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Review of the Bioenergetics Policies Predominant in China, Colombia, India and Indonesia

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Following the global warming on greenhouse gas abatement, most industries have adopted biomass-based energy generation as a fundamental basis for its growth with the inclusion of a low-carbon policy. This study present a literature systematic review of predominant policies formulated in different countries such as China, Colombia, India and Indonesia, in order to characterize the legal and regulatory framework worldwide state in the use of biomass as a source of energy for sustainable development, addressing the policy implications of energy generation from biomass from their economic, social, planning and environmental aspects. Also, based on individual interactions with some stakeholders, is presented the current scenario of the Renewable Energy/biomass opportunities and its development challenges. Finally, some policy recommendations are proposed for each country considering the role to play in approaching climate change and growing the worldwide renewable biomass energy industry.

1. Introduction

For years, the most critical action to move the economy around the world has been the transformation of matter and energy (DI, 2004), not to mention the importance of the relationship between energy and the economy for all countries (Bilgili & Ozturk, 2015). In this way the energy landscape according to a report of Energy Technology Perspectives 2016 more than half of the world's population and around 80% of the world in 2013. Cities account for about two-thirds of primary energy demand and 70% of total energy-related carbon dioxide (CO_2) emissions (IEA, 2016). This issue arises due to the unbalanced distribution and not considerable use of energy sources in countries and leads to energy dependency in some possible states by adding the current policy of the state, therefore, providing energy security is especially important for energy importing countries (Halder *et al.*, 2014). Thus, policies have been a necessary and forceful means to achieve the inclusion of Renewable Sources to achieve considerable energy savings (Agency, 2016) (Budes *et al.*, 2017). Biomass is the third largest source of primary energy in the world, classified alongside coal and oil (Bapat, D.W., Kulkarni, S.V., Bhandarkar, 1997), biomass is the main source of energy for almost half of the world's population and accounts for 14% of the world's annual energy consumption (Werther *et al.*, 2000). Biomass sources can transform to solid, liquid, and gas, and biomass energy (bioenergy) obtained from these sources can be utilized in transportation, heating, and electricity generation (Akorede *et al.,* 2012). China, for example, implements policies and strategies related to the use of Densified Biomass Fuel during five years, which are implemented in large and medium-size companies seeking viable solutions to energy problems. (Shan *et al.*, 2016). China and India are, among the few emerging countries, that are increasingly using biomass energy together with other renewable resources to expand the supply of electricity to meet a demand that will grow at a high rate over the next two decades (Agency, 2007).
Politically, some Asian statutes contain some countries involved such as Japan, China, and South Korea, which have already adopted joint combustion technologies. Biomass production and trading have also

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increased in the countries where new investors are becoming more interested in investing in biomass co-firing (Asian, 2013). Also, the total installed electricity generation capacity in India is 2,666.64 GW in 2013 where renewable energy contributed 10.5% of the total energy generation of which 12.83% is to being generated from biomass. (Kishore VVN *et al.,* 2004), This country together with Indonesia is privileged with abundant potential biomass resources, 23 GW and 50 GW equivalents respectively.

The focus for amount is on energy conservation and the reduction, of dependence on oil, increasing the amount of energy from non-renewable sources (coal and gas) and from renewable sources, electrification of rural areas (90% of the population in 2020), better appropriation of subsidies and attracting more investment by creating favourable conditions. While, on the demand side, the objective is based on better pricing mechanisms, more focused grants and with a better reduction comes, stimulating competitiveness between different energy sources based on the principles of diversification and energy efficiency. However, both countries (China-Indonesia) harvest small proportions, with fundamentally different policies deployed and strategies articulated, allowing the policies of both countries to progressively restructured (Government & India., 2010). Colombia's strength is based on the generation of biomass energy; this country has installed power capacity composed of 64% by large hydroelectric plants and 36% by thermoelectric plants based on coal, gas and other fuels (UPME, 2017).

