Futuristic Trends in Renewable & Sustainable Energy.

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Energy Management can be brodely defined as proactive, organized and systematic management of energy use in a building or organization to satisfy both enviornmental and economic requirement. Company’s acrocc all sectors are turning to energy management as a means to reduce their operating costs. Specific requirements and practices differ by sectons but the core principles apply to all companies.

Energy flows continiously through the surface of the earth and also through its atmosphere. The dominant component of the input energy is obtained from solar radiation. Each square metre of area at the atmospheric boundry intercepts normalprependicular radiations at the rate of 1377 w/m2. This so called solar constant is not constant but but subject to annual variation. Energy demand is divided into three sectors: (i) electricity, (ii) transportation, and (iii) “heat” which comprises all stationary uses of energy except for those associated with generating electricity or transportation fuels. Energy demand is the term used to describe the consumption of energy by human activity. It drives the whole energy system, influencing the total amount of energy used; the location of, and types of fuel used in the energy supply system; and the characteristics of the end use technologies that consume energy.

Global primary energy consumption grew rapidly in 2018, led by natural gas and renewable energy. However, carbon emissions increased at their highest rate in 7 years. Primary energy consumption grew 2.9%, almost double the 10-year average of 1.5% per year and the fastest since 2010. The impacts of climate change continue to exert considerable costs on the global economy, especially for least developed countries, with little adaptability and resilience. Energy-related carbon emissions grew 2.0%, again the fastest expansion in many years, with an increase in emissions of around 0.6 gigatons.

The energy sector is continuously affected by rapid changes, including multilateral innovations. In the run-up to the COP21 climate conference in Paris in December 2015, more than 160 countries submitted national plans on how they intended to contribute to the objectives of the convention on climate change in the post-2020 period .The new global energy governance agenda now overlaps with global environmental governance and the poverty alleviation agenda. The protection of the environment and climate change promote the use of renewable energy. Renewable energy technologies could offer competitive cost options for the delivery of modern energy services in remote areas, while innovation and scale merit continue to achieve cost savings. A robust dialogue on the nature, scope, and challenges of energy and climate governance must be initiated. Energy governance encompasses regulation and enforcement that aims to overcome collective action problems related to energy supply and use. The concept of energy governance is highly context dependent. It generally includes policy-related attributes. Such as international interactions, coordinated and interactive agreements, and institutionalized rules and, finally, a complex and diverse range of stakeholder groups Energy governance is a process of coordination between public-private institutions in order to decide how to provide energy services].

It is understood as a system of regulation of energy-related interactions between the State, society and the economy .Energy as a field of politics is an almost classic cross-cutting theme, closely related to climate policies, but also to development cooperation, research and innovation, trade, and foreign and security policies. One of the key factors brought together by the study of global environmental policy and energy research is the threat of climate change. Problems caused by fossil fuels, including widespread air pollution and climate change, have led governments, companies, investors and the public to recognize the need to decarbonize the world economy. Climate change poses an existential threat to humanity and the Earth’s ecosystems. Unless urgent steps are taken to decarbonize the energy sector, the world complies with the Paris Agreement. Most pathways to a low carbon economy would require a rapid deployment of renewable energy and doubling energy efficiency, given that the energy sector accounts for two thirds of global emissions .Ref. has shown that implementing renewable energy combined with an improved energy efficiency provides the most cost-effective way to achieve 90% reduction in energy related emissions. Energy efficiency enables economic growth with lower energy inputs. In the 20th century, the average growth rate of energy demand was 3%, almost equal to the growth rate of world GDP. In recent decades, improvements in energy efficiency have overcome this correlation. The demand for primary energy is forecast to grow 1% annually until 2040 Energy transition implies a profound economic, industrial and social transformation. It could affect prosperity, employment and social organization as much as the first Industrial Revolution. Renewable energies bring several macroeconomic advantages. For example, by 2050, the cost of energy could go from 5% of world GDP to just over 2% of a much larger world economy The promotion of renewable energy and energy efficiency are popular ways for countries to achieve their energy and environmental goals and for decarbonization and decontamination in the future energy matrix Studies carried out by propose a long-term energy and climate planning that includes two strategic elements and processes: the National Integrated Energy and Climate Plan with a ten-year perspective, and the strategies for long-term low emissions with a fifty-year perspective. Energy and climate change policies must not be complicated; clean energy must be supplied at a competitive cost aimed at reducing emissions Based on their situations and concerns regarding energy, different countries may adopt different policies and legal measures for energy transition.

