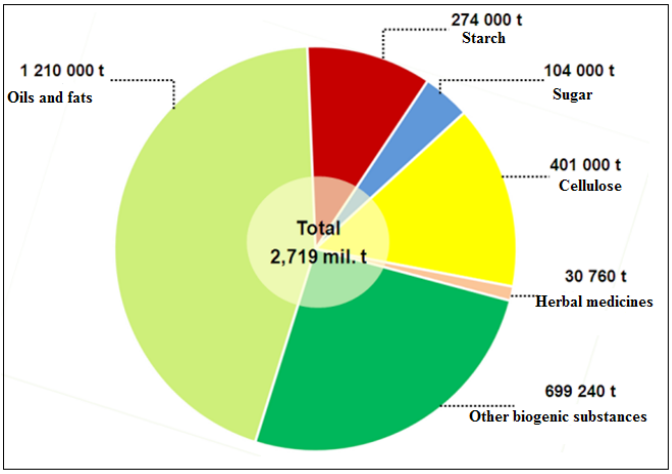
Figure 3: Turnover achieved by renewable energy companies in Germany, 2013



Source: FNR, 2014

Fossil substances continue to play an important role in the German chemical industry, with 18,900 million tones out of a total of 21,619 million tones, meaning 87.4%. Renewable products have won ground, being used in the chemical industry at 12.6%, meaning 2.719 million tones (Fig.4). Importantly is the fact that the food and medicine industries use large amounts of renewable substances and energy.

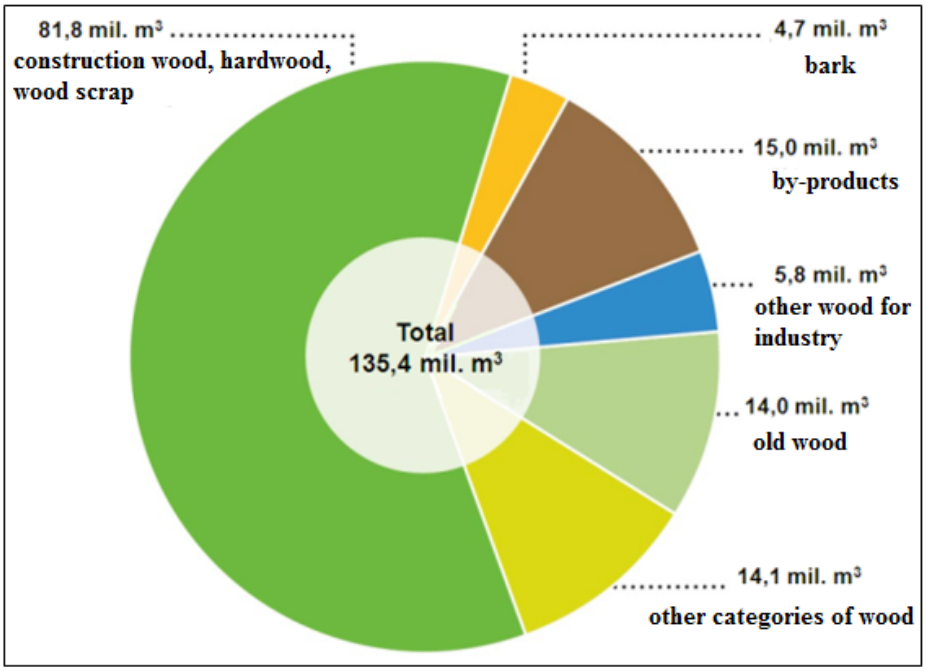
Figure 4: Quantities of renewable substances used
in the chemical industry in Germany, 2011



Source: FNR, 2014

The wood industry is present in construction, energy, chemical industry (ethanol, methanol), furniture and others (Fig.5). Germany has an impressive force to restore forest resources, with very strict rules on cutting and rebuilding forests following these actions.

