ISC3 WHITE PAPER

ADVANCED BIOECONOMY AND BIOENERGY:
STRATEGIES FOR SUSTAINABLE DEVELOPMENT IN ECUADOR & URUGUAY

ISC3

Content

Advanced Bioeconomy and Bioenergy – Strategies for Sustainable Development in Ecuador & Uruguay

Executive Summary

This white paper deals with the question of how a circular bioeconomy can support the sustainable deployment and valorisation of biomass and waste, with the intention of addressing decision makers from policy and industry, as well as academia. The regional focus of the paper is on Ecuador and Uruguay, providing a brief overview of the status quo and main challenges. On this basis, country-specific measures and solutions, related to energy and material issues, are proposed.

Ecuador is characterised by a strong agricultural production and rich biodiversity, in parallel to funding derived from international cooperation for the expansion of its bioeconomy. However, investment and technical assistance are needed for product improvement at the producer level and there is a lack of governmental support for the development of biorefineries. Hence, it is essential to promote industrial symbiosis, expand the knowledge on bioeconomy, attract investors, and strengthen the collaboration between academic, industrial and public sectors on an organisational and funding level.

Uruguay's strengths lie in a strong political interest in residual biomass utilisation and the country's existing capabilities, while conversely, there is a lack of uniform technical knowledge. Additionally, regional measures for climate change, research on waste utilisation and collaboration between academic and productive sectors are required, as there is a firm belief that trade agreements, including international standards, should not only consider the economic dimension but should also address environmental and social aspects.

In both countries, the advantages of a regional approach compared to individual, national measures have been clearly recognised. Therefore, regional networking (institutional), systematic exchange of knowledge and experience (research and education), in addition to the use of common infrastructure is needed to leverage the potential towards a sustainable bioeconomy.

1 Introduction

The objective of this white paper is to identify and examine approaches towards a sustainable bioeconomy that can be effectively implemented in Ecuador and Uruguay. It aims to highlight best practices and outline the requirements for successful implementation at the national level. By providing policy makers, decision makers and scientists with insights from bioeconomy, this document facilitates informed decision-making and promotes the development of a sustainable bioeconomy in the region.

ACHIEVING A SUSTAINABLE BIOECONOMY

The challenges in transitioning to a sustainable bioeconomy are significant and raise the question of how to harness the region's vast biodiversity and natural resources to promote a bioeconomy that supports sustainable development? This implies a holistic view and follows the Do-No-Harm approach in order to satisfy human needs, while preserving natural resources for future generations, thus ensuring economic, social, and ecological balance.

GENERATING A MULTIDIMENSIONAL IMPACT

The shift to a bioeconomy generates profound impacts across multiple sectors. Economically, it can contribute to gross domestic product (GDP) by creating new markets and job opportunities in bio-based industries. Socially, it promises job creation and improved livelihoods, yet poses potential conflicts with food security if biomass production competes with agricultural land. Ecologically, it promotes the conservation of natural resources, reducing reliance on conventional agriculture which often involves monoculture and pesticide use, leading to biodiversity loss and water scarcity. Thus, bioeconomy assumes the role of key player in addressing global challenges, such as overpopulation, resource depletion, climate change and microplastic. More specifically, a sustainable bioeconomy offers the potential to replace fossil-sourced fuels and plastics with renewable biological resources, reduce carbon emissions and reduce energy dependency on fossil fuels.

STRUCTURE OF THIS PAPER

This white paper is based on the results of two virtual workshops, which were conducted with a multidisciplinary group in 2024. The *Background* provides a basic understanding of the concepts of bioeconomy and bioenergy. The *Problem Analysis* examines the current energy supply and key issues in Ecuador and Uruguay, highlighting technical, economic and social factors, while the section *Methodological Approach* describes the research methods applied during the workshops. The chapter *Results and Discussion* presents the findings of the analyses, suggests strategies and solutions, and weighs up their advantages and disadvantages. *Country-Specific Examples* highlights successful bioeconomy initiatives in Ecuador and Uruguay, and lastly, the *Conclusion* emphasises the added value of a bioeconomy and the potential for a circular approach to sustainability.