To reduce the effects of the environmental problem, governments must develop and implement energy conservation policies. It is generally accepted that a country's energy supplies are considered of utmost importance at the level of national energy planning. As such, policies are established in order to afford Government a measure of control on overall consumption, without dire consequences to either its industry or commerce.

Countries which had turned to oil in preference to other fuel forms, due to its competitive prices and convenience of use, were suddenly faced with high inflation rates and large deficits in their balance of payments as a direct result of the energy crisis in 1973. To disengage themselves from such imbalances and their economic vulnerability to fluctuations in the oil supply market, governments made strident efforts to establish, what was hoped would be, effective energy policies without compromising existing strategy towards growth in industry and commerce.

Indeed the legacy of the "oil embargo" has left the major industries of the developed countries with a greater respect as to the real importance of energy in their operations. The forest products industry for their part, previously complacent to the role of energy in their overall operation, now regard it as an area where potential savings may be made, thereby affording significant reductions to production costs. Yet, in spite of the fact that the present day oil glut has allowed a relaxation in most energy conservation investment projects, both government, industry and commerce, on a worldwide basis, are seen to be keeping a wary eye on developments in the oil market.

An upward trend in energy prices is inevitable, though to what extent is difficult to predict, nor can events such as civil disturbances, local wars or failure in diplomatic relations be foreseen so as to avoid the sharp increases in oil prices, as took place during the years 1973/74, and to allow governments the lead time necessary to establish buffer stocks and implement effective energy conservation measures.

The country is shifting from heavy dependence on fossil fuels to almost complete self-sufficiency through renewable energy, especially hydroelectric power. The country is also improving its energy transfer infrastructure to allow massive loads to be transported more efficiently at high voltage. Ecuador is a country with some important aspects when analyzing the energy sector. A remote oil-producing region limited financial resources and lack of infrastructure are just some of the great challenges that the country must face when exploring its natural resources, while guaranteeing its diverse and unique Amazon ecosystem .Ecuador’s economy operates around the supply of non-renewable natural resources: mainly crude oil and, to a lesser extent, gas and other minerals. Ecuador has a high economic vulnerability due to dependence on oil exports and its fluctuating price. Oil production approaching its maximum peak, fossil fuel prices being highly subsidized .significant potential for the use of hydroelectric energy and/or other renewable energy sources.

A key moment for Ecuador’s energy policy was 1979, when, after a decade of military dictatorship, Ecuador returned to a nominally democratic system. National strategic resources, including the exploitation of primary energy resources and the generation of electricity, were privatized. The electricity sector pursued a combination of hydrothermal electricity, consisting of large-scale hydroelectric power plants and fossil fuel-based thermoelectric plants. In 2008, a new constitution was drafted. The new approach aimed at reverting to a state-controlled natural resource management system, and the country set out to making its energy matrix cleaner and more environmentally sustainable. The control of the energy sector shifted from a mainly privately-owned system to a centralized State-owned system. The period from 2008 to 2014 has generally been characterized by economic prosperity as a result of high oil prices and increased production from mature oil fields in the Amazon. The government implemented policies to promote hydroelectric energy and unconventional renewable energy, which have not reached the expected performance. Energy subsidies remained among the highest in the world, which has led the transport sector to become the fastest growing sector of the economy in terms of energy consumption.

Ecuador exports crude oil and imports fossil fuels, which causes a significant imbalance in the national economy. In 2013, the Ministry of Electricity and Renewable Energy introduced the concept of “change of energy matrix” or “energy transition” in order to legitimize a new energy policy based mainly on the use of renewable energy. This commitment to clean energy was mainly intended to be implemented by the electricity sector. It would contribute to greater environmental care and would begin a post-oil period by reducing fossil fuel-based thermoelectric plants and investing in eight new hydroelectric plants. In Ecuador, several policies have been incorporated to promote the use of non-conventional renewable energy.

