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Community Power as a Driving Force for Sustainable Local Development

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Abstract

Beyond the controversial debate about the causes of the depletion of the natural resources and the environmental deterioration of the planet, the world society is determined in the search of solutions to the energetic subject, that unquestionably pass for the appropriate use of the renewable sources of energy, through The efficient use of resources and sustainability as a guiding criterion in the energy scheme. The paper offers a historical analysis of energy development on a global scale, interpreting the causes that have led to the depletion of natural resources, as well as the progressive deterioration of environmental conditions, valuing the concepts related to the Community Power, as an alternative for the construction of socially sustainable territories, from a scheme, focused on local development models. The results obtained are shown from studies of solar and wind potential. The use of Geographic Information Systems (GIS), in the support of data to the territories on the potentialities available in renewable sources, is valued, facilitating the promotion and promotion of projects aimed at the use of these energy sources in the scheme of the Community Power

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1. Introduction

For thousands of years, a common interest in the use of available natural resources prevailed, But the development of the productive forces and the changes effected in the relations of production and appropriation of the fruit of labor showed the basis of the progressive decomposition of that society and of the energetic relations which were produced in it.

2. Materials and Methods

When analyzing the emergence of the first manifestations of human life on earth and for thousands of years, it can be seen that renewable energy sources (RES) served as a driving force for the development of society.

The human species, like the hominids immediately before it, used primarily five sources of energy: its own musculature, that of the animals it domesticates, firewood, wind and water currents. Even for millennia, man did not count on another usable energy source, other than his own musculature to hunt, fish, crush food grains, carry loads and other vital tasks.

It is estimated that tree biomass was the first natural resource used by man. It is stated that in those conditions the average energy consumption from the use of firewood and some vegetal residues, was about two thousand kilocalories per day [1].

Already on the stage of the farmer man, the average energy consumption of the human being aided in his labors by the use of some domesticated animals and the fire, became three times greater than the characteristic of the previous hunting and gathering phase, that is, About twelve thousand kilocalories per day [1].

During later ancient civilizations, the man manages to melt copper, make alloys and obtain bronze, at some point developed the technology of iron, a material even harder and more resistant than bronze. Obtaining it was more economical, although it was more difficult to work [1].

Over the centuries the means of transportation over lakes, rivers, and seas were developed, and the wind was widely used by means of cloth sails to propel the boats. At the same time, hydraulic energy began to be used for productive purposes, used to rotate the stones or grinders with which the grain (maize, wheat, rye ...) was used, mainly for bread making [1].

In the Middle Ages, the Catholic Church practically generalized its dominance in Western civilization, turning to a period where the fundamentalism of religious dogmas almost stifled the sciences and the full development of man. In these conditions the center of attention was the contemplation and adoration of God, who according to religious dogmas made man in his image and likeness, establishing by divine command that the relationship man-nature, would start from the supremacy of the first over the second , Thus consolidating an egocentric position over the right to biological diversity and the existence of other forms of life, [2] a selfish and insensitive attitude that unfortunately continues to this day, in many of the people who populate the planet.

However, during the transition from the Middle Ages to the Renaissance, important technical advances occurred in feudal Europe. Mining, metallurgy and various industrial activities were developed with the help of hydraulic power, animal energy, and wood combustion. At that time, large wooden hydraulic wheels were used, capable of delivering a Maximum power of the order of 35 kW, while it proliferating industrial processes dependent on hydraulic energy [1].

Between the XII and XVI centuries, the construction of impressive Gothic constructions of the period proliferated, ingenious inventions flourished like the gunpowder, invented by the Chinese and introduced in Europe by the Arabs, increased the manufacture of pieces of artillery, great bells for the Churches and other uses of iron and bronze. These activities represented a considerable increase in the demand for wood to be used as fuel. All this led to an unprecedented increase in deforestation in many European regions [1]. It is estimated that by the year 1400, that is, at the end of the middle ages and the beginning of the Renaissance, per capita, energy consumption was about 26,000 kilocalories per day. Of these, approximately 23% corresponded to food, 46% of housework, trade and other services; 27% of agriculture and industry and 4% to transport [1].

