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Transformation and Sustainability Governance in South American Bioeconomies

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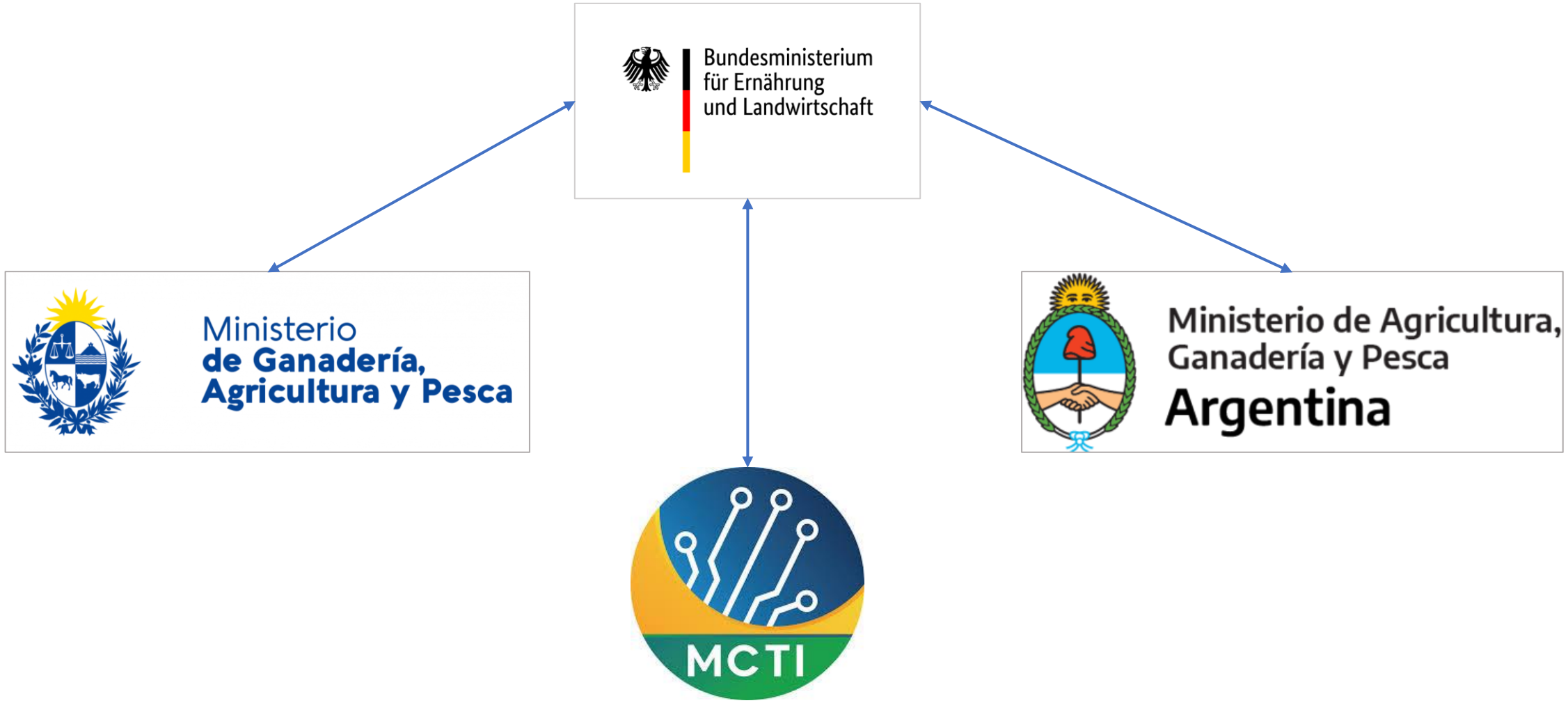
Green Rio – 02.09.2022

International cooperation



Our Team

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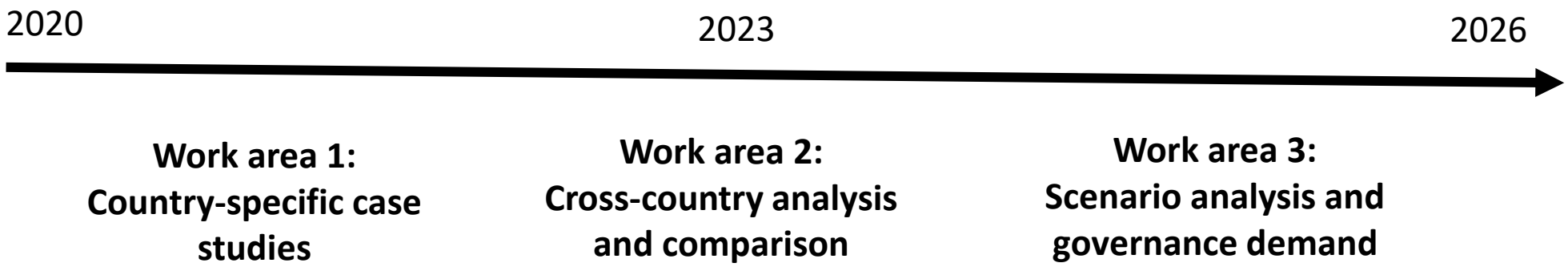
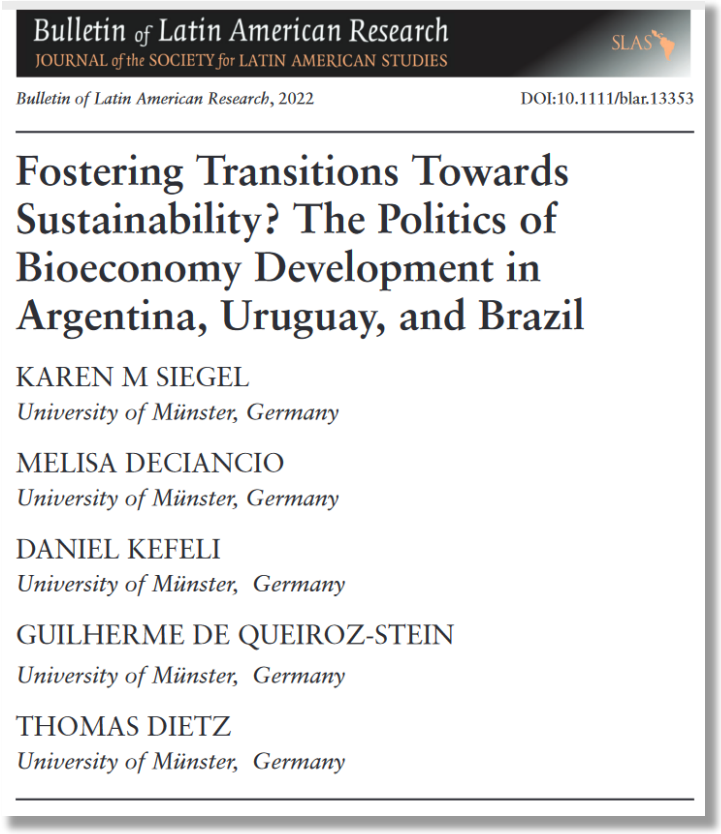
Objectives and project components