The 1998 Constitution of the Republic already established that the State will promote its use, while in the 2008 Constitution strengthened this principle and incorporated the concept of energy efficiency. In 2000, Ecuador ratified the Kyoto Protocol, and therefore can participate in the application of the Clean Development Mechanism (CDM). Given its geographical conditions, there is significant potential to apply technologies with renewable energies. Hydroelectric energy will prevail in the short and medium term in the country, since the country still has great potential and in full use. Ecuador requires other energy sources to Energies 2020, 13, 3883 4 of 18 diversify generation and reduce the vulnerability of the electricity system, avoiding the increase in high-cost and high-impact thermoelectric generation. Materials and Methods Strategic energy forecasting consists of determining and analyzing the most probable future scenarios for a given energy system and constitutes an indispensable tool to develop the most appropriate strategic options. Projections of future energy demand and composition have implications for policy decisions. Energy system models are important methods used to generate a range of knowledge and analysis of energy supply and demand. Regardless of how power systems modeling develops, policymakers and analysts who support them should focus on understanding the assumptions included in any modeling output

This research mainly has a two-part methodology that includes literature review and evaluation and scenario analysis using system dynamics (SD). Systems dynamics methodology has been widely used to model complex systems in which feedbacks, delays, and nonlinearities are frequent Some of these applications have been aimed at modelling energy and environmental systems, as well as integrated evaluation models. These models represent the relationships between the main variables using flows and stocks in an easily understandable way. From all the analyses of the literature review, it is understood that the promotion of renewable energy and energy efficiency will help Ecuador achieve its objectives in the energy field. This research mainly has a two-part methodology that includes literature review and evaluation and scenario analysis using system dynamics (SD). From all the analyses of these reviews, it is understood that the promotion of renewable energy and energy efficiency will help Ecuador achieve its objectives in the energy field.

The evaluation in this document seeks to clarify “which are” the current energy policy instruments related to renewable energy and energy efficiency in Ecuador, comparing the situation to the rest of the world. It also seeks to identify what should be considered in the future, considering Ecuador’s economic sectors. After the evaluation process, it was determined that the possible future challenges of energy policy will show and emphasize how future policies should be designed in Ecuador by decision makers in the last part of the discussion section

Renewable Energy and Generation Potential The past decade has seen strong growth in the deployment of renewable energy technologies, with the electricity sector leading the way thanks to sharp cost reductions for solar photovoltaic (PV) and wind power.

* Renewable energy is the fastest-growing energy source in the United States, increasing 42 percent from 2010 to 2020 (up 90 percent from 2000 to 2020).
* Renewables made up nearly 20 percent of utility-scale U.S. electricity generation in 2020, with the bulk coming from hydropower (7.3 percent) and wind power (8.4 percent).
* Solar generation (including distributed), which made up 3.3 percent of total U.S. generation in 2020, is the fastest-growing electricity source.
* Globally, renewables made up 29 percent of electricity generation in 2020, much of it from hydropower (16.8 percent).
* A record amount of over 256 GW of renewable power capacity was added globally during 2020.
* Renewable ethanol and biodiesel transportation fuels made up more than 17 percent of total U.S. renewable energy consumption in 2020, a decrease from recent years, likely due to the COVID-19 pandemic.

Regarding solar resources, in 2008, National Electricity Council (CONELEC) published the first Solar Atlas. This has allowed locating local power generation projects: 2.8 MW, under construction, in addition to 907.94 MW from other potential projects. In 2013, the Wind Atlas was published, which determined that Ecuador’s gross wind potential is 1671 MW with an average energy production of 2869 GWh/year. Ecuador has an enormous diversity of biomass source to produce energy and other products. Although important steps have been taken to encourage the use of biomass for energy purposes, hard work is still required to achieve a greater participation of this renewable energy source in the national energy matrix. Ecuador is a country that has a high potential for water resources. For the water system of continental Ecuador, a water potential measured in flow equal to 16,500 m3 /s is estimated; of which 11,715 m3 /s correspond to the Amazon slope, and 4785 m3 /s to the Pacific slope The (CONELEC) has studied the country’s potential for hydroelectric generation; and as a result of these studies and investigations, a potential of 2255.94 (MW) and an average annual energy of 11,837.29 (GWh/year) have been determined.