It is precisely in the seventeenth century, when, as a consequence of a mismanagement of the use of wood as fuel, there is an acute shortage of this resource in Western Europe, especially in the British Isles, where for the realization of industrial activities which used thermal energy, had to start burning coal. Until then, this resource had been used very little in Europe, because it was considered dirty and harmful to health, although since the eleventh century the Chinese already used it as fuel [1].

3. Results and Discussions

Energy transitions and preferential use of oil

From the seventeenth century onwards with the first industrial revolution, technologies such as the steam engine, railroad, and textile machines were developed, with the first energy transition taking place, where wood and charcoal were replaced by coal [1].

The second energy transition linked to the second industrial revolution took place between 1860 and 1930, when electric systems, aviation, and the steel industry were introduced. At this stage, the mineral coal gives way to the preferential use of petroleum [1].

It is important to analyze that both processes take place in different historical periods, however, they are characterized by a common denominator, focused on favoring the factor of energy analysis above the environmental and social, materializing a linear technical thinking that has taken too far, the Convenience for using a fuel with higher energy density, without any concern for efficiency, quality, or the consequences of uncontrolled use.

In the context of the industrial revolution and the extensive application of the use of fossil fuels, the foundations were laid for the further development of the world energy monopoly, accelerating the decomposition of traditional community energy relations and the emergence of a prototype of uneven development, Based on wasteful consumption of natural resources.

Since the beginning of the extensive use of oil in the second half of the nineteenth century, its share in the world market for primary energy increased rapidly and by 1970 was the basis of the first global energy supply system.

The current situation is not very different; But worsened by the gradual increase in the consumption of fossil fuels and when the scenario of the new energy policies is described, it is considered that the global energy demand registers a strong increase and can increase a third of 2010 to 2035 [3], of So that if alternative solutions are not adopted with other energy sources to meet this demand, the depletion of fossils can accelerate above expectations.

During 2010 the subsidies that fomented the fossil fuel waste exceeded 400 billion dollars. The high number of people without access to electricity, around 1 300 million, which accounts for about 20% of the world's population, remains unacceptable [3].

Few signs indicate that the urgent shift in direction of world energy trends is underway. Global primary energy demand rebounded by a remarkable 5% in 2010, which catapulted CO2 emissions to a new record, the world follows a path that generates a level of emissions, which induces a rise in the long-term average temperature of More than 3.5 ° C. Without the application of new policies, the path taken is more dangerous, with a rise in temperature of 6 ° C or even higher [3].

Oil demand is projected to rise from 87 million barrels per day in 2010 to 99 million barrels per day in 2035. The total number of automobiles can double to almost 1 700 million barrels in 2035. It is argued that the increase in the use of Oil can be produced, despite the achievement of some impressive advances in fuel economy in many countries, especially in European cars and heavy transport in the United States.

It has been estimated that at the current rate of consumption, these sources will eventually be depleted or no longer be economically profitable in the medium term, with coal depleting between 200 and 250 years, uranium 70-90 years old, natural gas 60-80 Years and oil between 40 and 50 years [5].

The International Energy Agency's executive summary for 2011 points out that Russia's main oil and gas fields in Western Siberia will be declining and a new generation of higher-cost oil fields will need to be developed, both in Traditional production areas of Western Siberia, as in new frontiers of Eastern Siberia and the Arctic [6].

It is time to internalize with the total human responsibility that the era of cheap energy is over, that the depletion of fossil fuels is a reality that beats the economic health of society and that its continued use can irreversibly worsen the conditions of Habitability of the planet.

It is not the time to continue imagining the existence of immense underground lakes in oil, when the truth is that this resource is embedded in the mantle spaces of the porous rocks of the interior of the earth, mainly in the sandstones and limestone type, which Is something like the water that soaks a sponge and that in no case there are oil lakes [7].

The paradigm shift. Distributed generation and new challenges

The need to assume a paradigm shift in energy is a requirement that is already imperative for society from the environmental point of view, even more, urgent for underdeveloped countries that do not have fossil energy reserves, where dependence on the use of these resources is revealed as a matter of political dependence.