- Under what conditions can a sustainable bioeconomy be developed?
- What are the most effective governance mechanisms to promote and regulate a transition towards a bioeconomy?
- What are the effects of different policies and technologies associated to the bioeconomy on socioeconomic and environmental dimensions?



Bioeconomy concept in South America

- A concept in the making
  - Use of biological resources ✅
  - Reduce reliance on fossil resources (?)
- Diverse actors, (very) different priorities
  - Biotechnology and agribusiness (Argentina)
  - Forestry and bio-based energy (Uruguay)
  - Biofuels and sociobiodiversity (Brazil)
- Focus on large-scale intensive agriculture can enhance inequalities and aggravate environmental problems
- Inclusion of civil society in public debates is limited
- Risk of mainstream ag. being relabelled as Bioeconomy



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Fostering Transitions Towards Sustainability? The Politics of Bioeconomy Development in Argentina, Uruguay, and Brazil

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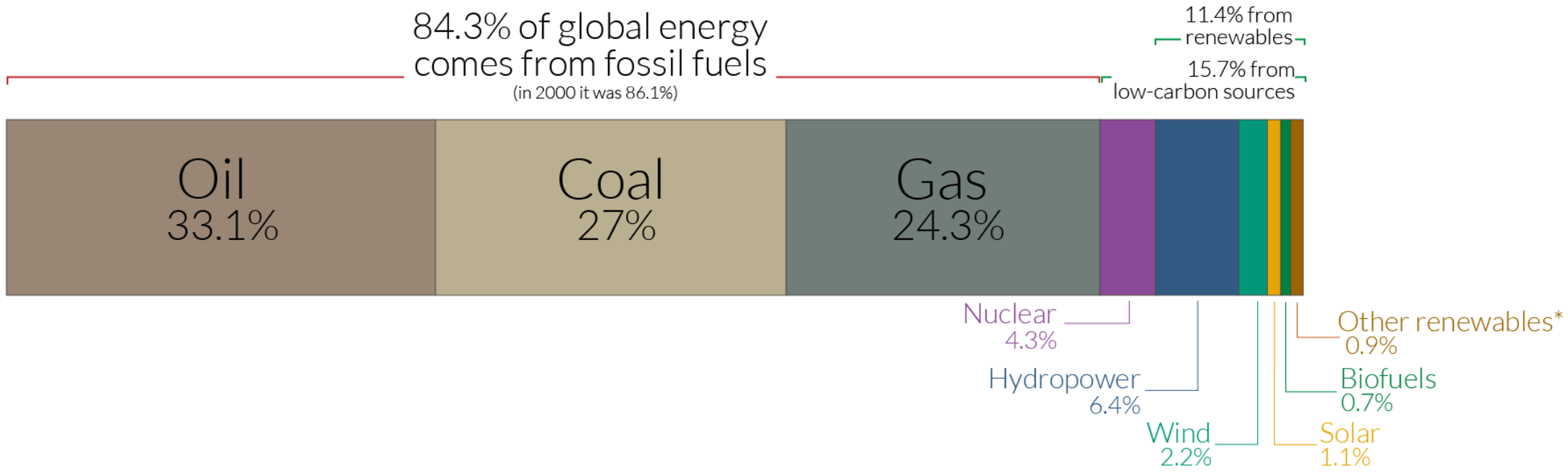
Source: Siegel et al. (2022, *Bulletin of Latin American Research*)

Global primary energy consumption by source

The breakdown of primary energy is shown based on the 'substitution' method which takes account of inefficiencies in energy production from fossil fuels. This is based on global energy for 2019.



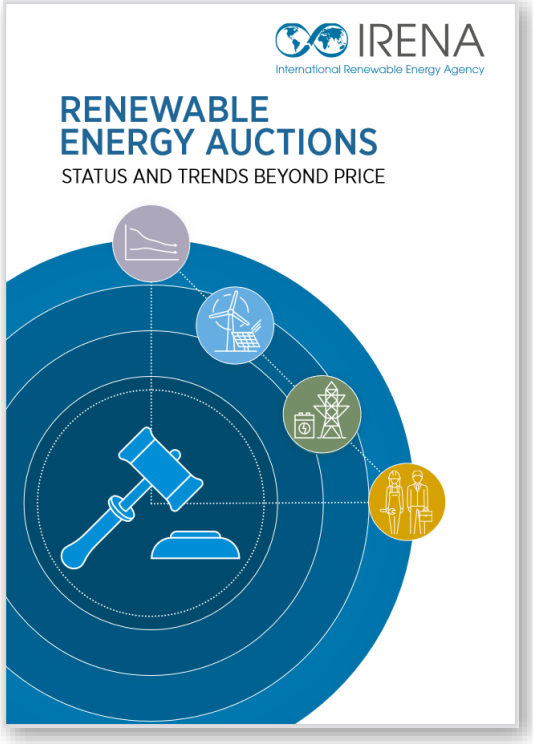
*'Other renewables' includes geothermal, biomass, wave and tidal. It does not include traditional biomass which can be a key energy source in lower income settings.