The main contribution of this work is based on a bibliographic review of the official national documents and studies related to the policies of countries such as China, Colombia, India, and Indonesia, allowing the analysis and recognition of opportunities for the inclusion of these policies.

2. Methodology

The governmental entities of the different countries highlight the benefits of bioenergy, therefore it is necessary to create laws that allow the development of different forms of generation, encouraging the different societies to use biogeneration, among its benefits are, firstly, the important connection between the production/consumption of biomass and economic growth and the relationship between biomass and CO2 emissions, bioenergy could be the most outstanding renewable energy source today and in the future in terms of its technical and economic feasibility (Bhattacharya SC *et al.,* 2003).

Biomass sources can provide countries with less required energy imports from oil exporter countries which do not have political stability (McCarl BA and Maung T, 2010), bioenergy can increase employment in rural areas, may advance agricultural economy, and, so, might be able to reduce poverty in developing countries (Demirbas MF and Balat M, 2009) among others. The methodology has been base in explain the fundamentals of creating regulation in general, related to the study of the topic, mentioning timely literature base.

China. Laws can be divided into primary law and support statutes for a first year, with the former being the guiding role and the latter being the supporting role. Biomass power generation developments cite from planning, and the rules and regulations support these goals, this activity to realize for de Second Year. In China, there are first laws, support laws, plan, and purpose, created in the plans of the four and five years. All of this linked to the Chinese Legislation, which standardizes in industrial orientation the form of energy generation by biomass source, the previous interconnected as shown in Figure 1.

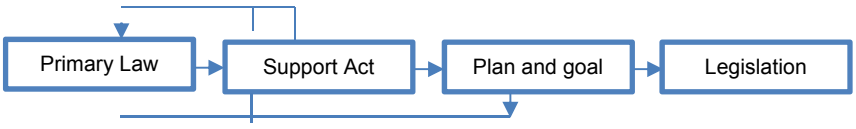

Figure 1. China legislative process

Colombia. Renewable energies in Colombia have an explicit legal framework for liquid fuels, but not for the generation of electricity, however, for electricity generation in Colombia, there are general rules such as laws 142 and 143 of 1994, regulations applicable to transmission, distribution and commercialization activities, governed by technological neutrality to benefit end-users. Also, Law 697, on the Rational Use of Energy USE, defines as its national purpose to advance the use of small-scale renewable sources and, mainly, supports necessary and applied research to reduce costs and expand the capacity of energies such as wind, solar, geothermal and biomass; this law would exempt from income tax sales of power from renewable sources, for fifteen years, if the certificates of reduction of carbon emissions provided for in the Kyoto Protocol is obtained, which generate income for contractors. The government entities that issue these laws are shown in Table 1.

Table 1. Electricity Sector Insitutions – Colombia

Function	Entity
Address	Presidency of the Republic and Ministry of ance
Sectoral Policy	Ministry of Mines and Energy, National Planning Department and Ministry of Finance
Legislation	Congress of the Republic
planning	UPME and CAPT
regulation	CREG
Transaction and market	CND CNO ASIC CAC
Control and surveillance	Superintendency of Public Services

Where related, UPME: Energy Mining Planning Unit, CREG: Energy and Gas Regulatory Commission, CAPT: Transmission Advisory Committee, CND: National Dispatch Center, CNO: National Operations Council, CAC: Commercialization Advisory Committee, ASIC: Administration of the Commercial Exchanges System.
Source: CREG-2016

Indonesia. The process of evolution of the Bioenergy policy is consolidated in the Bakoren Ministerial Energy Coordination Board, Under the chairmanship of the Minister of Mines and Energy, Bakoren was assigned the task of formulating general energy policy guidelines. At the microeconomic level, the Committee formulated implementation campaigns and took other measures to promote the energy efficiency programme. After devoting a decade to the gradual evolution of energy policy, environmental aspects were introduced into the policy-making process. Compared to energy policy in the 1980s, the system in the 1990s had a broader scope of application; this shows that system during the 1980s and 1990s developed from a specific level to the macro-level orientation, with incremental change. Also, after 2000, when the Ministry of Mines and Energy was reformed as the Ministry of Energy and Mineral Resources (ESDM), Indonesia focuses its efforts on the country's economic equilibrium, emphasizing the supply and demand of its inhabitants.