It is not a question of assuming a hypercritical attitude in relation to the traditional energy profile, much less denying the extraordinary contribution it has made to the scientific and technical development of recent years; But it would not be responsible for failing to recognize that the contemporary energy system is burdened by apocalyptic realities such as: global average temperature increase; The increase in intensity of extreme hydro-meteorological phenomena; The change of the global climate with serious affectations for the human life; The depletion of fossil and radioactive resources; The forced energy withdrawal of more than one billion people who do not have access to educational and basic services; The astronomical prices of hydrocarbons; The risks of catastrophic nuclear accidents; And pressures, political blackmail and wars over control of fossil resources [8].

In another order of analysis it can be argued that there is no viable way to approach sustainable development using fossil energy carriers, the possible solutions based on the use of these resources, however novel and phenomenal they may seem, would only serve to continue Aggravating the accumulation of environmental impacts, while delaying for a historically brief time, the final resolution to the growing energy demand posed by the balanced social development of humanity.

In spite of these realities, the adoption of a new sustainable energy paradigm, from the use of renewable sources of energy through a distributed scheme, constitutes a challenge to nothing void of obstacles, where more than a century of practices based on the use Of fossil fuels and the consolidation of energy systems based on centralized technical designs, has shaped a culture rooted in consumerism, inefficiency and waste, which is based on the technological myth of the robust energy-consuming natural resource industries, with enormous Factories to produce electricity based on a complex design of the dispatch and distribution, which through monumental metallic lines and the use of an enormous amount of electrical transformation technologies, supply the electricity in the form of merchandise, to a consumer totally alienated from the energy process And of the consequences S environmental conditions that stem from it. It is important to note that the renewable energy sources considered within the centralized generation and distribution scheme do not appear to be competitive with traditional sources since they are less efficient and more expensive.

Renewable energy sources are distributed by their nature of origin, do not need to be distributed to be supplied, their use will be more efficient and advantageous, as the generation takes place closer to the center of consumption, managing to link social subjects with Energy management and the responsibility to control and reduce environmental impacts.

The results obtained in a research carried out at the Technical University of Manabí in 2016, through a project that managed to install a small photovoltaic plant directly to the low voltage network of a load center, allowed to demonstrate that when a kWh of Photovoltaic power directly connected to the consumer center can save more than one kWh generated with fossil fuel, this difference being given when considering the losses of the centralized system that are avoided, as it was verified, that when the photovoltaic generation is made directly connected to The load of a consumer center can be up to 16% more efficient than when it is connected to the distribution network.

In these conditions will be necessary to face the new challenges, with novel political solutions, where the commitment is not only to a group or isolated and select groups of people. It requires the adoption of decisions that promote spaces of responsibility, involving different sectors of society, by designing schemes that at local community level, can play an important role in the energy matrix of the territories, localities, Municipalities, and provinces.

Community power

In recent years a number of countries have undertaken efforts to harness renewable energy sources for electricity generation, but there has been a trend towards the centralization of facilities and the provision of energy. The same technical rules of generation and distribution have been applied to renewable sources as to concentrated fuels, in order to maintain intact and even increase the profits derived from the electric service, although with the renewable facilities the fuel has an equal virtual cost To zero, which can perfectly mask the losses due to the inefficiencies of the centralized system.

About three and a half decades ago, the initiative of the community power found spaces by developing some ideas of socialization of the energy scheme, managing to escalate the political will of some governments in the old continent, when in the mid-1970s The Danish government was to promote the participation of the local community through the implementation of policies, initiatives, and incentives for the use of renewable energy sources.

The objectives of the community power were focused on linking local communities and citizens as owners, managers, partners, and beneficiaries of the projects in their plots, yards and properties, with the objective of achieving a broad social support of renewable sources [9].

Other European countries followed Denmark's example by promoting investments in local ownership, which were called community power. At present, interest persists among European decision-makers in government policies, to support citizens' participation in renewable energy projects, to generate local benefits, to increase acceptance of the paradigm shift, to achieve a conscious link between citizens and The scheme of generation, supply, energy consumption and control the concerns of society regarding environmental health [9].