OurWorldinData.org – Research and data to make progress against the world's largest problems.

Source: Our World in Data based on BP Statistical Review of World Energy (2020).

Auctions as policy instrument to foster RE

- Auctions are increasingly popular policy to promote renewable energy (RE) while seeking to fulfill other social or economic objectives
- RE auctions represent an institutional innovation in the pursue of decarbonization and have been rapidly adopted in the last couple of decades in different regions of the world.
- Many of the newcomer countries to auctions are concentrated in Asia, Africa and Latin America.
- Are RE auctions appropriate for all countries?
  - Non-competitive market settings
  - High levels of corruption can affect results tendering system
  - Lack of trust in the government



Source: http://irena.org

Auctions work…

	TWFE	CS	2SDID
Full sample	2.16***	0.98*	2.49**
	(0.78)	(0.55)	(0.99)

Notes: *** p<0.01; **p<0.05; *p<0.1
Std. errors clustered at the country level are shown in parentheses
TWFE include Arellano correction for autocorrelation and heteroskedasticity

Source: Mac Clay, Börner, and Sellare (*in preparation*)

Auctions work… but not everywhere

	TWFE	CS	2SDID
Full sample	2.16***	0.98*	2.49**
	(0.78)	(0.55)	(0.99)
High quality institutions	2.91**	3.39***	3.10*
	(1.23)	(1.26)	(1.63)
Low quality institutions	1.17	1.64	2.07
	(0.94)	(1.25)	(1.31)

Notes: *** p<0.01; **p<0.05; *p<0.1
Std. errors clustered at the country level are shown in parentheses
TWFE include Arellano correction for autocorrelation and heteroskedasticity

Source: Mac Clay, Börner, and Sellare (*in preparation*)

Argentina and the RenovAr program

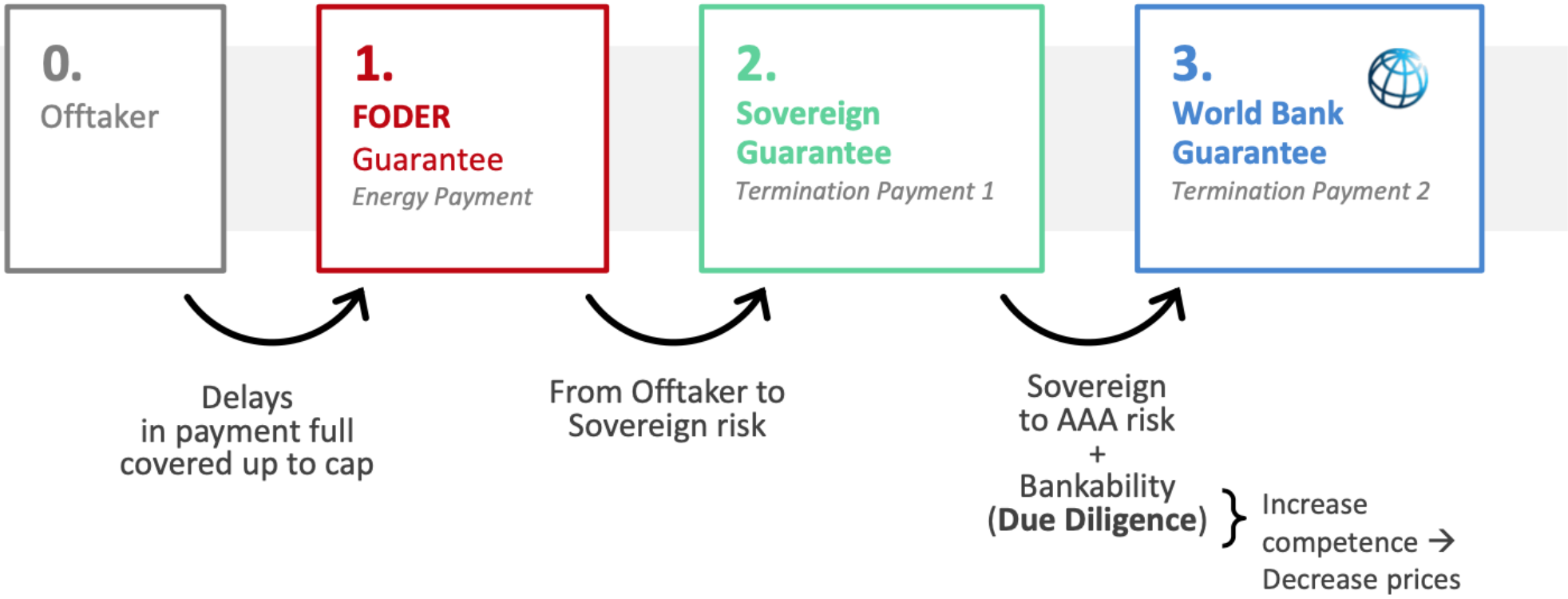
Context:

- High inflation, low rule of law, public debt, corruption, weak business environment
- Unemployment levels have risen over the last 10 years to over 11% (youth: 25%)
- High dependency of fossil energy
- Higher than average CO_2 emissions relative to neighboring countries

RenovAr:

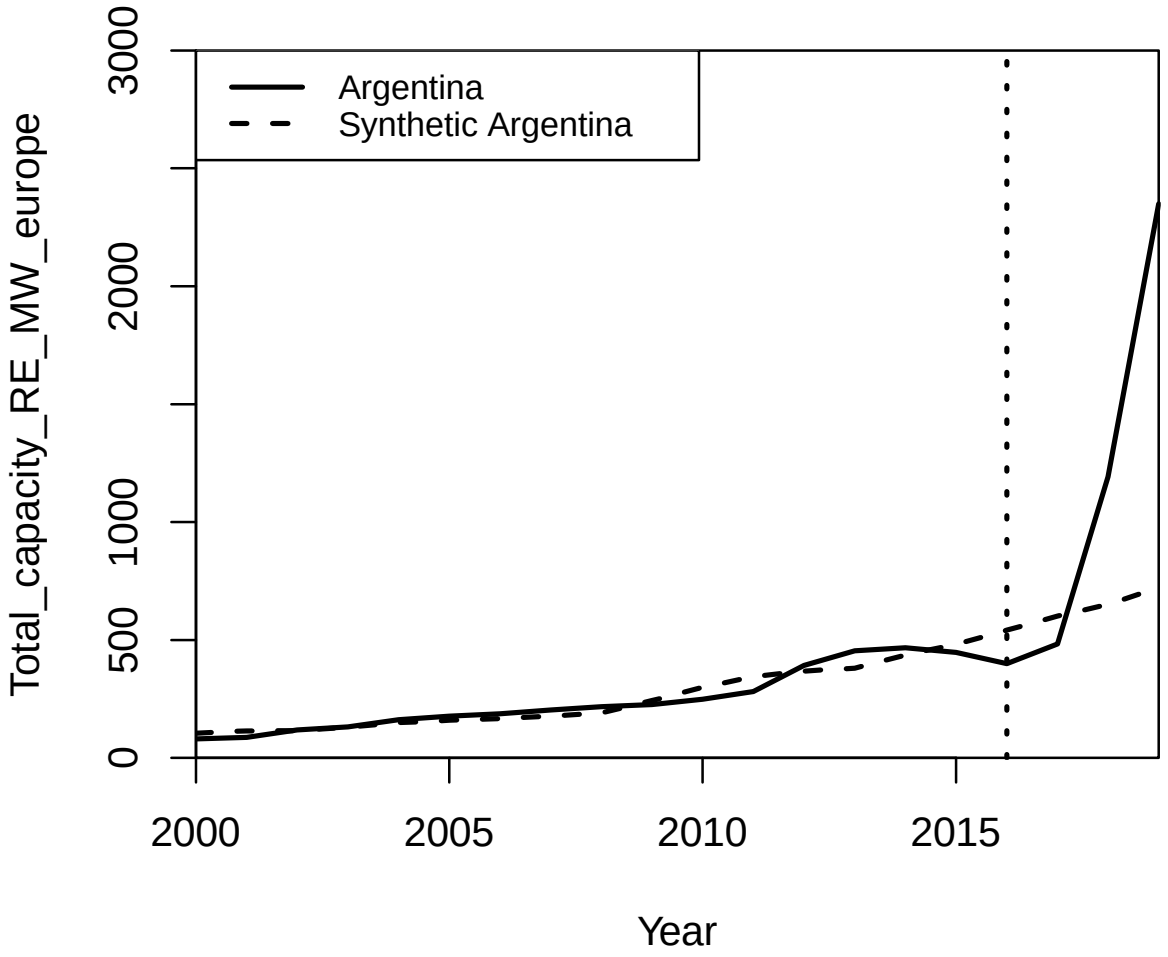
- Goal: to reduce fossil fuel dependency, mitigate GHG emissions and meet renewable energy targets
- Resource Diversification: Geographical and Technological
- Solar, Wind, Biomass and Small Hydro are promoted

Payments and guarantee mechanisms in the RenovAr



Source: https://esmap.org/sites/default/files/events-files/8_20190205_WorldBank-ESMAP-MMorrone.pdf

Effects on total capacity of RE sources in Megawatt



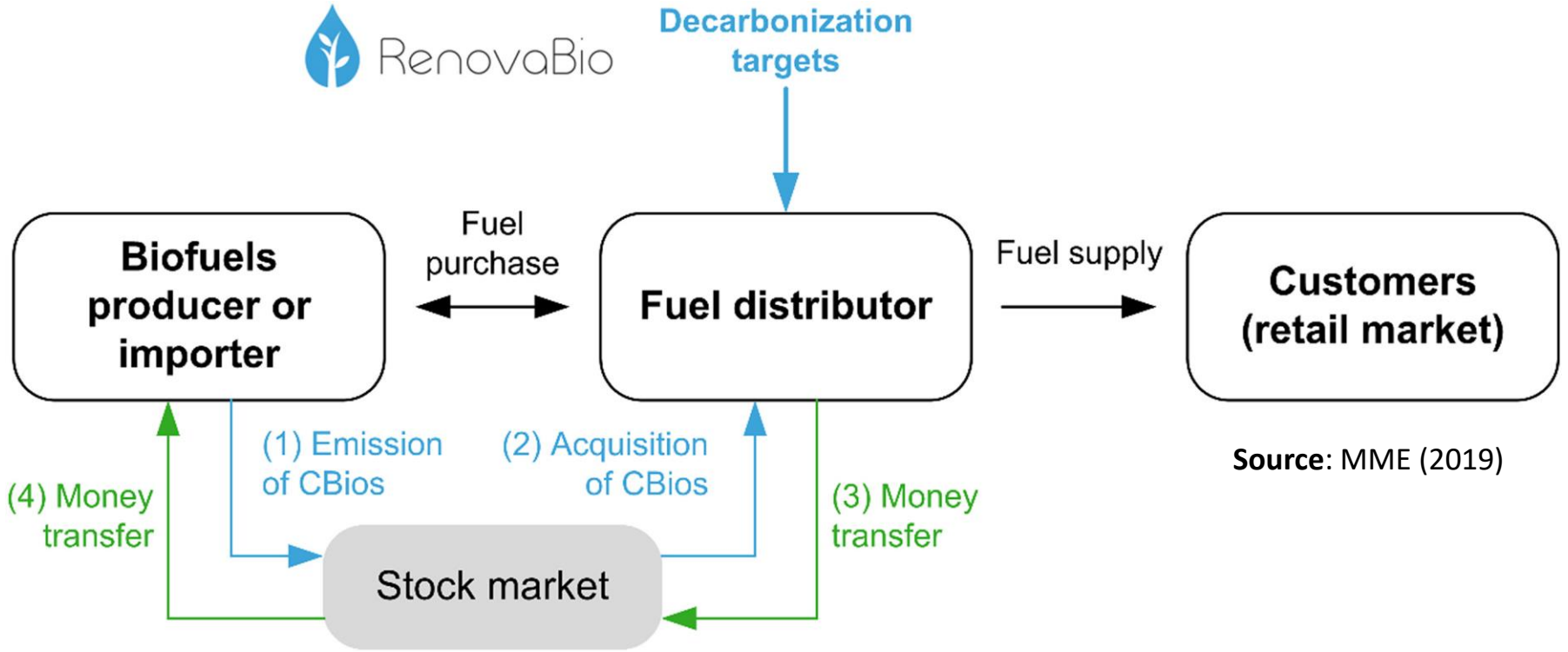
- A set of comparable countries had a similar growth over the years until 2015.
- When RenovAr was implemented a year later, there was a strong spike in the capacity of RE

