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Debate entre a Vida Moderna e o Meio Ambiente

Cleiseano Emanuel da Silva Paniagua
(Organizador)

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APRESENTAÇÃO

O E-book: “Química: Discutindo a Vida Moderna e o Meio Ambiente” em seu volume I é composto por dezoito trabalhos científicos em forma de capítulos que buscam apresentar e promover a discussão em relação à busca por alternativas e soluções que visem ampliar o aproveitamento de matéria-prima de origem vegetal que são tratados como resíduos e até passivos ambientais. Neste sentido, a incorporação de materiais lignocelulósicos (rico em fibras, vitaminas e outros nutrientes) como matéria-prima na composição de outros alimentos vem sendo cada vez mais investigado e aplicado tanto na nutrição animal quanto na humana. Além disso, a biomassa vegetal vem sendo estudada para: (*i*) produção de materiais e utensílios com propriedades semelhantes às encontradas em matérias-primas virgens provenientes de fontes não renováveis e que causam grandes impactos ao ambiente tanto em sua extração quanto no descarte após sua utilização; (*ii*) produção de combustíveis oriundos de fontes renováveis e que causam menor impacto ao meio ambiente; (*iii*) materiais com alta capacidade de remoção de poluentes presentes em diferentes matrizes aquosas e com enorme potencial para serem utilizados tanto em substituição quanto na complementação de etapas convencionais de tratamento de água e esgoto.

Neste contexto a busca por novos materiais; tecnologias que proporcionam maior rapidez, menor consomem de reagentes, reaproveitamento de materiais, solventes menos tóxicos e produzidos a partir de fontes renováveis vêm ganhando cada vez mais espaço e se constituindo na chamada Química Verde.

No entanto, apesar de todos os esforços que vem sendo feitos nos diferentes setores da industria, pesquisa e tecnologia na busca por processos ecologicamente mais corretos e sustentáveis, o estilo de vida da população fundamentado no consumo além da necessidade vem ocasionando inúmeros impactos ambientais tanto a biota aquática quanto aos diferentes ecossistemas do planeta Terra, tendo nos recursos hídricos o principal meio de propagação de substâncias provenientes de inúmeras fontes, em especial pelo sistema de saneamento básico e pela aplicação de pesticidas nas atividades agropecuárias.

Neste contexto, inúmeras técnicas de detecção e quantificação em escala traço (ng a μg L^{-1}) vem se destacando pela miniaturização ou capacidade de detectar e quantificar inúmeras classes de compostos (resíduos de fármacos, pesticidas, drogas ilícitas, hormônios, dentre outros) que se constituem em uma classe de substâncias na qual não se conhece os possíveis efeitos deletérios a médio e longo prazo para a saúde humana e do ambiente.

Com o intuito de colaborar tanto na divulgação quanto na disseminação de novos conhecimentos, a Atena Editora organiza e publica trabalhos de alta relevância, disponibilizando de forma gratuita em diferentes plataformas de busca e pesquisa.

Cleiseano Emanuel da Silva Paniagua

SUMÁRIO

CAPÍTULO 6

RESTRAINTS ANALYSIS FOR THE RENEWABLE ENERGY EXPANSION IN BRAZIL SENSITIVE BIOMES FROM THE IRP PERSPECTIVE

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ABSTRACT: Energy planning focused on distributed supply and demand resources pursuing a Low Carbon Economy could allow a faster and more intense integration of modern renewable energy sources - RES in sensitive biomes areas. The State of Mato Grosso constitutes the Geodesic Center of South America, and is the only region in Brazil that contains three sensitive biomes in its territory: The Wetland (Pantanal Mato-grossense), the Brazil Central Plateau Savannah, and the Amazon Rainforest. RES expansion in these regions is very critical and must be guided by actions and necessary decision making that make the appropriate use of the potential of energy resources compatible, considering an efficient electricity supply to society with a reduced impact on the environment. Environmental restrictions, the renewable sources prices, the competition with other energy costs, interest rates for investments, the technical limitations of distribution networks regarding the penetration of stochastic sources, regional infrastructure and counties poorer are factors that will only be overcome with planning and effective public policies. This paper discusses these restraints and barriers to the development of new sources of renewable energy, particularly biomass from wood residues and solar photovoltaic, available in the three biomes. As a way of helping to understand the difficulties that can slow or interrupt the energy transition in these regions, proposals for solutions are evaluated through the guidelines of the IRP, which is an approach that allow the integration of strategies for production, transmission, distribution, energy use and the production, distribution and water usage in the river basins scope. In this context, the primary products from IRP include goals and/or projects economically feasible and of "low regulatory risk" of hydropower and thermoelectric plants and new RES, in addition to considering environmental policies. By identifying these factors as strategic points for the transition energy, the work signals priority mechanisms, compatible with the national guidelines, which can guide the actions to the generation and proper use of its energy resources. In this context, government and private initiatives aimed at the public interest are essential for the balanced development of a renewable energy market in these regions. This paper shows that Integrated Energy and Water

Resources Planning can be the key to these questions.
KEYWORDS: Renewable Energy, Energy Planning, Sensitive Biomes, Low Carbon Economy, Brazil Biomes.