The distributed nature of renewable energy sources naturally leads to a broad decentralization of the units and technologies that exploit it. The widespread use of renewable resources can multiply the number of energy facilities throughout the territory over a number of times and over a short period of time, making it difficult to control, operate and maintain it using a management scheme, And supply of centralized energy, which would only put at stake the competitiveness of these sources.

The momentum of the Community Power initiative can be more successful, as decentralization of jurisdictional competence towards the provinces and municipalities is achieved in matters of planning and materialization of investments in the energy scheme. It will be very difficult to socialize the energy matrix in a community, from a system with a centralized vision of the planning, direction, and execution of the investments that clings to possible models of development stopping any new initiative that represents a break with the inefficient and costly schemes of the Traditional energy planning.

The forms and methods of planning, direction, and control applied to the traditional energy scheme are not very useful to develop the use of renewable energy sources and to promote the initiative of the Community Power.

The international organizational support option for the Community Power Initiative has been welcomed by the World Wind Energy Association (WWEA), creating a Community Power Working Group, which has entered to define a group of concepts related to the Community power.

It has been pointed out that the community power can be defined by three primary elements [9]: Who owns the project?; Who controls the project? And Who benefits from the project?

It is specified that the concept can be defined by any combination of two of the following: Local shareholders own all or most of a project; Voting control is maintained in the community-based organization, And Most social and economic benefits are distributed locally [9].

It can be said that the definition of the concept of community power must certainly be broadly based on the socio-economic, political and legal diversity of world jurisdiction. But flexibility must not fail to protect the essence that gives life in its own right, the principles that originate the initiative. In this way, it may be necessary to consider one of the elements analyzed within the combination required to consent to the definition of the concept.

Principles of Community Power

The axiom of Community Power must be based on a set of basic instrumental principles that guarantee its coherent development within the framework of world jurisdiction. These principles may be focused on the following aspects:

The universality of energy services, based on the rights of the world's citizens, to have access to quality basic services; The sustainability of community development, based on environmental respect and consideration of the right of future generations, to the full enjoyment of the riches of nature; Energy self-sufficiency, focused on the satisfaction of social needs, taking advantage of the local resources of the localities, emphasizing the achievement of a high efficiency in the use of energy resources; The sense of social belonging to the energy scheme of the community, promoting a social vision committed to the generation, supply and adequate consumption of energy; The diversity of ownership models, based on the recognition of the right of individual citizens or associates in groups, associations and institutions, to appear as director eventual owners of all or part of the projects; The diversity of projects, focusing on the promotion of a high diversity of projects, for the use of the primary energy contained in renewable sources, according to the local potentialities, economic possibilities and viability of the installations; The

generalization of best practices, aimed at promoting a comprehensive information system, ensuring constant renewal and information transparency on the use of renewable sources; The transparency of rights and benefits for local participants represents recognition of the right to local distribution of most of the benefits derived from community power; The community social commitment in environmental management, aimed at promoting the active participation of various social subjects, in the scheme of reduction of environmental impacts.

At the same time, it has to meet a set of requirements, which can form the organizational basis of the Community power, such as: That the activity is focused on the balanced development of the community, implying that the impulse of the community energy initiatives, respond to the right of a reasonable equity of social benefits within the community; That has a broad operational generality, so that the implementation of energy policies and initiatives, offer sufficient flexibility and operational transparency, that allows its application in several jurisdictions; That it is sufficiently fair and competent, guaranteeing a solid base of energy management, based on the articulation of an information and knowledge system, that allows the transparency of energy actions in the community, based on the potential of each territory; Which is compatible with development interests at local and national levels, this requirement implies that actions and investments may be economical, socially and environmentally viable to the interests of the local community, municipalities, districts, departments And provinces; and. That is activity does not contradict the interests of the country's development.

The community power is a novel option for sustainable social progress, with the potential to be articulated in a wide range of local organizations, committed to specific tasks in the energy development of the territories.