Economic and Energetic Context the debate on the economic impact on the environment today is wide. Two scenarios can be defined: optimistic and pessimistic. Optimists argue that, as resources run out, the economy will replace them with others. Sustained economic growth will produce a less polluted world. On the other hand, pessimists claim that, if the current trend of economic growth persists, the world will become more polluted and the supply of certain essential resources will decrease or can even be forever lost, without the possibility of finding substitutes. The extraction, conversion and use of energy have a considerable influence on the environment and external costs. While replacing fossil energy with renewable energy technologies can often reduce greenhouse gas emissions and, to some extent, other environmental effects and external costs, these technologies may also impact the environment and external costs, according to the energy source and technology used. The current population of Ecuador is approximately 17.35 million inhabitants, the GDP per capita in 2018 was 6344.87 (current USD). The oil sector of the country continues to be the main source of foreign exchange, but it has strongly reduced its participation in national GDP, from 13.2% in 2011 to 4.8% in 2017, according to the World Trade Organization (WTO). The poverty rate fell from 29.6% in 2011 to 24.5% in 2018. External debt rose to $39.5 billion at the end of 2017, when in 2011 it amounted to c. Sending remittances amounted to $2840 million in 2017. Energy is a fundamental input in the quality of life of the population and in the productivity of a society. Although the production of renewable energy since 2005 has increased by almost 100% in 2016, its participation barely reaches 5% of the total primary energy produced in Ecuador. The participation of renewable energies in the energy matrix of Ecuador considers the following aspects; electricity generation, using natural resources in hydroelectric, wind, biomass (co-generation) and solar (photovoltaic) projects. Projects have been implemented to use biofuels for transportation, through the consumption of extra gasoline with ethanol (pilot project in the city of Guayaquil). On the other hand, in several homes solar water heating systems have been installed. The indicators considered are those Energies 2020, 13, 3883 7 of 18 suggested at the regional level by the methodological guide of the study Energy and Sustainable Development in Latin America and the Caribbean and Sustainable Development in Latin America and the Caribbean

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Evolution of sustainable development indicators (Minister of Electricity and Renewable Energy. Scenario Analysis The construction of scenarios allows exposing a set of alternatives regarding the future; it can be defined as the creation of multiple possible futures to support strategies. Scenarios are descriptions of trips to possible futures that have different assumptions about how current trends develop, how critical uncertainties develop, and what new factors may change over time leading to strategic planning.

In this case, the energy prospect and the CO2 emissions in Ecuador is to be identified. The settings necessarily include subjective elements and are open to various interpretations. Three scenarios were developed to consistently describe the relationships between energy supply and demand and emissions in the country. The formulation of the scenarios is necessary to predict the evolution of the main variables, which can promote energy generation policies, and to project consumption and mitigation of CO2 emissions. Our methodology considers three scenario approaches: The Business As Usual (BAU) scenario projects the current trends identified by each nation. It assumes that past trends will continue in the future and that neither new energy saving, nor environmental protection policies will be implemented . SCENARIO2 (The National Policies) includes the government plans and strategies that have been established for the coming years in Ecuador in terms of energy production and consumption.

The following documents are considered: National Energy Agenda 2014–2040, National Energy Balance 2015–2017, National Energy Efficiency Plan 2016–2035, Electricity Master Plan 2016–2025, Electrification Master Plan 2013–2022, Analysis of R&D&I opportunities in Energy Efficiency and Renewable Energies in Ecuador, National Strategy for Climate Change of Ecuador 2012–2025.

Finally, (Global policies and trends), considering the environmental dimension of the objectives of sustainable development, global environmental governance, multilateral environmental agreements and global macroeconomic perspectives for sustainable development. Replacement plans for clean energy and energy efficiency will serve as the basis, or the trends in the reports of organizations such as the Intergovernmental Panel on Climate Change (IPCC), International Energy Agency (IEA), BP, among others. The model combines different sectors through feedback mechanisms to capture the complexity of the behavior of the economic-climatic system.