2 Background

The concept of bioeconomy refers to an economic system that utilises biological resources, processes, and principles to sustainably produce energy, materials, and chemicals, thereby reducing reliance on fossil fuels and minimising environmental impact. It follows the principles of circular economy, where renewable biological resources are efficiently used, promoting economic growth while contributing to environmental health and social well-being.

Beyond that, an advanced bioeconomy can be understood as an economic system that sustainably produces and converts biomass into high-value products, including food, feed, bioenergy, and bio-based products, while integrating innovative technologies to optimise resource efficiency, as demonstrated in Figure 1. It should be noted that while food and feed are understood as integral parts of bioeconomy, this white paper strongly focuses on energy and materials, all the while recognising that food and feed should not be affected since food security is of highest priority.

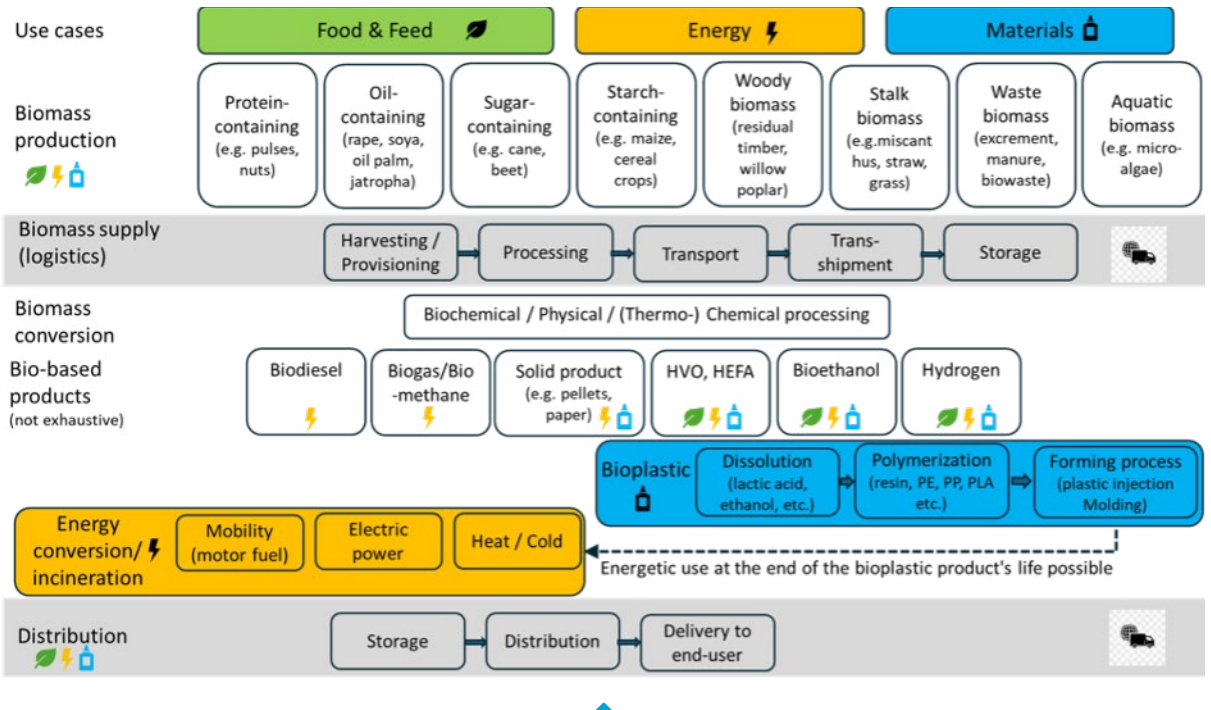


Figure 1: Bio-based use cases with a focus on energy and bioplastic applications. As illustrated by the dashed arrow, after use these bio-based materials often can be recycled or used for energy conversion or incineration. The diagram makes no claim to completeness.

