

Sustainability Content in Brazilian Ethanol Planning

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Abstract

Biofuels have been expanding all over the world, one of the prominent experiences being sugarcane ethanol, considered to feature better economic, social and environmental results when compared to other commercial biofuels. In this research, we gauge to what extent Brazilian national energy planning embrace sustainability thinking when framing ethanol strategies by focusing on the content and role of the social and environmental analysis included in Decennial Energy Plans. Those plans have been annually published since 2007, presenting supply and demand studies for electricity, oil, gas and biofuels and including a socio-environmental analysis. The review showed the role of such analysis is limited to listing some consequences of sugarcane ethanol expansion. The complexity and the trade-offs of the projected expansion are not addressed. Scope is variable in the plans, impact analysis is featured in little detail and not always explicit in terms of the potential benefits or threats. To advance towards a sustainability assessment approach, (i) scoping should select and analyze in detail a number of issues for ethanol sustainability especially land use change, water consumption and pre-harvest burning; and (ii) analysis should indicate possible limits to be observed in sugarcane expansion and provide for explicit trade-offs consideration. By doing this, the analysis would be able to support defining actions to avoid, reduce, or compensate adverse impacts and enhance potential benefits. Energy planning could offer better contributions to sustainability if socio-environmental analysis advances in content, provides in-depth analysis and indicates thresholds and trade-offs, evolving from a list of consequences to outlining action plans.

Keywords: energy planning, sustainability assessment, policy impact assessment

1 Introduction

Energy is one of the most critical aspects of any blueprint to a more sustainable future, and the current world energy matrix, largely based on fossil fuels, requires a major shift to cleaner and renewable sources (IPCC, 2013; UN, 2014). The present share of fossil fuel in the global energy mix is around 82%, essentially unchanged from the situation 25 years ago (IEA, 2013).

Among the efforts to increase the participation of renewables, many countries adopted policies to incentivize biofuels production (Sorda, Banse and Kemfert, 2010). Brazil pioneered energy policies aimed at reducing dependency on fossil fuels by launching, in the 1970s, the *Proalcool* program aimed at adding ethanol to gasoline. Although its major driver was economic – due the oil shocks of that decade – a lasting contribution was a meaningful increase in the share of renewable fuels in the country (Goldemberg, 2007; Szmrecsányi and Moreira, 1991).

In the 2000s ethanol production soared, driven both by market forces and government policies. Praised as a renewable energy source, vast sugarcane plantations expanded over southeastern and central Brazil, raising an array of concerns ranging from potential threats to food security to displacing other land uses that could encroach over the Amazon forest. Hence, ethanol policies are an interesting subject for studying the environmental and social impacts of public policies.

In this research, we gauge to what extent Brazilian national energy planning embrace sustainability thinking when framing ethanol strategies by focusing on the content and role of the social and environmental analysis included in Decennial Energy Plans. The plans include a so called socio-environmental analysis and were reviewed for their contents in sustainability.

2 A brief on energy planning in Brazil

In many countries, including Brazil, energy planning is developed by public agencies to be implemented by private companies, with governments playing the role of regulator in a competitive market (Leite, 2009; Pollitt, 2012). This approach is called *indicative planning*, aiming at coordinating private and public investment and output plans through forecasts or targets (Nielsen, 2008). In Brazil, new regulatory agencies were created to implement this planning model, namely the National Agency for Electric Energy (ANEEL), in 1996 and the National Agency for Oil, Gas and Biofuels (ANP) in 1997. In 2004, a new energy planning unit was created within the Ministry of Mines and Energy, named EPE (*Empresa de Pesquisa Energética*).

EPE has been preparing long and medium term energy plans. The medium term plans are decennial plans, published annually since 2007, with one exception (2009), totaling six plans reviewed here (EPE, 2007, 2009, 2010, 2011, 2012, 2013b). Strategic Environmental Assessment (SEA) is not conducted alongside planning, but energy plans contain some elements of what is expected as SEA good practices (Partidário, 2012).

3 Results - The socio-environmental analysis

Socio-environmental analysis has been included in decennial plans since the first review (2008-17). Its objective for ethanol is broadly defined as the analysis of the social and environmental effects associated with the processing and use of the fuel. In the most recent plan (2013-24), it is stated that "socio-environmental studies (...) were guided by the concept of sustainability, buoyed by reducing the social and environmental impacts in expanding energy supply and by the climate change discussions at the national and international levels" (EPE, 2013, p. 15).

The plans address several issues at different levels of detail. Table 1 shows a general picture of themes included in the socio-environmental analysis with an indication of the level of detail in approaching them.

Water quality appears in the table despite not being addressed in the plans because it is a matter of concern reported in the literature. All other themes reflect current debate around ethanol in Brazil and are echoed in the literature. Food security, greenhouse gas (GHG) emissions, employment and water consumption have been addressed in recent plans. Other themes, such as family farming, agrochemicals and biodiversity do not appear consistently. The plans do not explain the reason for inclusion of issues.

Table 1 – Issues addressed in the decennial plans, from 2007-16 to 2013-22

Decennial Plan	1. Food Security	2. Family farming	3. Biodiversity	4. GHG emissions	5. Burning (part of air quality)	6. Employment	7. Work safety	8. Agrochemicals	9. Water consumption	10. Water quality	11. Wastes
2007-2016											
2008-2017		M			M		M		M		M
2010-2019	A	M	M	A		A	M		A		M
2011-2020	A	M	M	A		A			A		
2012-2021	A	M		A	M	A		M	M		M
2013-2022	A			A	M	A	M	M	M		M

Notes: (1) “M” means that the topic is mentioned in the plan, applied for issues that received only a short review in one or two paragraphs, based on general information about sugarcane or secondary data. “A” means analyzed, applied for issues that were addressed using projections, mathematical modeling or spatial analysis. (2) No plan was prepared for the period 2009-16.