The matrix of productive sectors in this study Energies 2020, 13, 3883 8 of 18 consists of six sections:

1. transport,
2. industry,
3. residential
4. construction and others
5. Commercial, services and public administration,
6. Agriculture, fishing and mining,
7. Construction and others.

The constant energy matrix of the following primary energy sources: oil, natural gas, hydroelectric energy, cane products, and other primary products. The final energy sources are electricity, LGP, gasoline, kerosene and air fuel, diesel, fuel oil, gases, reduced and non-energy crude oil. Renewable energies not included include photovoltaic, wind, biomass, biogas and biofuels. This structural approach allows for a more scientific representation of feedback relationships. The simulation model is structured in three main modules: economy, energy demand and emissions. The main characteristics of each module are: Economy: The economy is modeled assuming the monetary value of the final goods and services produced by an economy in each period. The volume of economic activity during the study period is analyzed and considered considering the dynamic integration of regional and global input-output data. Energy Demand: Final energy demand by sector is estimated through projection of sectoral economic production, efficiency improvements, and energy replacements driven by national, regional, and global policies. Emissions: the global model calculates the production of CO2 emissions is set based on the consumption and type of energy considering the three scenarios proposed as a reference.

2.3. Modeling and Simulation - The proposed model was simulated using Vensim software, a modeling tool commonly used to build, simulate, and analyze dynamic model systems based on causal loops or stock and flow diagrams. The model was designed to estimate economic growth, energy substitution and the CO2 emissions in Ecuador in 2030. To achieve the research objective, Ecuador’s traditional energy resources and possible renewable energy resources were considered. Consideration is being given to examining the impact of economic growth on energy consumption and the CO2 emission system. Figure 5 shows the summary flow diagram of the Economic—Energy—Emissions system, the model analyzes the CO2 emissions that come from the energy demand of the different economic sectors of the country. There are three stocks in the proposed SD model including Final energy demand, GDP, Population. Total energy demand is the sum of the demand for different types of energy for each of the six economic sectors of Ecuador. Total CO2 emissions are the sum of the emissions by type of energy that each economic sector demands.

Economic—energy—carbon emissions system flow diagram in Ecuador (adapted from [56]). 3. Results Below are some of the most relevant results of modeling scenarios for the Ecuador energy system. For each of the productive sectors, the substitution of fossil energy for renewable energy has been proposed. Economic—energy—carbon emissions system flow diagram in Ecuador (adapted from Energies 2020, 13, 3883 9 of 18 3. Results Below are some of the most relevant results of modeling scenarios for the Ecuador energy system. For each of the productive sectors, the substitution of fossil energy for renewable energy has been proposed. 3.1. GDP per Capita the simulation of GDP per capita based on the projection of the three scenarios

Shows a positive economic projection until 2030 Economic growth would be between 35% and 37% in the first two scenarios, while there would be an increase reaching 60% compared to the year 2000 in SCENARIO3. Although the simulation shows economic growth, it is necessary to indicate that for the next decade the Economic growth is not very encouraging, so Ecuador’s GDP per capita would continue to be one of the lowest in Latin America [57], which could be attributed to high population growth and moderate economic growth [58]. Politically, a structural change in the Ecuadorian economy has been proposed, focusing on sustained and equitable economic Energies growth in the long term. GDP per capita projection in thousands of US dollars/inhab (USD of 2007). Final Energy Demand Figure 7 shows the scenarios of the final energy demand of the transport sector. The energy demand of this sector shows an upward curve in the case of the SCENARIO1, while in the case of the energy demand stabilizes, and the increase is greater at the end of the evaluation period. This is mainly due to the substitution of fossil energy for renewable energy, which in the case of Ecuador would be hydropower. Energy efficiency and renewable energy policies can reduce the demand for, and supply of energy generated from fossil fuels [60]. The reduction in energy demand is associated with energy policies that seek to replace energy sources and improve its efficiency. The change in the energy mix will improve the efficiency of a sector that has traditionally been very inefficient energy wise.