India. At statute level, they develop from the 1990s onwards. However, a piecemeal policy approach shift to a staged leapfrogging approach with a decision in 1992, bioenergy policy in India during the 1980s focused on different scales of technology, from small to large. Each scale had various purposes, from a generation and cogeneration perspective, the path for the biomass sector along with the other renewable energy sectors to achieve strong institutional support regarding financing, known as fiscal incentives. This institutionalization process impacted upon the foundation of the Bureau of Energy Efficiency (BEE) through the Energy Conservation Act passed by the Indian Parliament in 2001. This law was formulated to provide a legal framework, regulatory mechanisms and institutional arrangements in the central and state government to promote energy efficiency in the country. This step is an essential part of consolidating the foundations for the future formulation of the country's energy policy (Government of India & India., 2010).

3. Results and Discussions

China. The legislative system as shown in Figure 1 is composed in an integrated form as shown in Table 2.

Table 2. Integrated China Legal System

Chinese Legal System (Legislation-Energetic)	
Law	**Year-Article**
Electricity Law	April 1996, Article 5 - The State encourages and supports the use of renewable energy and clean energy generation.
Energy Saving Law	Implemented in 1998 and revised in 2007, Article 7 - The State encourages and supports the development and use of new and renewable energies.
Economic Promotion Law Circular Letter	Implemented 2009, Article 23 - if conditions permit, the region must make full use of renewable energy.
Renewable Energy Law	Implemented in Jan 2006 and revised in December 2009, determines the legal status of renewable energy in China.
Power Generation Law	From 1 July 2010, the rate of generation of agricultural and forestry biomass energy is increased and adjusted, to 0.75 yuan/kWh.

The Renewable Energy Law was enacted in China in 2005 to support the development of renewable energy, including biomass energy. In 2007, the law came into effect and was enforced as a framework for renewable energy development strategies; it aimed to increase the domestic energy supply, optimize the internal energy-consumption structure, and realize a continuous and sustainable economic and societal development. In 2009, the Ministry of Finance enabled the policy entitled the Provisional Procedures for Management of the Subsidiary Fund for Energy Utilization of Straw (China, 2010).

Colombia. As a fundamental step, forward to implement the policy of promoting the use of non-conventional energies, the National Government approved Law 1715 of May 13, 2014 (Renewable Energies Law) that defined the normative framework to encourage non-conventional powers to promote and promote their use in Colombia, where 70% of the energy produced comes from hydropower, and thermoelectric are the only support (UPME, 2017). This law aims to promote the development and use of non-conventional energy sources, mainly those of a renewable nature, in the Colombian national energy system through their integration into the electricity market, their participation in non-interconnected areas and other energy use as a necessary means for sustainable economic development, the reduction of greenhouse gas emissions and the security of energy supply. The current panorama of those incentives that favor the use of alternative energies in the country is uncertain since Law 1715 of 2014 indicated that the Ministry of Mines and Energy was responsible for regulating the issue and to date, this has not been possible, which is why investments stop. Incidentally, it is worth noting what has been pointed out by some authors in the sense that there is a generalized perception that the current regulations for the energy market. Colombia does not allow the development of generation projects with alternative energy sources" (Chain et al., 2009). The government in 2014, fulfilled its part of providing better opportunities for cogeneration plants (Valencia, et al., 2017), allowing them to sell the surplus produced to the market if their source is renewable, albeit at a stock exchange price.
In Colombia, there is a possibility of making this sale without distinction on the technology used according to Law 1215 of July 16, 2008, but adjustments in energy and regulatory policy are still lacking, because the Law provides an incentive of a tax nature, but additional change required in the structure that generates the expansion of the system. An essential aspect of Law 1215 of 2008 is that it allows any citizen who wishes to become an active participant in the supply of electricity generation on a small and medium scale. Contrary to the progress, made in recent years, the country has come to consider the CREG proposal, made through Circular 089 Document CREG 077 of 2014.