2 Background

Bioeconomic innovations combine biological knowledge and advanced technological solutions and make it possible to develop new, resource-saving processes and products, thereby expanding and linking various supply chains. They harness the natural properties of biogenic raw materials (such as their recyclability, renewability, CO2 balance and adaptability) for the benefit of a sustainable economy. Policy makers therefore need to create a framework that fosters the development of national- and regional-enabling environments.[1]

[1] BMEL 2020

The decision as to whether a product, a process or a service is aligned with principles of bioeconomy depends on the biological resources used – from agriculture, forestry and marine settings, in fisheries and aquaculture, or microbial production. It needs to be considered that not only the crops themselves serve as input, but also biogenic residues and, preferably, waste materials. In addition to physical materials, bioeconomy requires a knowledge of technologies and fields for new applications.[2]

[2] Through the Global Start-upService ISC3 is supporting innovators, e. g. start-ups substituting leather, raw material for the production of paper and offer biodegradable alternatives for single-use plastic.

The enormous potential a bioeconomy has and the urgent need for a transformation have already been acknowledged around the world as more than 50 countries have adopted individual bioeconomy strategies and started to make progress toward their goals. In 2012, the European Commission published the first European bioeconomy strategy. Since then, various states and regions in Germany have developed their own bioeconomy strategies or are currently in the process of developing their strategies.[3]

[3] Fraunhofer-Gesellschaft 2023

According to the *2020 Global Bioeconomy Policy Report*, an increased recognition of bioeconomy can be observed in Latin America and the Caribbean (LAC). However, the formulation process of national bioeconomy strategies has been slow in the region. Several countries, such as Argentina, Brazil, Colombia, Ecuador and Uruguay have been actively working on formulating bioeconomy policies, principally to make sustainable use of their diverse natural resources, thus valorising biomass waste and side streams. In LAC, the concept of bioeconomy is included in the political agenda of the Inter-American Institute for Cooperation on Agriculture (IICA), and the United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC).[4]

[4] IACGB 2024

2 Background

Ecuador has taken steps towards a national bioeconomy strategy, by signing up to the *National Pact for a Sustainable Bioeconomy.*[5] In April 2024, the *White Paper on Circular Economy (Libro Blanco de Economía Circular)*[6] was published, including a definition of bioeconomy in the national context with a view to 2033, by which Ecuador is expected to have transformed its productive structure, promoting innovation, sustainability and the responsible use of biological resources. This provides the foundations for the construction of a solid public policy, focused on the creation of a National Strategy on Sustainable Bioeconomy, and capable of contributing to the sustainable development of the economy and the ecological transition. Furthermore, the implementation of Bioemprende centres[7] brings together key actors from industry with (applied) research.

[5] MPCEIP & MAATE 2024

[6] MAATE 2024

[7] CORPEI 2022

Uruguay's *National Strategy for a Sustainable Bioeconomy (Estrategia Nacional de Bioeconomía Sostenible; ENBS*) seeks to consolidate and diversify the country's productive matrix, promoting a sustainable, efficient and innovative economic model for the use of its natural resources. This vision is complemented by the identification of four strategic axes and six key productive complexes for the development of the bioeconomy. The Bioeconomy Action Plan 2024-2026, elaborated with the support of FAO, is framed in the ENBS and is led by the Ministry of Livestock, Agriculture and Fisheries (*Ministerio de Ganadería, Agricultura y Pesca; MGAP*).[8]

[8] BioEconomia.info 2024

Biomass can be transformed into a variety of useful materials such as bioplastics which can be used for products like liquids, fibres and films, and biodegradable polymers that are designed to be compostable, breaking down more quickly and generating a reduced environmental impact (e.g. avoiding pollution through microplastic). Additionally, biomass can be transformed into biodegradable surfactants and solvents – such as those found in detergents, cleaning products and personal care items – fibres for textiles, and sustainable packaging (e.g. packaging made from seaweed or lignin, thus reducing the reliance on traditional plastics).

Bioenergy refers to energy derived from biomass, which includes organic materials like plants, agricultural and forestry residues, algae, and organic waste. It encompasses various technologies and processes to convert biomass into usable energy forms namely: biofuels (such as ethanol and biodiesel used for transportation); biogas to be used for heating, electricity, and as vehicle fuel; biomass power (such as combustion or co-firing to generate electricity); and bioheat which is biomass used for heating.