Source: Breddermann, Mac Clay, and Sellare (*in preparation*)

Biofuels in Brazil

Policy Goals:

- Contribute to Brazil's NDC commitments to the Paris Agreement to lower emissions.
- Generate revenue (via CBIO sales) rewarding biofuel producers who increase production efficiency and lower their production related carbon footprints.

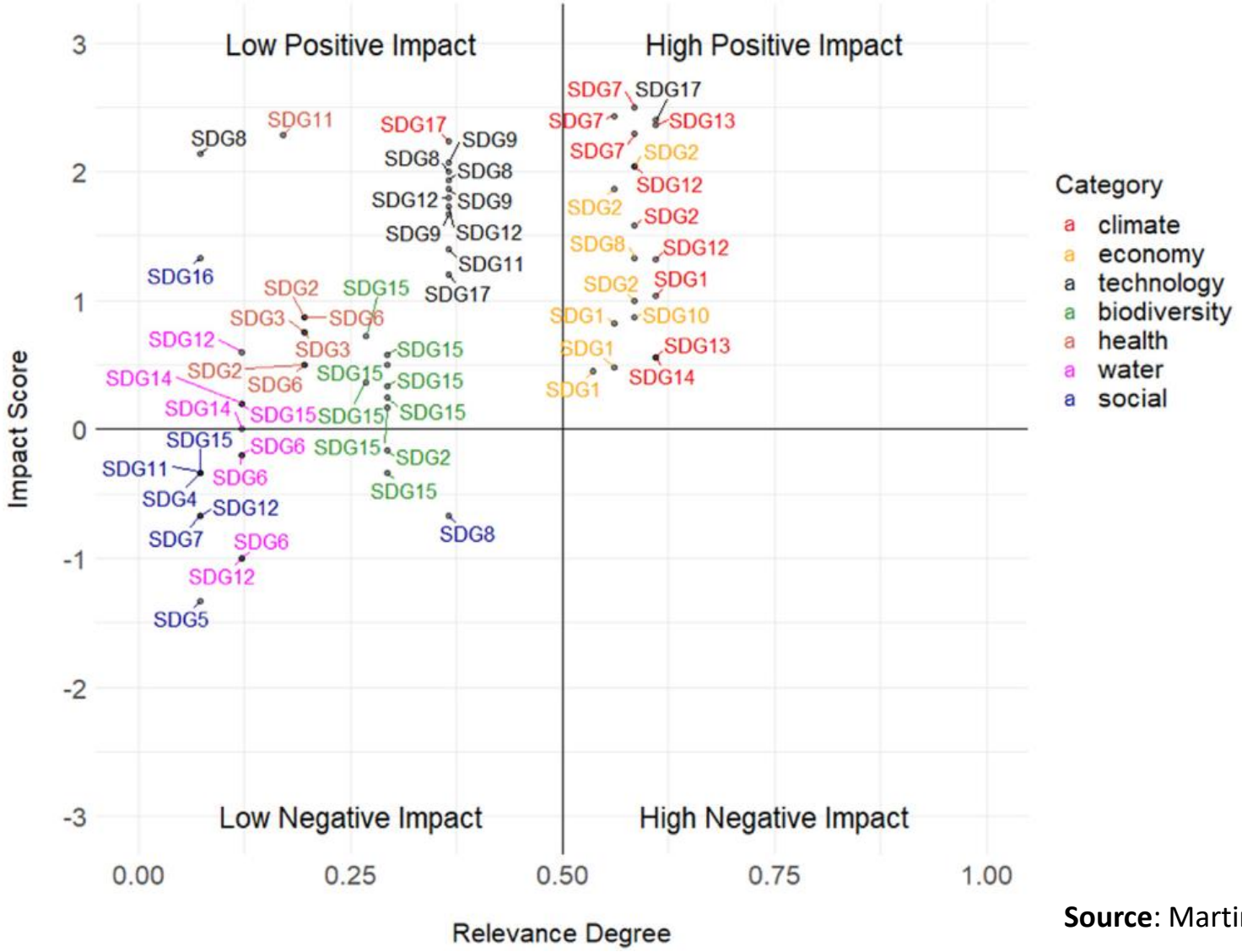


Source: MME (2019)

Principal Policy Mechanisms:

- A Mixed Compliance-Voluntary Carbon offset market. Petroleum sector must purchase certified carbon offset credits (CBIOs) from biofuel producers. Voluntary third-party purchasers are allowed to participate.
- Mandatory annual Greenhouse Gas Emissions offset goals.
- Factory-level Life Cycle Assessment (LCA) to determine biofuel carbon efficiency gains.
- Land Use Change Verification from 2018 onward.