There is also variation in methods adopted. For water use, after analyzing only average consumption per unit and probable total water consumption in the 2010-19 plan, in the following plan data on consumption are compared to regional availability.

Food security is one of the concerns when biofuels expansion is considered (FAO, 2010). The plans present maps predicting where sugarcane could replace pasture or other crops, although there is no mention of which crops could be replaced. The conclusion indicates availability of land for the predicted expansion with no harm for food security.

Beyond exploring some issues, the plans also present a section named “socio-environmental integrated analysis”, applied for electricity. By putting together all the predicted projects, it indicates environmental management priority issues that results from potential interactions among the projects. For sugarcane mills, included in this section due to their ability to supply bioelectricity for the national grid, the priority issue is air quality, an issue that is not even well explored in the socio-environmental analysis.

As for the influence of the socio-environmental analysis on the energy future scenarios suggested in the plans, we can notice that there is a target to be met regarding GHG emissions. As Brazil assumed voluntary targets in the 2009

United Nations Climate Change Conference of Parties in Copenhagen, if emissions resulting from the combined effect of all energy sources are not predicted to meet the targets, the mix of energy sources should be reviewed, as shown in Figure 1.

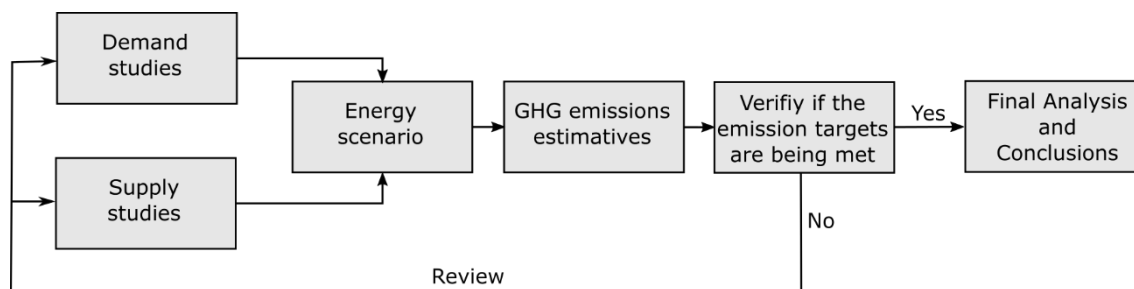


Figure 1 – Influence of GHG emissions in decennial plans, adapted from EPE (2013)

Other issues are explored aiming to clarify potential consequences, but mostly are superficially addressed, far from what would be required for supporting decision-making towards sustainability.

4 Discussion

The sustainability content of ethanol planning in decennial plans are discussed in terms of their comprehensiveness, deepness, and influence in the outcomes of the plans.

Regarding their scope, the socio-environmental analysis sections of the six decennial plans cover most impacts of sugarcane and ethanol referred to in the literature. When addressing food security, GHG emissions, employment and water consumption, decennial plans are indicating what was considered relevant, but without justifications for what was scoped out or addressed superficially. It is hard to identify any methodological evolution over the years, what has resulted in similar analysis in many plans.

GHG emissions is certainly a high priority topic in the sustainability agenda, and it is a positive result the current Brazilian energy planning is addressing targets for reducing emissions. Still, it cannot be the only sustainability goal of planning. A sustainability assessment would consider multiple objectives for ethanol planning and an array of alternatives for meeting them in order to enable multiple gains (Gibson *et al.*, 2005; Morrison-Saunders and Pope, 2013). But the issues must be analyzed ensuring “integrated attention to all of the key intertwined factors that affect our prospects for a desirable and durable future” (Gibson, 2012, p. 13).

To advance towards a sustainability assessment approach, it would be desirable to deepen the analysis for the most relevant issues for biofuels sustainability, also considering stakeholders opinion. The definition of the most relevant issues can evolve through planning cycles, given learning and knowledge acquired in previous processes. Additionally, documenting and justifying changes in successive plans is relevant both to provide greater transparency to the process and to enable organizational learning processes (Sánchez, 2012).

Additionally, the outcomes of socioenvironmental analysis requires discussions on what is acceptable or not, and transparency on the limits or thresholds adopted (Gibson *et al.*, 2005; Morrison-Saunders and Pope, 2013; Stoeglehner and Neugebauer, 2012). For example, when addressing water consumption the plans just indicate total consumption at the end of the decade would still be “very high” (estimates are not provided) and explore potential technological advances to reduce consumption, but do not indicate acceptable levels for water consumption. If the energy planning is not going to define desirable thresholds, at least integration with water management plans should be established.

Finally, the current “socio-environmental integrated analysis” is a challenging effort towards identifying interactions on the proposed energy projects. Decennial plans could proceed in this analysis including cumulative effects assessment procedures, which will also help to identify potential trade-offs and desirable management actions for dealing with them.

5 Conclusions

It was found that the energy plans are limited to listing some consequences of expanding ethanol production and do not address the complexity of a fast expansion of sugarcane crops. Scope is variable in the six plans; impact analysis is featured in little detail and not always explicit potential benefits or threats. To advance towards a sustainability assessment approach, the most relevant issues for ethanol sustainability should be addressed in more detail, while possible limits to sugarcane expansion should be discussed and considered as well as explicit consideration of trade-offs. Recommendations or, ideally, commitments from major government actors on actions to enhance, avoid, reduce or compensate for social and environmental impacts would be the outcome of a sustainability-oriented ethanol planning.

Expanding sugarcane ethanol, and still considering a sustainability agenda, will require more efforts in modernizing planning practices. Sustainability assessment can provide the conceptual framework and the tools to support the development of a strategy able to organize actions towards a more sustainable energy future.

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