It may be considered that the initiative of the Community power can construct its definition when it materializes the combination of three of the primary elements set out below:

1) That the ownership of the local shareholders is retained in the largest fraction of the project shares. Understood in the fact that an individual or group of local shareholders, whether farmers, cooperatives, independent electricity producers, financial institutions or associations, municipalities, schools, etc., are immediately or eventually owners of all or most of a draft;
2) That voting control is maintained in the community-based organization. This legal mechanism assumes that an organization of this type, made up of local shareholders, has the majority of the voting rights with respect to the decisions taken on the project, that is to say concretely, that the right of decision on the projects It resides in the community;
3) That most of the social and economic benefits are distributed locally. Assuming that most of the economic and social benefits go to the local community, giving the possibility of being reinvested in the extension of the scheme and the strengthening of community power;
4) That not less than 60% of the energy resources to be used have their origin in renewable energy sources. This criterion guarantees the materialization of the central idea that originated the initiative of the community power, distinguishes it as a development option preferably sustainable and aimed at energy self-sufficiency of the community.

Geographic Information Systems

The technological changes that have occurred in the last decades are associated with many ways of producing, transmitting and processing information. The use of energy is a problem directly linked to the territory and to the human society that resides in it. The complex social relations that take place in the territorial space, generate a great amount of data and information, that would be practically impossible to control, without the aid of the modern tools of the information and the use of the techniques of the computer science and the Communications.

Geography is one of the sciences that can provide more information about the territory, from the topographical elements present to the characteristics of the migratory phenomena that occurred in it. Knowing what the different historical trends and their consequences have been, allows us to determine the type of information that can be obtained and how it should be interpreted.

Energy management of the territory is materialized in a succession of planning and management figures, which can be expressed in maps, maps at different scales, with different types and volumes of information.

Geographic information systems are an adequate tool for the solution of problems, since like no other information system, they allow to study in a global way the territory, with its characteristic and differentiating elements, as well as the environmental, social, Cultural and geographical.

The versatility of these systems allows them to be used in multiple territorial analysis functions, offering data and information in tables and graphs of different formats, incorporating a rather approximate spatial vision to the actual behavior of events and phenomena operated in the territorial environment, offering Concrete results with an economy of time and economic resources.

These tools applied to the energy planning and control scheme can be used in studies of demand, evaluation of the behavior of renewable sources of energy, inventory of energy facilities, evaluation of environmental impacts, studies of the impact of natural disasters on Energy social infrastructure, evaluations linked to the short, medium and long-term territorial planning process, simulations associated with efficiency studies and many other useful applications.

Some institutions such as IRENA (International Renewable Energy Agency) have used a geographic information system to model the world's solar and wind potential map [10].

The use of geographic information systems in Ecuador for the purpose of managing renewable sources is a recent function, through which the map of the solar radiation of Ecuador has been made. Recently the Technical University of Manabí began the development of the project called: Geographic Information System for Sustainable Development (SIGDES) [11] which has allowed the development of maps of solar and wind energy potential in the province of Manabí, based on measurements of solar radiation and wind speed published by NASA.

In 2016, the information generated by the SIGDES project served as a basis for developing two research projects focused on a study, which allowed the introduction of a 3.4 kWp photovoltaic power plant directly connected to the low voltage grid in one of The buildings destined to the professors of this university, in the figure 1A shows the map of the average annual solar potential and in figure 2 the wind speed map, both of the province of Manabí.

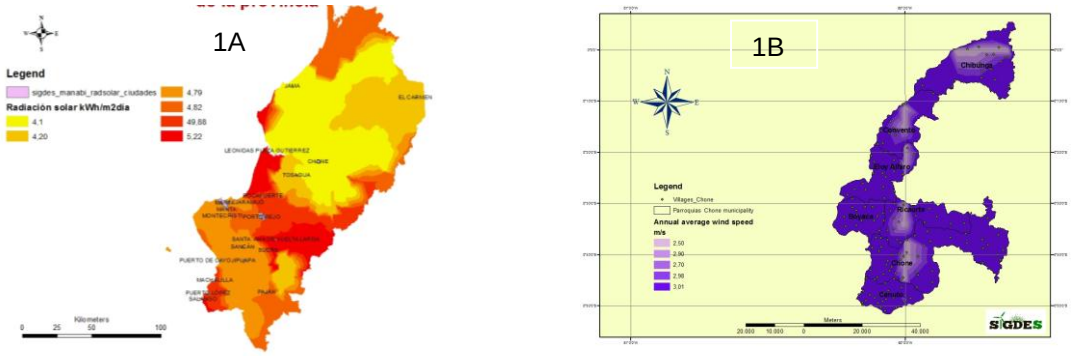

Figure 1A. Map of average annual solar potential. 1 B, Map of the wind speed of the province of Manabí