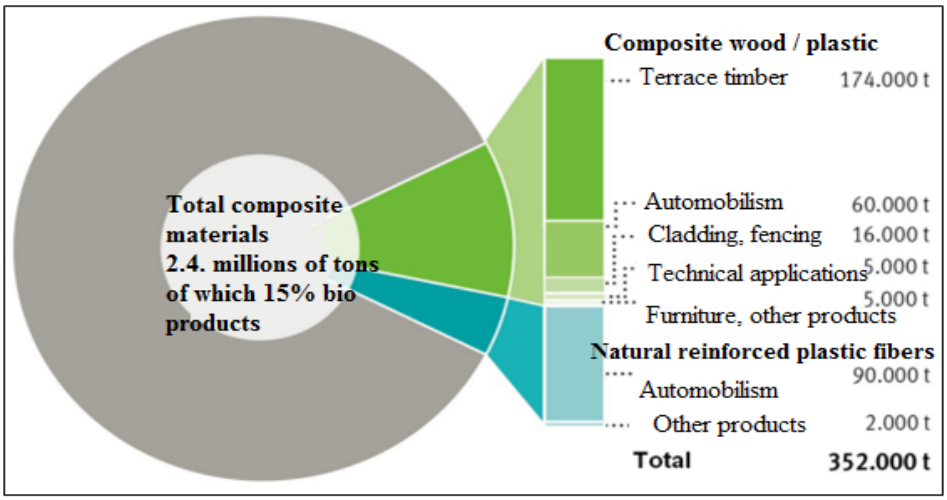
Figure 5: Wood Balance in Germany, 2010



Source: FNR, 2014

Substances which play the role of substitutes of the specialty plastics represent 2.4 million tones at European level, of which 15% are realized using bio-based procedure, means 352,000 tones. It is the automobile industry that has taken over the use of these new bio-economy products (Figure 6).

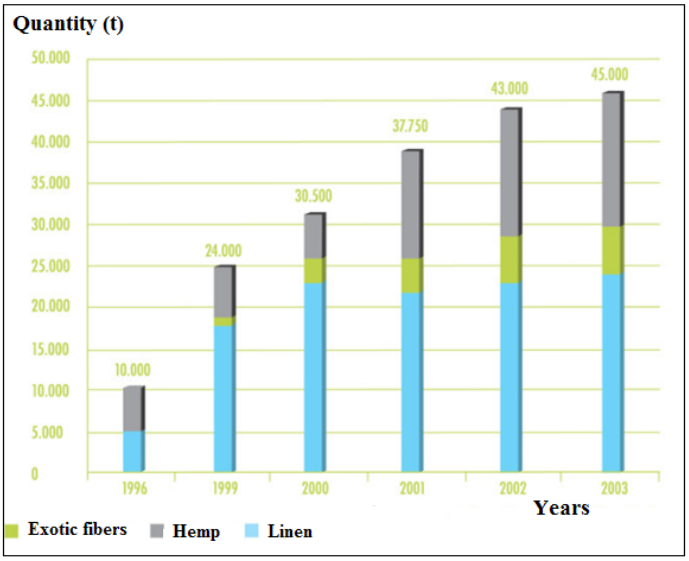
Figure 6: European production of bio plastics, 2012



Source: FNR, 2014

The total of natural fibers used in German industry amount to 88,000 tons only for cars and trucks. Total of natural substances as a substitutes of plastics, 160,000 Tons. It is also an intense concern of Germany for the replacement of fossil hydrocarbon fibers (Figure 7). The total amount of binders in Europe in 2014 was 2.4 million tones, of which 15%, means 352,000 tones, on a biological basis.

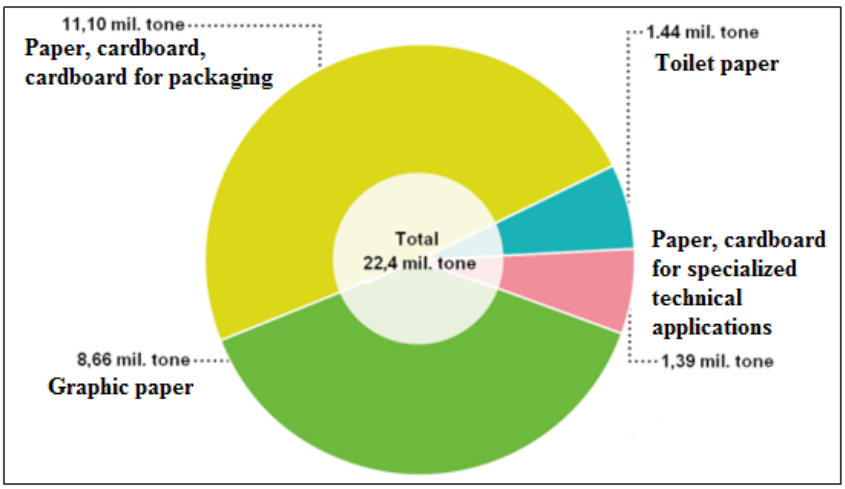
Figure 7: Quantities of natural fibers replacing those result from the chemical synthesis of hydrocarbons, Germany 1996-2003



Source: FNR, 2014

Paper can only come from the biological environment. Raw material doesn't requires only better utilization, that means the increasing the value index of utilization, in order to achieve the same benefits for people, with less inputs. The transformation of the paper industry, its migration to bio-economic space, refers to other inputs, especially to energy and biomass and pulp processing aids. In this area and Germany has much to do (Fig. 8).