A central aspect of the issues discussed is the observation that both politics and political processes are at the heart of governance for sustainable development. Climate change now affects all countries on all continents. It is disrupting national eco-economies and affecting lives, which is why there is an urgent need for global energy policies to address climate change, geopolitical tensions and economic vulnerability. Achieving a sustainable energy future requires a revolution in the energy system Energy is fundamental to all aspects of development, but sustainable energy is basic to improving the health and livelihoods of millions of people around the world, so there is an urgent need for progress on access to sustainable a o all aspects of development, but sustainable energy is basic to improving the health and livelihoods of millions of people around the world, so there is an urgent need for progress on access to sustainable and modern energy to support the progress of nations . Defining energy policies aligned with clean energy use, greater energy efficiency and responsible consumption is imperative in the effort to define sustainable energy governance. As an oil-exporting country, Ecuador has maintained a high level of dependence on oil and its derivatives in its energy matrix, and the economy accounts for a very significant percentage of the country’s total income. In recent years it has experienced a major change in energy, perhaps due to predictions that oil resources are in a phase of decline, estimating that reserves could last between 25 and 30 years. The development of renewable energies has focused on hydropower, with investment in several hydroelectric projects. The Latin American Energy Organization (OLADE) has determined that Ecuador’s water potential is approximately 22,520 MW. From the high dependence on fossil fuels to an almost complete self-sufficiency through renewable energies is the main challenge of the government, policies are needed to encourage the development of new technologies focused on non-conventional clean energy sources such as solar energy, wind energy, biofuels among others.

Projection of CO2 emissions by total energy consumption. 4. Discussion Based on the results obtained from the simulation of the energy variables in the SCENARIO1, SCENARIO2 and SCENARIO3 scenarios for the year 2030, energy policies could be established that are the pillar of sustainable energy governance concerned with the reduction of emissions, the improvement of energy efficiency and a sustained transition to renewable energy. The three scenarios make it possible to establish the effects of renewable energies and energy policies on energy governance in Ecuador. The modern fossil fuel economy shows characteristics of a mature socio-technical domain, with a tight integration between the components of the hydrocarbon industry (exploration, extraction, transport, combustion, and retailing) In reviewing the main agreements, policies and reports in the area of energy governance in the world, they conclude that none of the current forms of energy governance should leave aside the care of the environment and that there are many challenges in the energy field . A central aspect of the issues discussed is the observation that both politics and political processes are at the heart of governance for sustainable development. Climate change now affects all countries on all continents. It is disrupting national eco-economies and affecting lives, which is why there is an urgent need for global energy policies to address climate change, geopolitical tensions and economic vulnerability. Achieving a sustainable energy future requires a revolution in the energy system.

Energy is fundamental to all aspects of development, but sustainable energy is basic to improving the health and livelihoods of millions of people around the world, so there is an urgent need for progress on access to sustainable and modern energy to support the progress of nations Defining energy policies aligned with clean energy use, greater energy efficiency and responsible consumption is imperative in the effort to define sustainable energy governance. As an oil-exporting country, Ecuador has maintained a high level of dependence on oil and its derivatives in its energy matrix, and the economy accounts for a very significant percentage of the country’s total income. In recent years it has experienced a major change in energy, perhaps due to predictions that oil resources are in a phase of decline, estimating that reserves could last between 25 and 30 years. The development of renewable energies has focused on hydropower, with investment in several hydroelectric projects. The Latin American Energy Organization (OLADE) has determined that Ecuador’s water potential is approximately 22,520 MW. Energies 2020, 13, 3883 14 of 18 From the high dependence on fossil fuels to an almost complete self-sufficiency through renewable energies is the main challenge of the government, policies are needed to encourage the development of new technologies focused on non-conventional clean energy sources such as solar energy, wind energy, biofuels among others. It is important to have guidelines that allow for infrastructure projects that guarantee the supply of energy while meeting high quality standards. Renewable energy promises to play an important role in reducing the generation and consumption of high-carbon energy sources. The timely transition to a low carbon and renewable energy economy is key to mitigating climate change. Climate policies targeting energy-related CO2 emissions can result in short-term localized reductions in both air pollution and adverse impacts on human health. Increase in the use of renewable energy would discourage the use of fossil fuel consumption and thereby mitigate carbon emissions investigated the environmental impact of carbon emission mitigation to achieve sustainable economic growth; the study finds a long-term positive equilibrium relationship between renewable energy consumption and economic growth. Research has determined that there is an important relationship between the use of renewable energy and the economic growth of a country. The promotion of mechanisms for adopting the use of renewable energies fosters and stimulates the economic and sustainable growth of nations. Energy efficiency in Ecuador plays an important role in energy planning. The adoption of energy efficiency schemes within the energy matrix will minimize energy consumption and reduce the carbon footprint. In Ecuador, sectors such as transport and industry have maintained a tendency to consume more fossil energy, producing a greater amount of CO2 emissions. By taking into account the scenarios that propose the substitution of the energy mix and greater energy efficiency, a decrease in energy demand would be projected and a significant reduction in CO2 emissions would be achieved compared to the scenario that projects 60,233.7 KT of CO2 emissions if we continue as we have been acting. Furthermore, understanding the relationship between CO2 emissions and economic growth would be useful for formulating energy policies and promoting the sustainable development of energy resources.