1 | INTRODUCTION

Energy planning in the past decades has been mostly directed at just the least cost supply of the growing demand for energy and has depended heavily on resources availability and policies set up by central government. It has also shown little articulation among energy sectors and little concern with environmental and social issues. Nowadays, new, comprehensive, ways to manage these issues are sought for, requiring an integrated resources planning, which should include energy and water resources, directed to promote welfare and life quality for the citizens. There are some key elements which should be harmonized so that sustainability goals can be achieved through Integrated Resources Planning– IRP: (i) Increase in the energy and water supplies in the amounts required to meet human needs; (ii) Adoption of energy and water saving measures, so as to minimize the waste of primary resources; (ii) Recognition of the risks, in terms of public health, that are inherent to the conversion and use of energy sources and water and sewage usage; (iv) Protection of the biosphere and mitigation of local forms of pollution.

Within this perspective, the IRP approach currently proposes energy and water resources integrated management, both at a regional, or “macro”, level, involving, for instance, river basins, and at a “micro” level, concerning, for instance, industrial, or rural production enterprises. In the “macro” level, besides the traditional concern with supplying the energy and water demands, there are important roles for the electricity distributed generation, for the end-use efficiency of different technologies and for the identification, evaluation and mitigation of the environmental impacts resulting from energy and water usages.

The Central Savannah Brazil region presents high energy potential, but yet little known under the technical and economic points of view, more detailed studies are needed that will be useful for the understanding, analysis and prospection of new renewable sources and which may compete and integrate the energy system of this region and the National Interconnected System. Among the several sources, photovoltaic solar energy and biomass-based on forestry residues represent good alternatives for achieving the Low Carbon Economy goals, considering the IRP guidelines.

These regions are characterized for producing primary energy source only renewable, but, for the most part, hydraulic (37.0%). The matrix rest is constituted by the sugar cane products, with 40.0%, other sources (waste wood, rice husk, biodiesel, solar photovoltaics, biogas from agriculture and animal source), with 17.0% and firewood, with 6.0%. Particularly, the other sources, except biodiesel, not contribute, currently with more than 5% on regional

energy matrix. Ascendant in the electricity production the Savannah and Amazon Rainforest regions provided a growth in electricity consumption of 5.0% per year over the past decade, notably by the residential sector. Other secondary energy is the ethanol that represents 27% of secondary energy total production. However, the three regions remain dependent on petroleum products such as Diesel oil, among them, leads the consumption with 79.0%.

According to (ANEEL, 2018) data, electricity generation initiatives for solar source make up, today, 1269 enterprises in all sectors of the economy, totaling an installed capacity of 19.9 MW between DG and centralized plants, with tendency to significant increase. The sources from forestry residues reach a 67.0 MW installed capacity across the Amazon Rainforest, North of Mato Grosso, with nine plants currently operating.

A great advance in the regional energy matrix occurs through the countless opportunities that exist in the Savannah and Rainforest territory in terms of energy potential and that, if explored consciously and with advantageous planning; you can bring greater benefits and balance to the supply and demand. Examples of the biomass energy potential – mainly wastes from forest and agriculture activities, and the solar resource for photovoltaic and low temperature use, whose radiation is about twice the average intensity of Europe. Energy demand is characterized by increased use of renewable sources derived from biomass, cases of sugarcane bagasse, firewood and charcoal, among others. Between 2007 and 2017, the share of renewable sources increased at rates of 39.5% p.y. Regarding liquid biofuels, the region of the Savannah and close to the Wetland produce ethanol from sugarcane and corn, in addition to Biodiesel, accounting for 4.5% and 23.0%, respectively, of the national production, with significant potential for expansion.

From the IRP perspective, energy expansion, with a transition that aim for the inclusion of new renewable sources, will be possible with measures benefiting the implementation of economic projects and very low environmental costs. Many initiatives of economic-financial-environmental solutions exist and should be improved and applied with greater intensity, benefiting the scale of projects involved.

2 | MATERIALS AND METHODS

The study and analysis were performed through a literature reviews, including all relevant available data and interviews with key stakeholders (including wood products factories - SME). For understanding public strategies and policies the number of main ongoing initiatives identified was evaluated; as well as: Existing technical bottlenecks, limitations, insufficiency, and observed failures.

The restraints analysis was carried out based on: limitations, barriers and development prospects, subsidies barriers and competition with other sources and support measures for the renewable energy expansion in these regions, especially how the IRP guidelines can contribute to the sustainable expansion of these renewable energies in the long run.

In this proposal for river basins, methodological proposal by Dorileo (2009), the IRP approach, besides conducting analyses of risks and uncertainties as comprehensive as possible, also considers, in the feasibility studies of new power plants, the water resources plans of the basins in which the plants will be located, and not only the plants projects. This new type of planning expands the water resources plans, mandated in the Brazilian legislation, including energy resources in them, particularly electricity and natural gas (Dorileo, I. L.; Bajay, S. V. ; Jannuzzi, 2009). This approach is applied in this study, with analysis of barriers, restrictions and proposed solutions for implementing new renewable energy sources in sensitive environments.

3 | RESULTS AND DISCUSSIONS

3.1 RES Potential's Synthesis in the Three Biomes

The three biomes considered (Figure 1) have a strong hydro energy vocation that, currently, together with sugarcane products, determine a context in which the new renewable sources are not adequately known, explored, competitive and have a low market share.