3 Problem Analysis

In Ecuador, the use of bioenergy from biomass is minimal as the country has limited infrastructure for its production and distribution, due to the existing energy mix being based mainly on fossil fuels. In 2021, about one fifth of Ecuador's primary energy consumption came from renewable sources – from the total primary energy consumption, biofuels and waste contributed to 3 per cent while hydropower amounted to 15 per cent.[9] Unfortunately, there is a lack of modern technology and expertise for the efficient production of bioenergy, and compared to industrialised countries, investment in research and development in the field of renewable energy is low. As there are only limited government subsidies and incentives to promote bioenergy, it becomes less attractive to investors.

[9] In the appendix, additional information is provided on fuels used for primary energy consumption and for power generation in Ecuador and Uruguay.

It is understood that biomass has not yet been used on a large scale in Ecuador due to the following reasons:

- The biomass industry relies on subsidies in order to make investment feasible as large production scale needs to be researched and developed, representing technical challenges.
- The competition with food and water resources could lead to reduced sustainability as the use of agricultural land for the production of energy crops could affect food production. Since Ecuador is heavily dependent on agriculture, displacing food production in favour of energy crops could lead to food insecurity. Additionally, access to water and other resources could be further impacted by the cultivation of energy crops, implying environmental concerns.
- Biomass combustion contributes to increased flue gases and particles, generating air pollution.
- The process of submitting a patent takes a long time and is expensive due to difficulties within the academic sector to obtain financial support.
- A strong preference for other clean energies (e.g. hydroelectric) can be observed.
- Ecuador lacks a public policy to encourage pull-and-push measures to make large-scale investment more attractive.

3 Problem Analysis

- A lack of knowledge on how to make use of biomass efficiently, initial costs of implementation, and regulation and policy to promote development (incentives).
- A low level of public awareness and acceptance of bioenergy projects, since the population is poorly informed about possible benefits and opportunities.

As for the case of Uruguay, in recent years the country has made significant progress in the development of renewable energies, particularly in hydropower, wind energy and bioenergy. However, the substitution of plastic with bio-based or biodegradable materials has been slower than anticipated due to several challenges:

- Economic factors, such as higher production costs and limited scale, technical and infrastructure limitations like performance issues and lack of industrial capacity and regulatory hurdles, such as insufficient policy support and regulatory uncertainty.
- Market and consumer behaviour, including limited awareness and resistance to change.
- Environmental concerns like misconceptions and waste management challenges which have further hindered progress. Addressing these issues through policies, infrastructre investment and education could accelerate the shift to sustainable materials. [10]
- An increasing investment in renewable energy education programmes can be observed, however not yet with a strong focus on bioenergy. Uruguay has relatively large agricultural areas, but the switch to energy crops could affect food production and harm food security.

[10] The topic biodegradable packaging material is discussed in the following papers: Garrison, Thomas F., Amanda Murawski, and Rafael L. Quirino. 2016. Mandolesi, S., Kilic, B., Naspetti, S. et al. 2024.

As described, technical and infrastructural deficits, high initial economic investments, social acceptance problems and potential conflicts with food security are major hurdles. While today's advanced biofuels are largely produced from agricultural waste, used cooking oils and animal fats, the scalability is limited, possibly leading to shortages once blending mandates increase.

4 Methodological Approach

Between March and July 2024, the International Sustainable Chemistry Collaborative Centre (ISC3) conducted two virtual stakeholder workshops focusing on strategies for a sustainable bioeconomy and their implementation across various countries. Multidisciplinary experts from Uruguay, Ecuador, and Germany provided insights into the latest international advancements in sustainable use and reuse processes in bioeconomy. During both events, ISC3 facilitated presentations, organised panel discussions and fostered peer-to-peer-exchanges with specialists from Latin America to deliberate on current practices and future actions that can be taken to strengthen bioeconomy in the region. During the workshops, a SWOT analysis was conducted to establish an overview of the current status in Uruguay and Ecuador. This provided a better understanding of enabling framework conditions for an advanced bioeconomy.