The significant increase in energy consumption in Ecuador has negatively affected the country’s financial position, because large subsidies have been granted to energy consumption in the domestic market, and because Ecuador is an exporter of crude oil and an importer of oil derivatives. A scenario of economic growth would favor investments in scientific research that could lead to the development of new technologies related to the mitigation of CO2 emissions; therefore, greater economic activity would have a positive impact on the environment. Economic projections do not predict an encouraging scenario and therefore, at present, they would not be a preponderant factor in reducing emissions, so policies that improve the quality of life of Ecuadorians are necessary.

Conclusions- The scenario simulation considers the importance of a change in the energy matrix in Ecuador. Incorporating clean energy, mainly hydroelectric energy, considering the country’s water potential is one of the priorities that must be considered in national energy policies. Increasing the participation of renewable energies in the national energy matrix plays a fundamental role in reducing CO2 emissions. For the development of renewable energy, it is important to change the current energy landscape. Energy policies must be redesigned to promote research, implementation and use of renewable energy in the different economic sectors

Fossil fuels are still maintaining the largest portion of energy consumption and keep on their increasing trend all over the world. In this situation, environmental pollution is somehow inevitable, whereas the renewable energy plants do not directly contribute any.

In the future, it is aimed that the main energy sources will become new and renewable energies. While the fossil fuels are inevitably running out, renewables are to be more important. They are effective in many areas such as continuous cost reductions, generating jobs, developing future industries and meeting energy and environmental targets.

The development and use of renewable energy will improve the energy security, environment, economy, mechanical manufacturing, construction, transportation and industry and also help to create new jobs. Energies of solar, wind and biomass can meet local energy demands and assist to improve the environmental protection. Current situation related to the energy demand encourages an enormous market for renewable energy. As predicted, the share of renewable in meeting global energy demand will grow to reach 12.4% in 2023.

In the longer term, if the investments in the renewable technologies continue, renewable will have the potential to make significant contributions to energy needs. Further, there are several technologies that include biofuels, and fuel cells also can contribute to heat, transport and electricity markets.

The share of fossil fuels in total primary energy supply is expected to include around 81% of total in 2023. By 2050, renewable energy will approximately account for 30% of energy structure in the world.

By providing a balanced resource diversification of countries for the primary energy resources, the share of domestic and renewable energy resources in the generation system can be increased to the maximum extent. As also aimed in the current strategy plans of many countries, targets should be obtained in time for supporting, developing and encouraging new environment-friendly practices in generation and services. The largest market share and the most of advanced renewable energy technologies belong to the leading developed countries such as the USA, Japan and the Europe.

In order to use less and cleaner energy in power plants, buildings, industrial facilities and transport systems, many energy-efficient enabling technologies are applied. These technologies could slash costs by up to 80 per cent, ensure energy savings by up to 30 per cent and help to slow global warming in the future. Thus, the countries could stay cost-effective and make sustainable progress.