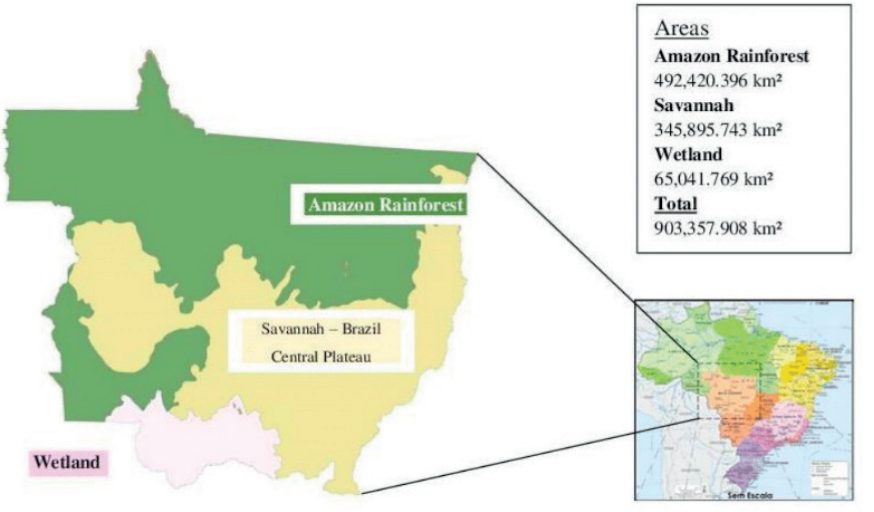

Figure 1. Three biomes partition in the Mato Grosso territory in Central Brazil, Geodesic Center of South America.

Source: Prepared using data from (Secretaria de Estado de Infraestrutura e Logística de Mato Grosso - Sinfra, 2017).

The existing energy resources are distributed in the Mato Grosso territory in the form of hydro, biomass, and solar energy. It should be considered that its production exploration

and expansion must privilege the characteristics of the sources, local interests, and regional development plans, as well as the implementation of strategies that increase decentralized sources and more environmental benefits.

In case of the energy biomass production, the wood producing regions in the Amazon Rainforest, large volumes of forest residues are deposited in the open, without final destination, for reasons of nescience, lack of incentive programs and development of best practices, both for heat or electricity production drives.

In the study of the wood residues potential to promote the energy use of woody biomass for electrical generation, the technical potential can be fully implemented given the capacity of using the available resources.

However, the implementation of this potential, from an economic point of view, or that of cost-effective, will depend, among others, on environmental factors, with management in legal and authorized areas, on overcoming the infrastructural, technical, financial, and logistical barriers. Table 1 presents a summary of the estimate of the energy potential of wood residues by biome.

Biome	Wood logs (m^3)	Woody forest waste (t)	Processing waste (t)	Electricity Generation (MWh)		Installed Capacity (MW)		
				Federal Public Forest	Private Forest	Federal Public Forest	Private Forest	Total
Amazon Rainforest	15,801,751	12,641,401	8,216,910	556,934	11,294,775	79.0	1,612	1,691
Savannah + Wetland	283,000	95,654	48,000	26,000		-		4.0

Table 1: Forestry waste potential's synthesis in legalized management areas in the three biomes.

Source: Prepared using data from (EPE, 2018a); (ONS, 2017).

The estimated photovoltaic potential (Niepe, 2019) for the three regions refers to the attainable market potential, which is the successful implementation of only part of the economic potential, taking into account only a realistic fraction of consumers. Figure 2 shows the attainable market potentials of the photovoltaic source for the three biomes, until the year 2050.

In this context, to take advantage of the energy potential, the technological options of RES that are more attractive from the environmental, economic, and social benefits standpoint should be privileged, compared with traditional supply options, especially those that exploit water resources in these three biomes. According (Filimonova, Provornaya, Komarova, Zemnukhova, & Mishenin, 2020) "economic growth is crucial in improving

production technologies and increasing the demand for the environment by the population, thereby contributing to the goals of sustainable development".

Thereby, the RES privilege over hydro energy lies in the consideration that the latter choose the minimum supply cost, while RES integrate a wider range of options including environmental costs, distributed generation opportunities, social and technology costs " cleaner".