4.1 SWOT Analysis

A SWOT analysis serves as a strategic planning tool to identify internal and external factors driving an organisation, a sector, or a country. The acronym „SWOT" stands for:

- **Strengths:** Internal capabilities and resources that can help achieve objectives.
- **Weaknesses:** Internal limitations that can hinder performance.
- **Opportunities:** External factors that can be leveraged for advantage.
- **Threats:** External factors that could pose challenges.

The aim of a SWOT analysis is to identify favourable and unfavourable internal and external factors, thus deriving strategic decision-making and business planning.

4.2 Strategies derived from the SWOT Analysis

Based on a SWOT analysis the following strategies can derived:

- **Strengths-Opportunities (SO) Strategies:** Use strengths to exploit opportunities. Example: Leverage technical expertise to develop higher added-value products.
- **Weaknesses-Opportunities (WO) Strategies:** Overcome weaknesses by capitalising on opportunities. Example: Pursue grants to address funding gaps.
- **Strengths-Threats (ST) Strategies:** Use strengths to mitigate threats. Example: Enhance emergency systems to handle natural disaster risks.
- **Weaknesses-Threats (WT) Strategies:** Minimise weaknesses to avoid threats. Example: Modernise energy infrastructure to improve energy security.

By systematically analysing these factors, comprehensive strategies tailored to the unique conditions can be developed, ensuring informed and strategic decision-making.

5 Results and Discussion

5.1 Country-specific SWOT Analyses

During the country-specific SWOT analyses , the following guiding question was asked: How can added value be created from biomass, through the use of bioenergy and bioproducts?

Ecuador

Strengths	Weaknesses
1. Payments for results in sustainability in the agricultural sector	**1. Research is expensive in a regional comparison**
2. Mechanisms to channel funding (Bioeconomy Fund)	**2. Investment & technical assistance needed for product improvement at the producer level**
3. Funding derived from international cooperation	3. Bioeconomy managed as waste treatment / valorisation
4. Ecuador is a country with strong agricultural production and rich biodiversity	4. Sustainability policies derived mainly from the produce and agricultural sector
5. Political interest in residual biomass (from the Minister of Environment)	5. Application of sustainability policies is scattered
6. Academia committed to development and innovation of bioeconomy	6. Lack of awareness of resources in society (consumers)
7. Critical mass of human talent in Ecuador	7. Technical knowledge at the agricultural level is not uniform
8. Launch of the bioeconomy white paper	**8. Lack of government push for the development of biorefineries**
9. Strong political will of the executive for the application of bioeconomy	9. Focus on sustainability policies, but the question is how to approach them
10. Launch of Ecuador's Bioeconomy Strategy (highly participatory)	10. Need to foster collaboration between academic and productive sectors to advance research and investment in bioeconomy, ensuring sustained innovation and growth.
11. Political and institutional framework	

The following color code is used: Economic – Ecologic – Social – Governance Dimension.
Highlighted in **bold** are the factors considered most important.

5 Results and Discussion

Opportunities	Threats
1. Channelling of incentives and promotion of production to reduce costs	**1. Need to encourage the productive sector to invest in the bioeconomy**
2. Potential for higher quality agricultural production from the use of bio inputs	**2. Much work ahead in the legal and political framework**
3. International demand for certified products	3. Need to encourage the academic sector to continue with research related to the bioeconomy
4. International demand for bioproducts	4. Need to encourage the productive sector to invest in the bioeconomy
5. Residual biomass from Ecuadorian exporters can be valorised	
6. Potential to valorise waste from the food export sector	
7. Decreasing use of fossil resources provides opportunities to develop alternative fuels	
8. Development of bioproducts	
9. Increasing international cooperation brings more importance to the development of the bioeconomy	
10. Territorial development	
11. Ministry of Environment's approach to waste biomass (2nd gen. biorefineries)	

The following color code is used: Economic – Ecologic – Social – Governance Dimension.
Highlighted in **bold** are the factors considered most important.