Indonesia. Biomass energy policy in Indonesia follows Presidential Regulation no. 5/2006 on National Energy Policy as the basis for biomass energy development is shown in Table 3. It set the targets for an optimal energy mix in 2025, where renewables contribute more than 15% of the total energy mix. It has 5% biofuel, 5% other renewables, including a different type of biomass energy, nuclear, micro-hydro, solar, and wind, and 5% geothermal energy (Annual report 2013–14, 2013).

Table 3. Evolution of policies related to biomass energy in Indonesia during 2010–2004

Decree	Legal objective
Ministerial Regulation no. 2 on Medium Scale Power Generation from Renewable Energy Sources, 2006	To extend the same price guidelines as Ministerial Decree no. 1122/2002 for projects from 1MW to 10MW
Presidential Regulation no. Five on National Energy Policy, 2006	To set energy diversification targets for 2025; including 5% biofuel, and 5% geothermal and other renewables such as biomass. To set an energy conservation target of reducing energy intensity by 1% for year
Government Rule no. Three on Supply of Electricity, 2005	To supports Law no. 15/1985 on electricity, which to reenacted in late 2005 following a Constitutional Court ruling that annulled Law no. 20/2002 on heat. To regulate the partnership between independent power producers (IPPs) partnered with PLN to develop electricity projects.
Ministerial Decree no. 02 on Green Energy Policy, 2004	To utilize energy technology efficiently, both from renewable and non-renewable energy. To increase public awareness of energy efficiency.

India. The Government of India carries out various energy sector planning and policies. Given that sustainable development is the world's principal objective, therefore, renewable energy resources are being considered for energy generation. New and Renewable Energy Ministry of India has developed many energy conversion projects and policies to promote the adoption of these methodologies through various subsidies and incentive. Biomass energy conversion to considering Subsidy for generation based projects, Subsidy for the cogeneration based project and Central financial assistance and fiscal. Subsidy for generation based projects, the objective of this element is to increase the use of biomass energy technologies and environmentally sustainable cogeneration projects found in the country and to improve the supply of electricity through renewable energy sources, additionally subsidy for cogeneration based plans to meet captive energy and thermal energy requirements. The implementation of cogeneration biomass projects together with its legislative system should promote in the industry, with at least 50% of the defined fixed-use air power. Stipulation for surplus energy sold to the grid the use of non-conventional energy sources and conserve the use of fossil fuels such as natural gas, coal, and oil.

4. Conclusions

As a developing country, China has structured its political system at different legislative levels in construction for the different years, all aimed at generating employment and systematized structuring its policies for the use of energy generation, micro and macro levels of confirmation, systems start from the most punctual to the most global. Also, Colombia, due to its environmental problems caused by the massive use of non-renewable energies such as natural gas, oil, coal, among others, is generating significant concern for seeking different energy alternatives that are safe, reliable and clean to maintain the well-being of people and the environment. Because of the above, the essay refers to the cost-benefit relation that would bring for the country to discourage the use of these conventional energies, by opting for clean energies such as wind, solar, biomass, geothermal, among others. India for its part, several projects related to biomass energy generation are installed in several states of India to supply energy needs for biomass gasification, this country formulates plans as maximum projections at the regional level to include production, such as cogeneration entirely. Currently, the Government of India is relatively ambitious in policy formulation, regulation, institutional building, and mobilization of industry's interest in biomass; for example, by the liberal tax regime, easy land acquisition, and the compulsory purchasing power of biomass-based energy producers. However, what is experienced by and produced in India may not be the same with other developing countries. In Indonesia, the policy placed more emphasis on the use of biofuels.

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