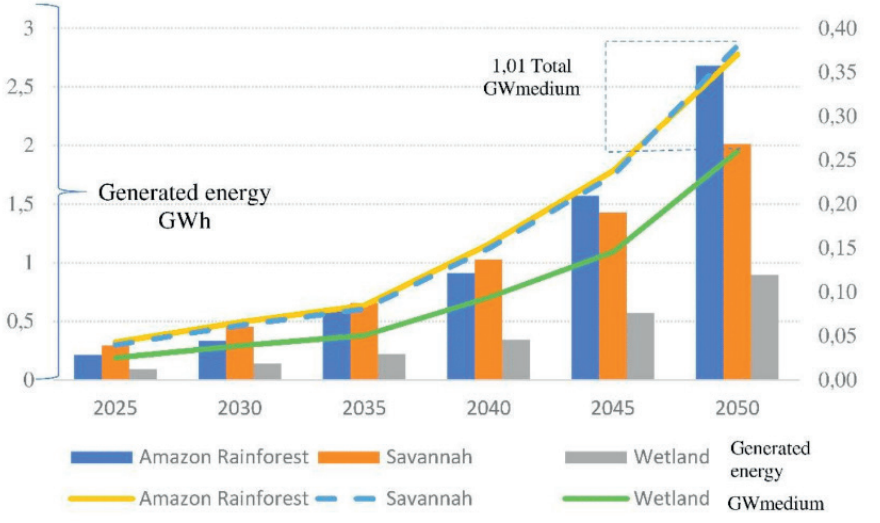

Figure 2. Achievable photovoltaic market potentials for the three biomes, by the year 2050.
Source: Prepared using data from (Niepe, 2019). Note: GWmedium in secondary axis.

3.2 RES Restraints, Barriers and Development Prospects

One of the biggest barriers to the public in the area of energy is the absence of the government in effective actions for the creation and promotion of incentive mechanisms and programs financing aimed at investments in renewable energy and energy efficiency. In this aspect, by not only financing lines, it is imperative to good quality in public intervention as responsible for determining the limits of actions that can to benefit all classes of consumers, without compromise the interests of the community or of the enterprises. Planning can formulate to support the application of public policies for this purpose.

Distinct biomes have divergent needs and different energy potentials to be explored. In this regard, energy policies must be implemented in a disparate way, taking into account these differences, promoting, in addition to competitive energy systems, social objectives, environmental protection and investments with greater sustainability. Furthermore, the role of renewable energies in sustainable development, among others, is remarkable in increasing

the economic development of the community (Razmjoo, Shirmohammadi, Davarpanah, & Pourfayaz, 2019). Some shortcomings are identified which constitute barriers and limitations to the full development of solar and renewable energy biomass-based in these regions as follows.

3.2.1 Subsidies barriers and competition with other sources

The competition, even if indirect with the hydraulic source, is a strong barrier and impact, through transaction costs – very high for RES -, on the decision to implement a photovoltaic or biomass-based generation project. The hydraulic potential exploration, with lower costs, occurs in all three regions and intensely in the Amazon Rainforest region, where the biomass is increasing its production. The competition between the hydraulic, photovoltaic and biomass sources are at different levels in relation to information and data registered in these regions, the investment and risk analyses, to the uses of areas of a possible implementation of hydropower projects, and updated potentials. It needs setting up an energy mix where every power will be developed rationally but with determination (Abada & Bouharkat, 2018).

Costs of solar and biomass sources, in most cases, are higher than those of conventional sources, whose current rules encourage them (Niepe, 2019). According to the National Electric Energy Agency (ANEEL), there are some difficulties for power generation from biomass of forest origin related to the following aspects:

I. CAPEX and Financing – higher investment cost in terms of R$/kW compared to conventional Diesel generation. With higher cost associated with the funding, the biomass generation incurs high cost of operation, although less than the Diesel generation and difficulty to prove ability to fuel supply.

II. Opportunity cost of current generators – the current generators agents can take advantage of the existing Diesel generation facilities, making it difficult to replace this source for generating to biomass of forest origin.

III. Implementation schedule – greater ease and speed in the implementation of Diesel generation in relation to generation from forest biomass.

PROINFA - Incentive Program for Alternative Sources of Electric Energy was created by the federal government through Law No. 10,438/2002 to increase the production of electricity by renewable wind sources, small hydropower plants and based on biomass. These generation projects must be carried out by agents that do not have corporate ties with electricity generation, transmission or distribution companies.

The difficulty to get financing on the part of government agencies, such as the National Bank for Economic and Social Development (BNDES), leads the private initiative to decide to invest for its own account in the implementation of production plants for self-consumption and sale of surplus energy to the public grid. However, the remuneration offered by the federal government program PROINFA serves as one of the factors to the

discourage entrepreneurship.

A barrier to investments that can be made in the installation of generation plants is the amortization period that is usually long. Another obstacle is the tariffs that do not reflect marginal costs and energy subsidies have values set by government agencies. These constraints persist with the lack of a regulatory framework that will allow to equate the problem of high generation costs, high taxes (sic), and the forms of financing offered (Soccol, Francisco Junior; Pereira, Adan Lucio; Celeste, Wanderley Cardoso; Coura, Daniel J. Custódio; Chaves, 2016).

Public acceptance - associated with the lack of knowledge and culture of unconventional sources (or new renewable sources) - constitutes another difficulty for the promotion of RES. There is a strong public power limitation on the use of diffusion mechanisms and incentives to these sources. According to research conducted by Market Analysis (Brazil, 2013); (Soccol, Francisco Junior; Pereira, Adan Lucio; Celeste, Wanderley Cardoso; Coura, Daniel J. Custódio; Chaves, 2016) to assess the Brazilian consumer perceptions in relation to the distributed microgeneration "(…) 71% of respondents claim to know little or nothing about the proposal of regulated microgeneration (...), indicating a great ignorance of the population". According to Soccol et. al (2016) the characteristic of those who know (28%) follows the pattern of upper class, high schooling and older.