5 Results and Discussion

Uruguay

Strengths	Weaknesses
1. Overproduction of renewable energy attracts investments	1. Low investment in private and public sector
2. High availability of biomass	2. Dependency on foreign investments due to lack of national priorisation
3. Existing certifications for forests and biomass	3. No guarantee for profitability of innovative processes
4. Capabilities in biomass production	4. Missing experience of management and monitoring: Does production and use of biomass contribute to sustainability? What is the impact on natural resources?
5. Highly skilled human resources due to high-quality education	5. No systematic, holistic view in environmental policies
6. Many studies conducted and good research capabilities	6. Effectiveness in educating the public to value more sustainable approach
7. Claims from younger generations for inclusion in the policy agenda	7. Lack in education and dissemination in the sustainable use of biomass
8. Many public institutions in the agricultural sector	8. Knowledge on transformation of biomass, but no practical experience
9. Previous experience (e.g. from the project BioValor): add value to biomass	9. Resistance to change the behaviour, but awareness for recycling
10. Good macroeconomic conditions and political stability	10. Difficult implementation and scaling up – from ideation to business „Valley of Death“
11. Strong commitment from government on biomass	11. Inconsistency in time – support started but no continuity
12. Good level of public administration	12. No available tools to translate innovation into practice
	13. Inconsistency of politics (initiatives start and stop; BioValor: political support decreases)

The following color code is used: Economic – Ecologic – Social – Governance Dimension.
Highlighted in **bold** are the factors considered most important.

5 Results and Discussion

Opportunities	Threats
1. Trade agreements (e.g. Mercosur)	1. High-income country; not eligible for international financial support
2. Possibilities for export and investments (e.g. green hydrogen)	2. Competition from abroad
3. Attract investments in bioeconomy	3. Few national investments
4. Lots of material, but sometimes no information with deeper understanding / studies on application and better use	4. Subsidised fossil feedstock
5. Importance of environmental issues for politicians	5. EU and Mercosur doesn't address environmental issues; negotiations are lengthy
6. Uruguay has the opportunity to educate and change behaviour	6. Social resistance to change
7. Young people are aware of climate change	7. No potential support. Inconsistent policy
8. First phase of the project BioValor served as a pilot and may attract investors during the implementation of its second phase	8. External regulatory issues

The following color code is used: Economic – Ecologic – Social – Governance Dimension.
Highlighted in **bold** are the factors considered most important.

5 Results and Discussion

5.2 Strategies derived from country-specific SWOT Analyses

During the second virtual workshop, the participants developed strategies based on the most important factors identified in the SWOT analyses, according to the described methodology (see chapter 4.1).

Through this methodology, three strategic objectives to create value from biomass were outlined for Ecuador. The first objective focuses on promoting industrial symbiosis in agriculture-related sectors by enhancing policy frameworks. This includes establishing legal regulations for waste management (amount & quality) and emissions, providing economic incentives (e.g. for investment in infrastructure), and engaging local governments in the implementation. The second objective aims to expand bioeconomy knowledge to attract investments by raising awareness beyond academia, identifying key actors, building a supportive ecosystem, and encouraging participation from large companies, Small and Medium Enterprise (SMEs), and suppliers. The third objective seeks to strengthen collaboration between universities, the private sector, and the public sector. This involves public sector funding for applied biotechnology research, securing international cooperation funds for bioeconomy research, universities driving bioeconomy innovations[12], engaging the private sector to scale-up these innovations, and the government establishing institutions and assigning responsibilities for expanded biomass utilisation.

[12] BioBall e. V. 2024

For Uruguay, the strategic objectives emphasise the need for regional measures tailored to respective territorial agendas and value networks, addressing the shortcomings of frameworks like Mercosur that focus mainly on economic aspects while insufficiently addressing the ecological and social dimension. With the aim of enhancing the value and export potential of biomass products, actions such as researching waste utilisation, adapting technology to national needs, coordinating funds from various agencies, and establishing an inter-ministerial group for coordination, are essential. Given the challenges and risks associated with scaling, it is crucial to train individuals in entrepreneurship and sustainable consumption, beyond recycling, raising awareness of sustainability on a holistic and systemic level. Additionally, it is important to adopt a regional perspective rather than a national one. Amidst the ongoing electoral process where the policy agenda is elaborated and the education reform is discussed, prioritising climate change adaptation and mitigation, natural resource management and social sustainability in education is vital.