The evaluation of the solar potential shows that its use for the generation of electric energy is viable throughout the territory of the province, being able to achieve a significant saving of resources and reduce the environmental impact derived from the generation of electricity.

In the case of wind potential, it can be used to design wind systems for small consumption, which can be used in isolated homes that are currently electrified or to improve the energy service to which they are electrified, but that the quality of energy does not meet the needs of users.

Local development

According to the definition of the concept in the local development, one starts from the possibilities of resources of the locality, constituting a conception that bets by the positivism like theory par excellence, in innovation and creation of new alternatives for the development. It establishes a philosophical break with the previous development policies, which are based on centralization of management, intensive exploitation of natural resources, lack of transparency in information and poor compartmentalisation of results.

Local development results in a decentralized development policy that is focused on the community, respecting and caring for the environment, transparent management and sharing results that focus on gradually eliminating social differences, under the establishment of a policy focused on achieving Social equity.

Unfortunately, however, their most immediate antecedents are found in the concepts deployed during the 1950s and 1960s when the central objective of the economic development model was growth and its measure was the gross domestic product (GDP) Under the rule of an erroneous developmental philosophy, which led to the unequal development of regions, territories, and countries, since not necessarily all GDP growth is synonymous with development.

During the 1970s, it was recognized that, in order to achieve an adequate development model, the reduction or elimination of poverty, inequality, and unemployment should be considered in addition to economic growth, thus achieving social equity. In this way the concept of "eco-development" was born, which is defined as that which is socially desirable, economically viable and ecologically prudent [12]. This introduces the model of development, a clearly innovative element with respect to the previous, concern for the environment. Thus, during the 1980s and 1990s, the fundamental objective of the economic development model became sustainability.

In the 1990s, as a result of the efforts of the United Nations Development Program (UNDP), a conception emerges that shows a new understanding of the concept of development, with a vision focused on the applications of human, Resulting in a new way of measuring development known as the Human Development Index (HDI).

The birth of the model of local development occurs basically in Europe, in response to macroeconomic crises, with a logical expression of horizontal regulation that emerges from the local global dialectic to confront the unequal development policies that emanate from the neoliberal current.

In 1975, the World Bank presented a definition of development applied to space, in which the local development model is understood as [12]: a strategy designed to improve the standard of living, economic and social population. The main currents that originate in those moments are local development endogenous; Integrated local development and; Development with a local approach that can, in turn, come together in a single concept or model with the three characteristics.

The local development is a process that is born and compatible with the local peculiarities of each zone and the immediate environment to the locality, which leaves with advantage when it comes to homogeneous territories, with a minimum population, that is to say, with a certain extension, which is sufficient to constitute the so-called critical mass required.

The objectives of local development focus on the following challenges: improving the quality and standard of living of citizens; Increase the degree of social welfare; Reduce dependence on the outside (not its elimination); Improve conditions to strengthen mutually advantageous exchange with the environment outside the locality; Reinforce the collective spirit as a component of conscious action to achieve social and individual development; Achieve growth and job creation; Achieve conservation of the natural environment and; Develop the cultural community.

This new model of development focuses not only on economic progress but also on human and ecological progress, one of its main policies being the promotion of cooperation between the different agents of a locality (individuals, public administration, non-governmental organizations). Government, companies families, supralocal entities, and other factors).

In terms of development the local word is not synonymous with small, nor does it allude to diminutive or reduced. The concept of local acquires, therefore, a connotation of something socio-territorial that happens to be defined as an area understood by an ongoing process of development, generally when this process is thought, planned, promoted or induced. Normally, when talking about the model of local development refers to development processes that occur in subnational spaces and in most cases such spaces are municipal or micro-regional.