3.2.2 Technical infrastructure and logistic barriers

Electricity grids expansion in forestry and wetland areas and its connection to power plants may present technical difficulties with electrical parameters and management. In case of photovoltaic plants distributed installation, there could be greater instability in the grid, with a view to the issue of sources intermittency, besides generating a high degree of complexity in procedures and execution of maintenance, safety measures and system planning.

Regions with availability of biomass feedstock are often far from the energy producing plants and/or these present difficulties to connect to grids of transmission or distribution. Many regions of the Legal Amazon Rainforest present very precarious road grid, preventing or hindering the adequate transportation of biomass to plants.

3.2.3 Regarding the transport capacity restrictions of woody biomass

The woody biomass production costs consist of harvesting and transportation costs. It is known that transport costs are not spatially explicit, but are shaped using cost functions constant elasticity transport at regional level which they approach the short-term availability of woody biomass in each region (Lauri, 2014).

Under these conditions, the volume variation in time changes the average costs of transport, which, in the long term, become more important. Thus, for Wetland and Amazon

Rainforest, where access and movement are still obstacles, the woody biomass supply less short-term variable becomes viable with the construction of forest roads destined for the transport of waste, according to studies of (Dykstra, D. R.; Binkley, 1987).

3.2.4 Barriers of technical training

Lack of technical training courses and programs of specific human resources directed to projects of photovoltaic and biomass sources, increasing the capacity to develop and accumulate “know-how”.

The diffusion of renewable sources raises the concern about the service quality offered in the entire supply chain of equipment and installation, and requires, necessarily, qualified technicians for the execution of tasks. The qualification minimizes human errors, reduces deadlines and rework in projects, installations and commissioning and decreases costs.

There is a shortage of skilled labor in Amazon Rainforest region and the issue makes it critical when it comes to installation, operation and maintenance within this region. The adaptation dilemma, integration with the location and the costs of recruitment, selection and hiring of employees are greater the more distant are the sources.

The permanent presence of technicians trained on regions to deploy, install, operate and perform maintenance of RES offer more reliability to the consumer, reducing operation and maintenance costs.

3.3 Absence of Local Technical Energy Resources Analysis

There are no local government agencies prepared to monitor and guide the regional energy planning. The performance of public committees and organs must accomplish these tasks, even if there are national MME guidelines through Energy Research Company - EPE. The characterization of resources and RES implementation in each of the three biomes have been made, mostly by the private sector, taking into account the geographical scope of interest. The attributes of supply resource analysis shall be conducted by the public entity when it comes to balance supply and demand of electricity. Each biome offers an insight of the resource differently, considering all the attributes (technical, environmental, geographic, socioeconomic, political, infrastructure), as there are different perspectives of its application and its use. If it is not like that, there are possibilities for inadequate allocation of resources, inappropriate technologies investment, high costs of externalities and generation, risk maximization, including project feasibility before authorities environmental, absence or low consumer participation.

3.4 The Lack of Regional Energy Planning

From the point of view of regional energy planning, and the balanced and homogeneous development among different biomes, feature selection of offer should give priority to local characteristics. Existing renewables attributes and demand scenarios should

consider, in addition to socioeconomic factors, usage habits, environmental preservation, social costs, full costs, energy efficiency and resource conservation.

The lack of knowledge about the adequacy of an energy resource to meet the needs of a region or a group of consumers is the lack result of precise evaluation of the repressed demands of each region. This evaluation should be carried out, as far as possible, at the level of end- use, thus avoiding waste and costly and unnecessary costs in the implantation of plants and networks. This is especially important in isolated regions of Wetland and Amazon Rainforest, away from the transmission and/or distribution, or with small networks or have a power shortage.

There is no concentration of efforts, so far, to implement an energy supply and demand that increases the participation, in the medium and long term, solar and biomass supply in the regions. There is a need to work with related plans to offer about the demand structure; to know in detail the consumer market characteristics (technologies, consumer habits, etc.) as the electrical system characteristics in operation and its prospects for expansion (Jannuzzi, G.M.; Swisher, 1997) in line with the plans of regional development. The RES expansion, properly implemented, responds to a strategy of increasing capacity on the demand growth that considers energy efficiency, decentralized sources and more environmental benefits (Jannuzzi, 2000).

Lack of development plans RES combined with water resources and environmental plans, considerably reducing conflicts and impacts. This means that it must focus on technological options of RES more attractive from an environmental point of view, economic, social benefits, compared with traditional offer options, especially those which exploit water resources in these three sensitive biomes. In this way, the privilege of RES on hydraulic sources in consideration of which the latter use for minimal cost of offer, while the RES is part of a wider range of options including environmental costs, social costs and “cleaner” technology. The difficulty lies in the lack of regional energy planning and regulation of incentives to drive the market towards the renewable energy technologies more efficient and less polluting.

The current model of electric power auctions in Brazil presents process improvements to meet the term demand and future market, but not sufficient to establish the importance of feasible timelines that create conditions of competition for the renewable sources. This includes a schedule compatible with the volume of services and works required for the implementation and operation of enterprises: rights, licenses, authorizations, projects, studies, drawings, plants and documents, books and tax registrations, in addition to material assets, land, logistics studies, equipment, civil buildings and other facilities, which constitute a substantial part of the collection necessary and/or appropriate to the enterprise deployment (EPE, 2018b).