6 Country-Specific Examples

The previous chapter highlighted the strategies needed to create value from biomass within the bioeconomies of Ecuador and Uruguay. This chapter aims to shine a light on selected best practices, however there are still downfalls. [13]

[13] MPCEIP & MAATE 2024

6.1 Biorefineries in Ecuador

In Ecuador, two concrete measures were identified, illustrating the principles of value creation from biomass. The first example refers to the biorefinery of banana residues and by-products – peels, leaves and stems from banana plants are used to produce bioethanol and other advanced bioeconomy materials through cell wall fractionation. The second example deals with the industrialisation of tagua (a nut from the palm *Phytelephas macrocarpa*) and the biorefinery of its by-products and residues. Both examples show the valorisation of residual biomass from Ecuadorian food exports, thus benefiting the territorial development.

6.2 Starch-based packaging material for plastic prevention in Uruguay

Uruguay's regulatory framework aims to minimise single-use plastics according to Law No. 19,829 on the Integrated Waste Management which established guidelines for waste management and promotes waste reduction and recycling. Packaging material from industrial hemp or cellulose pulp can substitute plastic as the material is biodegradable and can often be converted into energy or composted after its use. Therefore, it is viewed as environmentally friendly, since biodegradable products (compared to conventional plastic) avoid the release of microplastics in the ocean. However, Uruguay faces high labour costs as well as strong international competition, national bio-based products would thus need to be differentiated from imported goods to create greater recognition. Furthermore, the local production of biodegradable plastic is more expensive than the manufacturing of conventional plastic. In this case punitive tariffs could be applied in order to discourage the use of conventional plastics, labelling, certification and import restrictions.

7 Conclusion

Sustainable strategies endeavour to avoid decisions that reduce options for action and lead to irreversible situations in the future. Furthermore, they are multidimensional and holistic – for example, food security as well as social and environmental concerns must be taken into account during the development of these strategies. A circular approach considers the end-of-life of each product and can bring benefits on several levels according to the EESG scheme.

Ecuador's robust agricultural sector produces large quantities of food and animal feed, which are marketed on a large scale. Plant residues and waste can therefore be used for energy production to replace materials that were previously fossil-based. To this end, various strategies for the further development of the country's bioeconomy were discussed; however, institutions for implementation must be established, the political framework strengthened, knowledge deficits reduced, and cooperation between sectors and key players fostered. In this context, main strategies include the promotion of industrial symbiosis in agro-productive areas, fostering collaboration between universities, private and public sectors, while increasing bioeconomy knowledge to attract investments. These strategies aim to boost collaboration, fortify policies and raise awareness to drive research, innovation and investment towards bioeconomy.

Uruguay possesses a high potential for sustainable biomass production due to its strong use of biomass in the energy sector. However, there are several challenges, such as a lack of investment and an inconsistency in policies, in addition to limited knowledge and resources. To address these issues, several strategies are proposed, such as inter-ministerial coordination, waste utilisation research, promotion of sustainable consumption and support of bioeconomy-related entrepreneurs. Moreover, the country could differentiate itself from others through implemented certification systems, thus attracting investment in bio-based products to compete with imported goods. Another positive aspect lies in Uruguay's effort working towards replacing plastic with biodegradable materials made from plant residues or bio-waste.

A bioeconomy addresses major global challenges, such as food security, climate change, resource scarcity, and environmental pressure, thus, expectations are high. Therefore, it can be said that countries successfully implementing bio-based business practices not only rely on technological progress, but also require investment, skills and knowledge (research), complemented by an enabling political environment.

As a takeaway from the conducted workshops, it is evident that the exchange of knowledge and experience is important in the journey towards bioeconomy. ISC3 assumes the function of a knowledge and dialogue platform focusing on Sustainable Chemistry, connecting multidisciplinary expert groups from different countries. Together, knowledge is shared, opinions are discussed, horizons are broadened, and solutions are developed. Become part of the ISC3 community to gain access to trainings and tools, participate in events and benefit from the network.