The model of local development requires the realization of a complex process of agreement among the agents, sectors and forces that interact within the limits of a determined territory, with the purpose of promoting a common project that combines the generation of economic growth, equity, Social and cultural change, ecological sustainability, gender approach, quality, spatial and territorial balance, in order to raise the quality of life and welfare of each family and person living in that territory or locality. The execution of this model of development implies a concentration with regional, national and international actors, whose contribution enriches and strengthens that process, which has an internal logic, which progresses in a gradual, but not dynamic, linear way that gives meaning to the different Activities and actions carried out, by the different social actors. Figure 2 shows a graph where you can see a variant of the local development model.

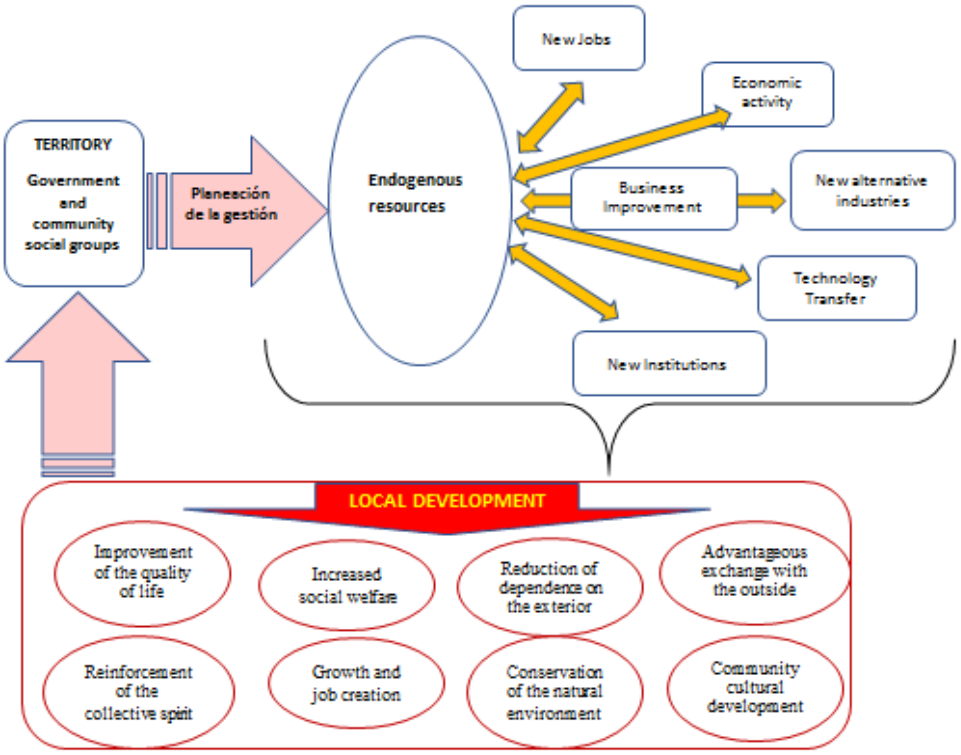

Figure 2. Local development model variant

The model translates as a process through which the government and the groups of a community, determine to manage their resources to create new jobs and stimulate the economic activity in a well-defined area from the economic point of view, indicating that process the formation of New institutions, the development of alternative industries, the improvement of companies and the transfer of technologies.

The local development model becomes a way of promoting sustainability, which takes into account the role of all the factors necessary to make the potentials dynamic, which can be identified when examining a delimited socio-territorial unit.

4. Conclusion

1. The importance of local development as a valid alternative to face periods of crisis and achieve sustainability has led to its generalization practically worldwide, being assumed especially by the developing countries of the region of Latin America and the Caribbean.
2. The community power is a viable option to be applied to local energy development, allowing to sustain the basis of development in the use of endogenous resources of the locality, ensuring the protection of natural resources, environmental care, and sustainable development.
3. Geographic information systems can be used as data management tools and relevant information for the study of the potential of renewable energy sources, as well as organizing energy management for local sustainable development.

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Statement of authorship
The author(s) have a responsibility for the conception and design of the study. The author(s) have approved the final article.

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