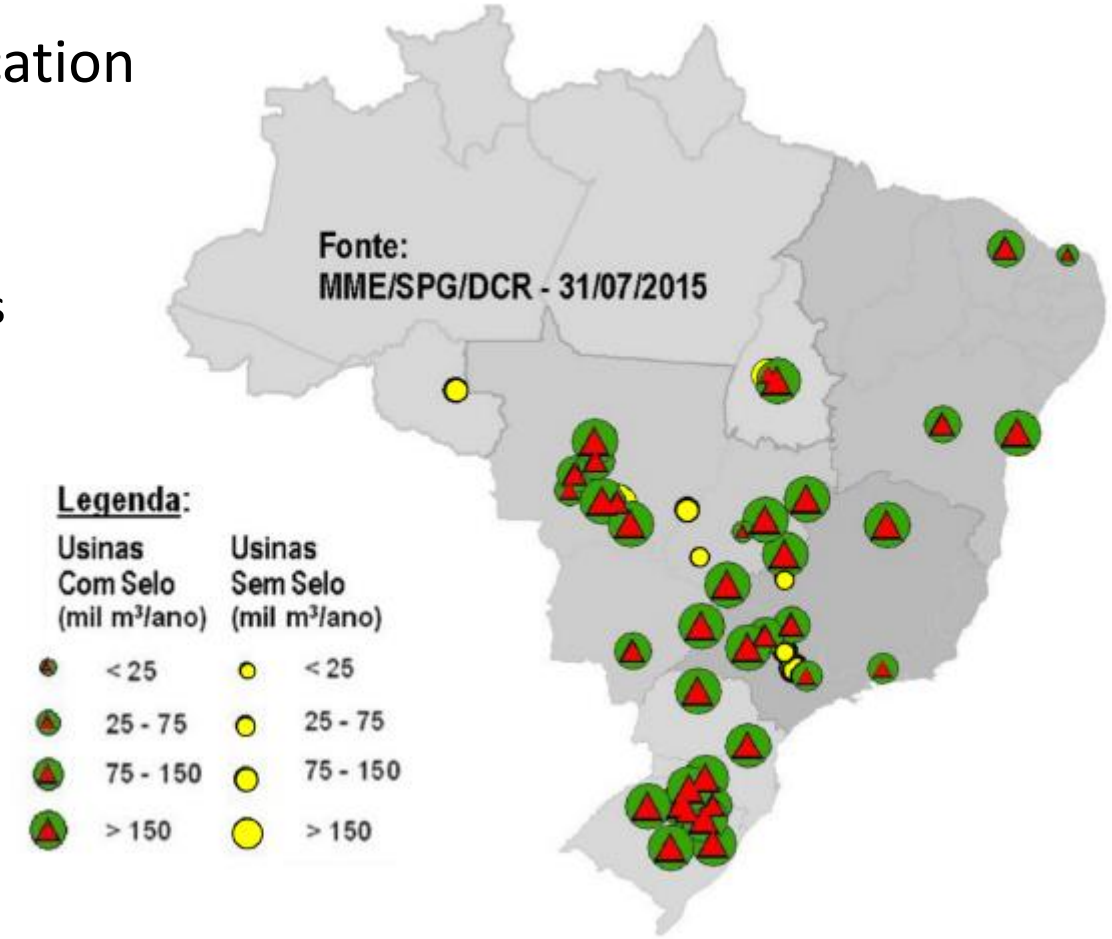
Sustainability trade-offs in biofuel policies



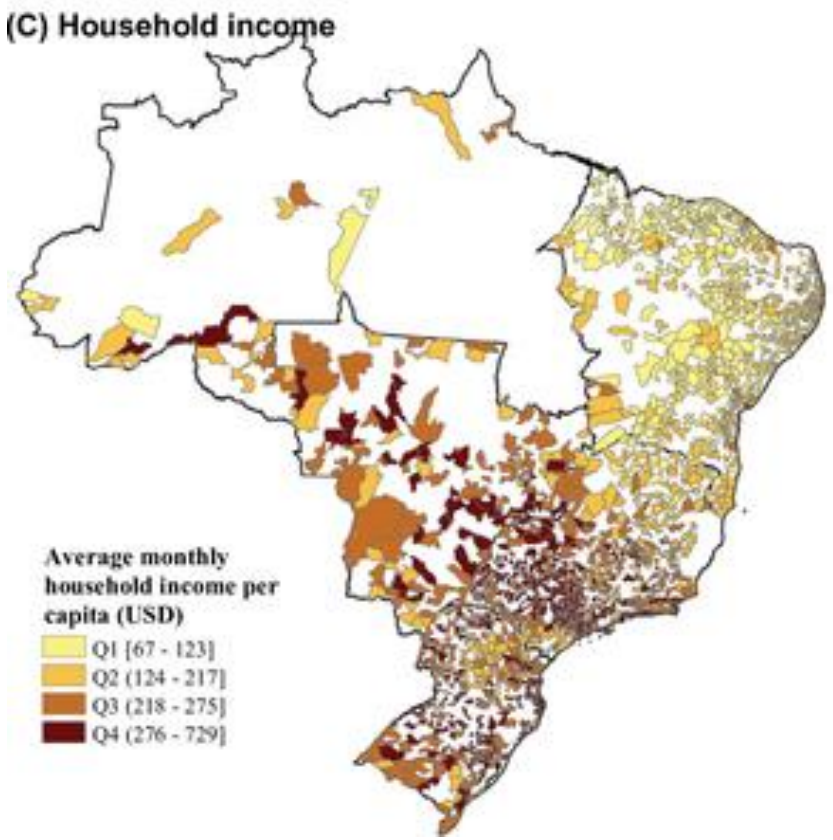
Source: Martinelli et al. (2022, *Cleaner Environmental Systems*)

Linking smallholders to the Bioeconomy

- The Social Fuel Stamp (SFS) is a voluntary certification program created in 2004
- Goals:
  - Integrate small-scale farmers into biofuel value chains while fostering regional development
  - Diversify the feedstock used in biofuel production.
- Government established a minimum mixture of biodiesel in diesel:
  - 2005: 2%; 2021: 13%; 2023: 15%
- Tax incentives for biodiesel-producing industries that purchase raw material from family farmers
- Farmers receive a price premium and technical assistance