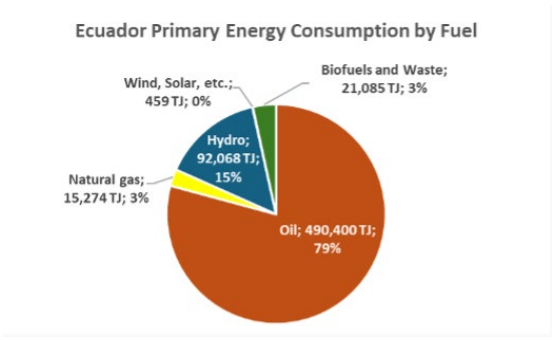
8 Glossary

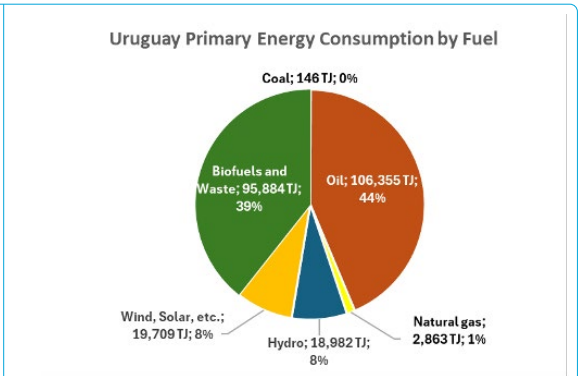
EESG	Economic, Environmental, Social, and Governance
ENBS	Estrategia Nacional de Bioeconomía Sostenible (de Uruguay) National Strategy for a Sustainable Bioeconomy (of Uruguay)
FAO	Food and Agriculture Organization (of the United Nations)
GDP	Gross Domestic Product
HEVA	Hydro Processed Esters and Fatty Acids
HVO	Hydrotreated Vegetable Oils
IICA	Inter-American Institute for Cooperation on Agriculture
ISC3	International Sustainable Chemistry Collaborative Centre
LAC	Latin America and the Caribbean
LATAM	Latin America
MGAP	Ministerio de Ganadería, Agricultura y Pesca (de Uruguay) Ministry of Livestock, Agriculture and Fisheries (of Uruguay)
SME	Small and Medium Enterprise
SWOT	Strengths, Weaknesses, Opportunities and Threats
UN-ECLAC	United Nations Economic Commission for Latin America and the Caribbean

9 Appendix

9.1 Primary Energy Consumption by Fuel

In 2021, about one fifth of Ecuador's primary energy consumption came from renewable sources. From the total primary energy consumption, biofuels and waste contributed to 3 per cent while hydropower amounted to 15 per cent. In Uruguay, about 55 per cent of the country's primary energy consumption was based on renewable energies with biomass having the largest share of 39 per cent from the total.

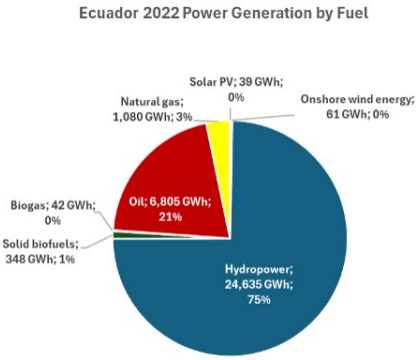


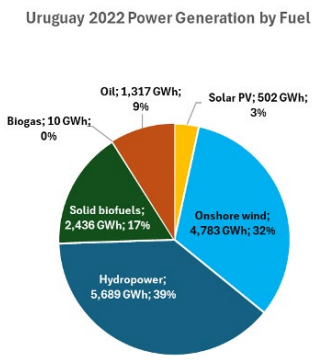


Source: IEA Data Services (Licence: CC BY 4.0) for year 2021, available at: https://www.iea.org/countries/ecuador/energy-mix

9.2 Power Generation by Fuel

In Ecuador, the share of renewable energies in the power generation was 76.1 per cent in 2022 with bio-based fuels contributing only 1.2 per cent to the total. While in Uruguay, the share of renewable energies in the power generation was 91.1 per cent in 2022 with bio-based fuels contributing 16.6 per cent to total.





Source: Renewable Capacity Statistics 2024 and Renewable Energy Statistics 2023, International Renewable Energy Agency (IRENA) & Abu Dhabi, [Latest update: 03 April 2024]

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