3.5 Difficulties in Obtaining Data on Energy Resources

One of the factors that contributes to low insertion of renewable sources, notably biomass -based on forestry residues, is related to the absence of potential data, offer of supplies and studies relating to socio-economic and environmental impacts and concerning interference with anthropic activities, and a good energy planning regionalized. In this area, there are no answers from the Government as to whether the spatial concentration of economic activity or resource use is sustainable because of local differences, resources existence, symmetries, of interactions between economies, the transport, mobility, environment treatment, exploitation and consumption of resources, policies etc.(Dorileo, 2009).

3.6 Cost Implications of Energy Sources in These Areas

For photovoltaic systems, there are still no business models, from electricity companies or leasing companies, in which companies renting equipment or offer financing with reduced rates for those who do not have economic conditions of afford the expensive costs of installation and project corresponding to the high initial investments. Added to this limitation is the fact that the consumer bears all the costs of connection to the electricity grid.

For the photovoltaic source, the current subsidy system is perverse: smaller consumers with lower incomes tend to subsidize larger consumers. Given the cost of installing solar panels, those with higher purchasing power can install the solar plate on the roof and generate their own energy. Those who do not have the purchasing capacity to buy these panels continue to buy power from the distributor and pay the subsidies included in the tariff. The current arrangement is unsustainable (Brazil, 2017).

- Sales of surplus power from photovoltaic sources (intermittent) may involve regulatory risks if there are government incentives. While there are some tools to manage surplus production (for example, inverters, storage or consumption management), this usually involves a degree of demand (commercial) risk, as this renewable energy source (solar) remains variable.

The spread of distributed generation incurs increased operating costs and the need for new investments in electrical systems, due to the complexity introduced – to the system dynamic equilibrium, pre-established levels quality maintenance (voltage and frequency) and reliability of supply, which will lead to a reduction of revenue. In order to mitigate the complexities of planning and electrical system operation in these areas, also due to the significant increase in connections to the network with distributed generation units, it is necessary to define public policies that favor obtaining financing and make the current regulation flexibly, in order to offer consistency the electricity companies activities in the new scenario (Brazil, 2017).

The electricity connection and charging system for producer-consumers is being reformed in Brazil.

The lack of clear policies in this area can cause problems due to the increase in DG facilities. The distributors' capacity factor can be reduced, if no economic policy is suggested, with a possible increase in the average price of electric energy supply, compensating for deficits in the generators, transmitters, and distributors accounts, affected by the increase in the number of micro generations.

In addition, the volatility of electricity generation from photovoltaic plants causes uncertainty in prices and adds new risks to the energy market, although it reduces cost due to low marginal costs of operation these sources (CPFL, 2015).

3.7 Standards and Labeling

The lack of performance establishment standards and labeling is determinant for the non-penetration of efficient equipment and services in the market. This prevents a more assertive decision-maker of investors who make the investment in a particular technology when the international market already has a high penetration curve.

In isolated regions, where the exploitation of wood, typically the population biggest part has modest life and can't afford the real costs of energy tariff produced by alternative sources, yet. Possibly these sources would receive or might require government subsidies to reverse this situation, increasing the values transacted in the electric sector in terms of tariff charges.

3.8 Support Measures for the Renewable Energy Expansion from the Integrated Resources Planning by River Basins Perspective

One of the ways to ensure the generation, transmission and distribution of energy expansion, articulate with the energy policies of various aspects, including energy efficiency, with the sector policies of development and environment, water resources and the system of regulation and social control through the implementation of a model of Integrated Resources Planning - IRP by river basins (Dorileo, 2009).

In this proposal for river basins, the IRP approach, besides conducting analyses of risks and uncertainties as comprehensive as possible, also considers, in the feasibility studies of new power plants, the water resources plans of the basins in which the plants will be located, and not only the plants projects. This new type of planning expands the water resources plans, mandatory in the Brazilian law, including energy resources in them, particularly electricity and natural gas (Dorileo, I. L.; Bajay, S. V. ; Jannuzzi, 2009). This Plan, when implemented, shall allow the analysis of the interferences in the usage of resources throughout time, shall determine the extension that the demand may reach in sustainable terms, and establish clear and consistent directions referring to the management of integrated resources involved in the energy and water supply in a river basin region.

From the perspectives of all stakeholders, IRP allows consumers, governments, institutions of production and commercialization of energy and water to define stable and coherent planning of the objectives, besides financing agents, industries associations,

commercial agents, agriculturist and cattle breeders, non-governmental organizations, associations and unions related to energy and water production and commercialization, entities and organizations that produce and/or render services to concessionaries and/or independent producers and pastoral entities. The model is sustained on the collective vision.

The federal Government has formulated energy policies in Brazil on a centralized basis, while the policies of water resources and the environment are being practiced in a decentralized way. This model has led to a series of problems and conflicts between these areas, notably in relation to large enterprises of hydropower plants. The IRP can respond to key issues of infrastructure through the search of the balance between the environment, the economic interests and the populations involved.

In a regional development scenario in which aims to integrate the Government has implemented social programs focused to structural policies, mainly in rural areas. In energy infrastructure works, the indicative planning cannot be limited to megaprojects, but must contemplate the small enterprises, taking into account the local needs of necessary infrastructure to energy production system, giving opportunity, particularly for small and medium-sized enterprises.