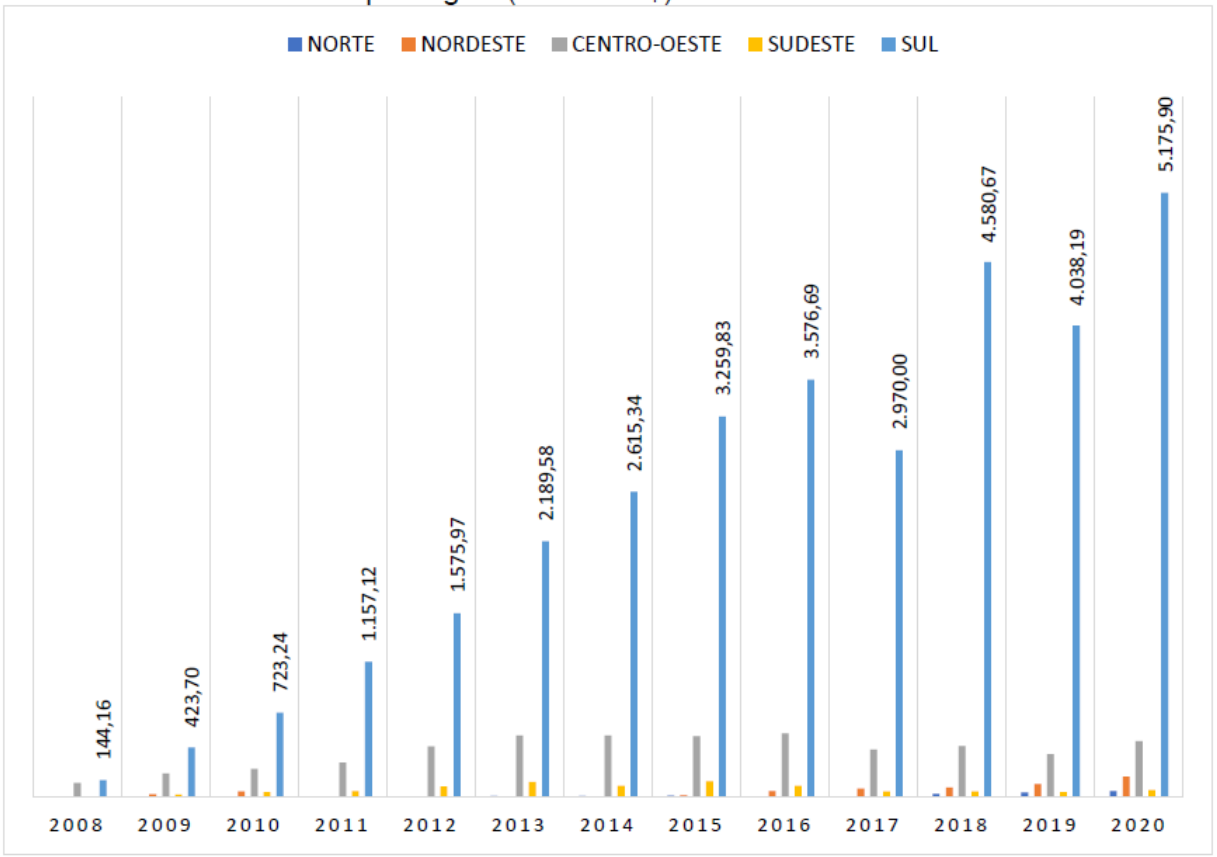


Regional inequalities



Source: Xu et al. (2020)

Gráfico 13 - Evolução do valor da produção adquirida da agricultura familiar nos arranjos do Selo Biocombustível Social por região (milhões R$).



Source: COER/MAPA (2021)

Value commercialized under the SFS by biomass (in millions of R$)

Biomass	2014	2015	2016	2017	2018	2019	2020
Peanut	0,66	0,00	0,00	0,00	0,00	0,00	0,00
Canola	1,13	1,52	0,00	0,00	5,44	2,44	3,03
Palm	0,00	0,00	0,00	0,20	6,24	7,24	0,59
Sunflower	0,00	0,04	0,00	0,00	0,00	0,00	0,00
Castor	4,70	13,09	12,92	8,86	9,61	11,17	25,47
Coconut	0,00	0,16	5,46	16,18	28,12	55,99	106,02
Soy	3.219,47	3.886,99	4.189,56	3.427,33	5.039,57	4.390,97	5.512,79
Total	3.252,83	3.942,20	4.273,56	3.512,88	5.176,59	4.596,42	5.941,71

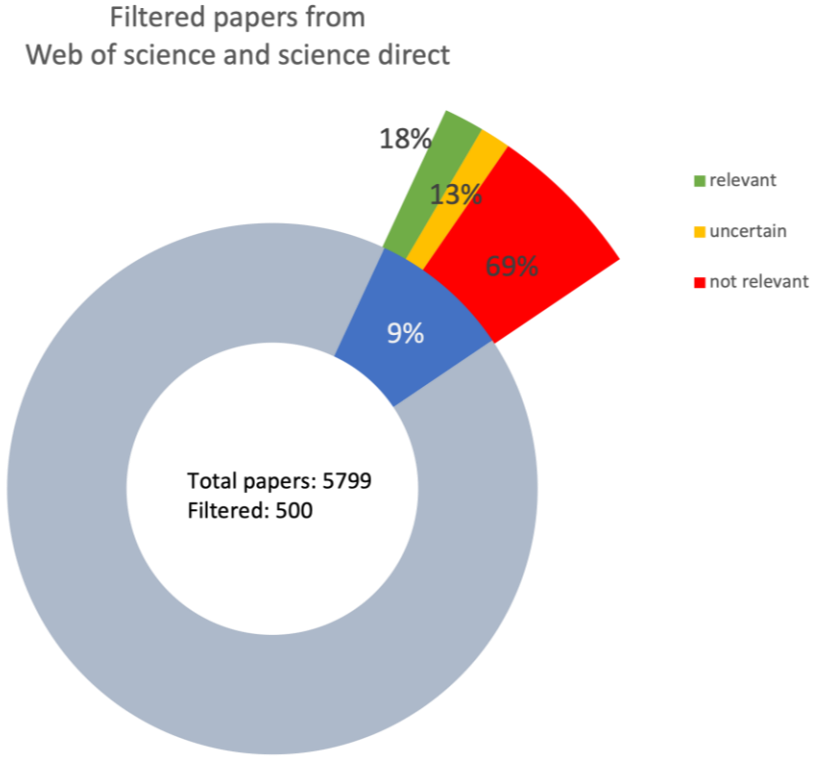
Source: Sellare, Kalif, and Bastos-Lima (*in preparation*); data from COER/MAPA (2021)