Figure 8: Products of the paper and cardboard industry in Germany

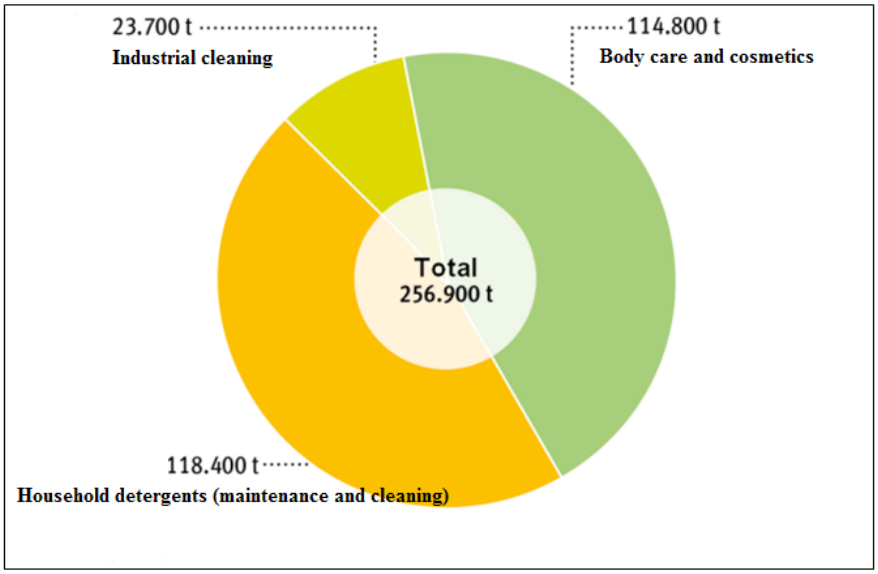


Source: FNR, 2016

The diversity of using vegetable fats in the lubricant industry is much higher than other types of oils, and advancing to the bio-economic category (of biological origin) is much faster. In 2011, the total oil market in Germany was 58,000 t, of which 30,000 t were easily degradable, meaning 52%, while the remaining 48% was NawaRo provenience (*Nachwachsende Rohstoffe*) exclusively - from renewable materials, which received a 25-50% bonus from the German government.

The total amount of surface active agents (tensides) is much higher today (around 600,000 tons). In the German economy, there is a good practice to reduce the tensides of petroleum origin and replace them with biological strains, especially from plants. In 2011, they amounted to about 256,900 tons (Figure 9), and are in a fast growing trend.

Figure 9: Use of active surface agents with biological bases in Germany, 2011



Source: FNR, 2014

We presented some of the Germany programs and strategies, which through an applied education at all levels has already succeeded in imposing bio-economic technologies at the level of obtaining goods and services, after highly elaborate researches, studies and innovations. Germany invested a lot of money and resources (€ 2.4 billion in 2011-2016) in the formation and orientation of the local human population towards the creation of bio-economic skills.

Growth, together with stability and human-nature sustainability, offers the current form of bio-economy that has begun to take shape and which, at least in Germany and in many other European countries and not only (Denmark, Finland, Sweden, partly Austria and France, Australia, Canada, Japan) have begun to get a good shape. The most sensitive branch, which sustains all the bio-economic activities, is energy, although the Sun is with us and provides for thousands of years more energy than human society needs until its disappearance. Extremely of many scientists warn about the use of bio-economy as a very possible system of human reintegration, into nature and of restoration of old flows (Wagner, H.G., 1997).

Conclusions

Bio-economy is creating growth and diversification for economy, especially in rural areas. Growth will only be achieved through research and innovation. It should, however, attach the utmost importance to education as a key factor in changing the mentality of the population, and the level and quality of research should be clearly defined.

Bio-economy can help society to find sustainable solutions to resolve the current turmoil of mankind, namely: food security; deficit of natural resources; dependence on fossil resources; climate change; the sustainability of system growth.

Bio-economics is based on life sciences - biology, agronomy, ecology, nutrition, social sciences, biotechnology, nanotechnologies, info-technology, communications and engineering.

Bio-economic production can only be achieved in a healthy environment consisting of robust, diversified and solid ecosystems. Agro-ecosystems are required to be smart and sustainable. Europe will produce the same consumer products with fewer natural biological resources. Natural resources will be exploited below the limit of their regeneration.

It is also necessary to draw up projects, respectively consumption programs, based on a new mentality, namely bio-economic education. In the same direction, transport, distribution, marketing and management programs will be developed. Throughout research and innovation, all vulnerabilities in supply, as well as market volatility imposed by current consumption, based on carbon sources and fossil energy, will be eliminated.

The production of bio-economic energy will take place through the use of natural resources, and a particular emphasis will be placed on reducing CO2 and other gas emissions, and the scientific development of a system of incorporation into the soil of excess carbon dioxide in the form of humus, to reduce the effects of greenhouse gases and climate change, but also to increase soil fertility and restore natural balance in agro-ecosystems.

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