Thus, with the IRP guidelines, the means to guarantee the adequate RES development in the three regions incorporate measures that must take into account the intra-regional disparity and the sensitivity of the three biomes that make up the territory of Brazil Central territory according to the model of (Figure. 3).

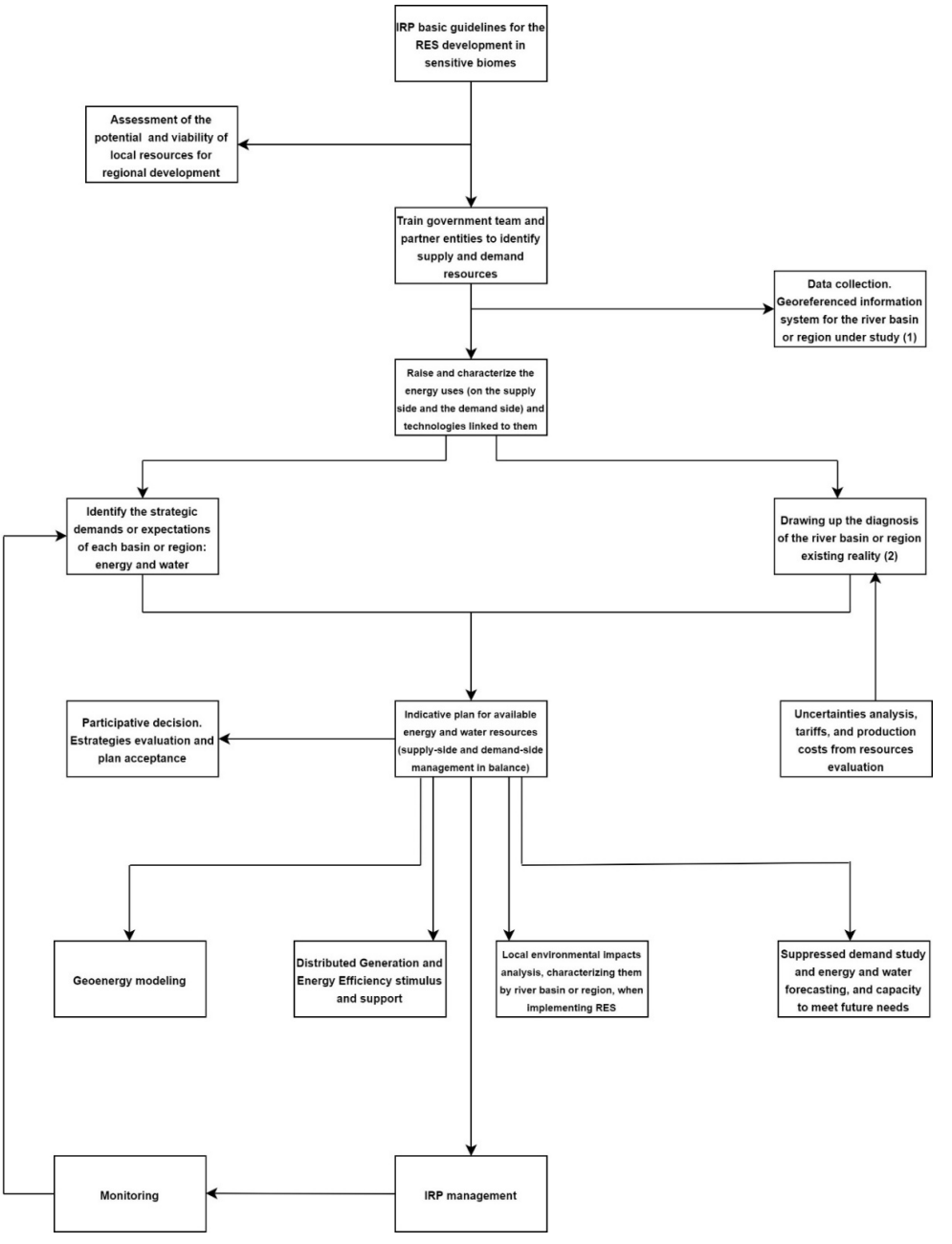

Figure 3. IRP flowchart model for RES development in sensitive biomes.

(1) Comprising economic, social, energy and non-energy, geographic, population, agricultural, environmental, water resources data, complementing the energy and water understanding of the region under analysis.

(2) To describe and clarifying the physical environment, the socio-economic aspects and the energy and water demand behavior and their evolution in time.

From the IRP perspective, public interventions are necessary for the viability and adoption of modern energy renewable sources and adequate use of potentials, Table 2.

On the supply side	On the demand side
i. Creation of funds to finance projects with biomass. The funds would be used to build new small and medium-sized plants and purchase machinery. ii. Priority funds, according to demand, for SMEs that produce forestry residues with difficulties to obtain financing due to lack of guarantee should be prioritized in specific programs for projects of independent production of electricity. iii. Promotion of a mandatory mechanism for the use of forestry residues as "greening" policy part of the energy matrix and the regional economy and as a reaction to the high carbon intensity in the three areas energy consumption mirrored in the demand for oil products. It is hoped, therefore, to reduce electricity costs in distant regions, due to the significant decrease of imported Diesel oil. iv. Encouraging the creation of small cooperatives of small producers of the wood chain, with the support of municipal governments, to join small and medium-low-cost projects with known and dominated technologies, establishing standard plants for the different regions, especially in those with low charge density. v. Establishment of partnership programs, with governmental promotion of research and development, among universities, the agriculture-forestry sector, energy companies, component producers, municipal governments, etc.), bringing together knowledge and skills that can identify the appropriate technologies and the its economic potential aiming at scale gains in the insertion of renewable sources. vi. There is a need for incentive programs that improve the sector performance in terms of technological innovation, that is, public policies that translate into investment in technology to reduce the cost of production, with the drop-in price per kWh, to make compared to the economies of competing sources scale, thus allowing a greater price competitiveness in the auctions of alternative energies. vii. Promotion of programs with teaching and training for human resources and the development of technologies and national industries essential to the operational continuity of the systems to be implemented.	i. To expand the energy base with new renewable sources, energy auctions must be structured so that there are no privileges between sources and offer prices that are commensurate with the costs of each technology. Projects that guarantee greater process efficiency in the generation of electric energy, using renewable energy, could be a way to reduce the cost per unit produced and thus guarantee the electricity supply. ii. The net-metering model established by ANEEL Resolution n° 482/2012 is the main policy to encourage the generation of distributed generation in the country. At the moment of insertion of the distributed generation in the energy matrix, the need to maintain the compensation incentive is also recognized for the share of the tariff corresponding to the costs of using the networks; in this situation the adoption of a more efficient system in which the compensation for the energy injected into the network occurred only in the portion of the tariff corresponding to the energy consumed, passing the consumers with micro or mini generation to bear the portion of the tariff corresponding to the use of the wire, would make investment in photovoltaic energy less attractive. With the gradual evolution of these sources, new policies on the remuneration of networks used by micro and mini generators and cross subsidies produced on consumers who did not invest in RES in the same concession area are required. iii. There is a need to review the charges taxes levied on electricity tariffs. iv. Official banks should create credit lines with more favorable financing conditions for the purchase of photovoltaic systems.

Table 2

Evaluation in the "On the supply side" and "On the demand side"

To achieve measures that favor the greater diffusion and insertion on RES in the three regions the intervention still includes:

i. Close cooperation between production and distribution energy electricity companies and the Government for the development of regulation and standards that make compatible the different technologies that use energy.

ii. Coordinated action of environmental partners, notably in the area of environmental licensing, energy, water resources and industry for joint technology initiatives, research and demonstration projects related to innovative technologies and their applications.

In addition to bringing together, in a permanent network, the city chambers belonging to each region or basin and the corresponding basin committee for conducting and maintaining programs at the local level, supporting and encouraging compliance with higher efficiency standards, voluntary initiatives, and full life-cycle monitoring of the incentive programs for renewable sources.

The natural effect is that this strategy allows the elaboration of an indicative planning by clusters of counties belonging to that geographic region, since the demand for goods and services by the citizen occurs at local levels, valuing the decentralized shape. It also provides for the overcoming of difficulties and insurmountable barriers of small and medium counties to achieve socioeconomic development, associating with larger ones, so that the sum of efforts and resources allows the complete organization of an institution to exercise of integrated planning activities with autonomy. The development of solar sources and biomass-based on forestry residues can be feasible, in each region, by economy sector, establishing realistic short-term goals and coordinated implementation strategies in regional level, by public and private efforts.

4 | CONCLUSION

In this paper, we accomplished a technical analysis of the restraints imposed on the modern renewable sources expansion, specifically, solar photovoltaic and based-biomass (from forestry residues) for three sensitive biomes existing in the Brazil Central Region, in the state of Mato Grosso, seeking to subsidize programs and public policies in this area associated with regional development measures.

Following a national trend, these three areas present a large attainable market potential for renewable energy sources and is increasing its supply of these sources, notably the photovoltaic, but still faces difficulties related to the costs of systems, financing and rates of interest and competitive prices with other sources, in addition to several technical bottlenecks in the electricity grids of their counties.

According to the analysis, the IRP guidelines can guarantee the adequate RES development in the three biomes incorporate measures that must take into account the intra-regional disparity and the sensitivity of the three regions. An important effect of the integrated resources planning for river basins is the institutional arrangement resulting

from the integration that may include in its design as the union of initiatives from several government levels which carry out or plan projects and programs for energy and water in the basin; and the integration of governmental goals with municipal policies and investments, creating compatibility requirements and co-relation bonds between them. All counties participate in energy integrated planning with water resources. This is particularly important in sensitive regions such as the Amazon Rainforest, in Mato Grosso northern portion, which is experiencing an increase in population, agricultural and industrial activities.

In order to accomplish this photovoltaic and based-biomass potential and implement them with, sustainability, an integrated resources planning is imperative, which, simultaneously with environmental planning, water resources and regional development plans, ensures the adapting of the development of renewable sources, considering the differences between biomes.

In these circumstances, what has been dealt with in this paper makes it clear that there is plenty of room for effective policies to increase the attractiveness of investments in this area – this is especially true for forest-based biomass-, and provide the necessary support for the integration of variable renewable energies into the electrical system.

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