Microbiome-based inputs (MBI) for ag. production

- MBI's adoption remains low
  - Agronomic efficacy in the field reduced due to ecological interaction
  - Farmers perceive them as short-lived and with slower response velocity, when compared to traditional chemical Ag. Inputs
- Focuses on MBI developed from specific types of microorganisms and their impacts on particularly delimited domains
  - Effects depend on interactions with ecosystem characteristics, agroclimatic conditions, etc.
- Research settings: laboratory, greenhouse, field
  - Lack of research in "real" settings
- Effects on socioeconomic outcomes are still understudied

Results based on papers classified at this stage



Source: Silva-Carrazzone, Scherer, and Sellare (*in preparation*)

Regulating the use of biodiversity

Benefits

- Gains in regulatory efficiency and decrease in transaction costs;
- Increase in the number of genetic heritage accesses;
- Greater legal security for users of genetic heritage
- Greater predictability regarding benefit sharing;
- Diversification of benefit sharing mechanisms

Challenges

- Underfunding of mgt. systems;
- Insufficient technological capacities;
- Lack of autonomy of regulatory bodies;
- Barriers to int. scientific cooperation
- Loss of decision-making power of civil society participation spaces
- Low effectiveness in the implementation of benefit sharing;

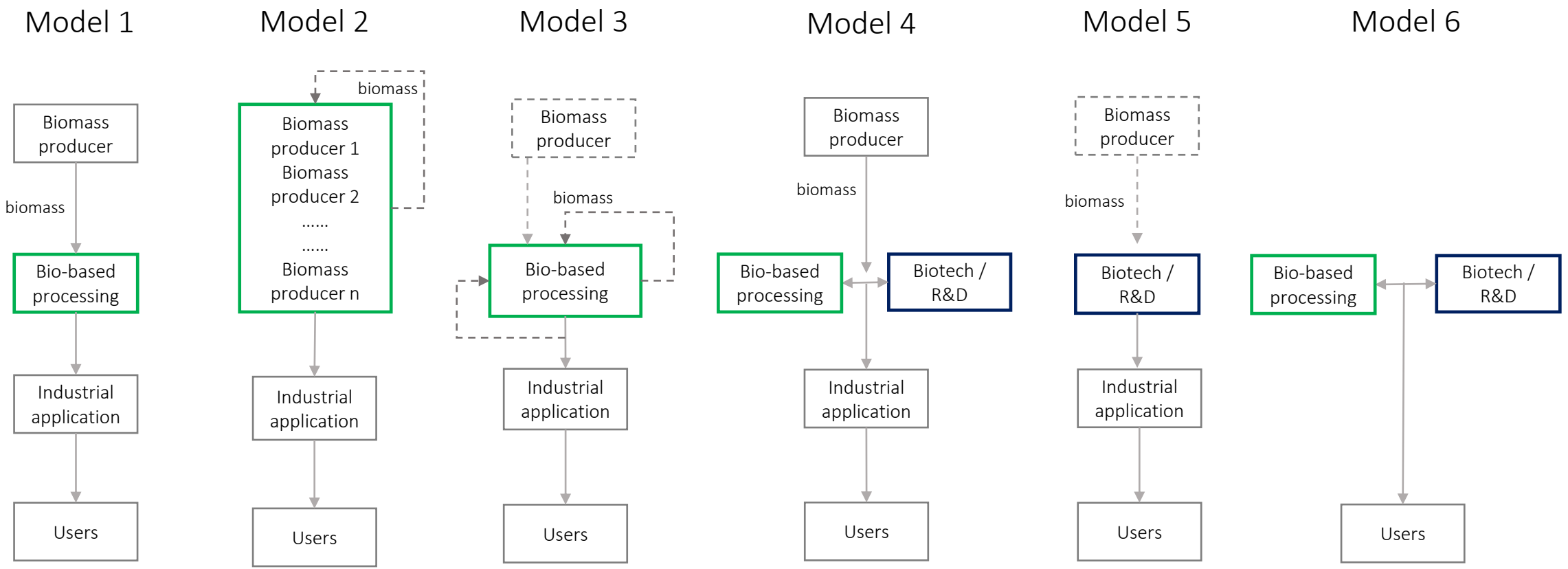
Source: http://escolhas.org

Source: Queiroz-Stein (*in preparation*)

Bioeconomy upgrading in global and local VCs

- A transition to a bioeconomy is presented as a path to overcome environmental externalities and create new business opportunities for many value chains.
- Welfare distribution effects and environmental impacts of value chains are well-documented in the literature, but it is not yet clear how the bio-based economy might require changes in the structure of value chains, which can lead to a redistribution of benefits among participants.
- A sustainable bioeconomy is not only about replacing feedstocks. On the long run, a bioeconomy upgrading requires moving from initial to advanced stages of a bio-based economy. This implies the mainstream use of higher generation feedstocks, the adoption of circularity principles and the design of new biosynthetic compounds.

Source: Mac Clay and Sellare (2022, *ZEF Discussion Paper Series*)

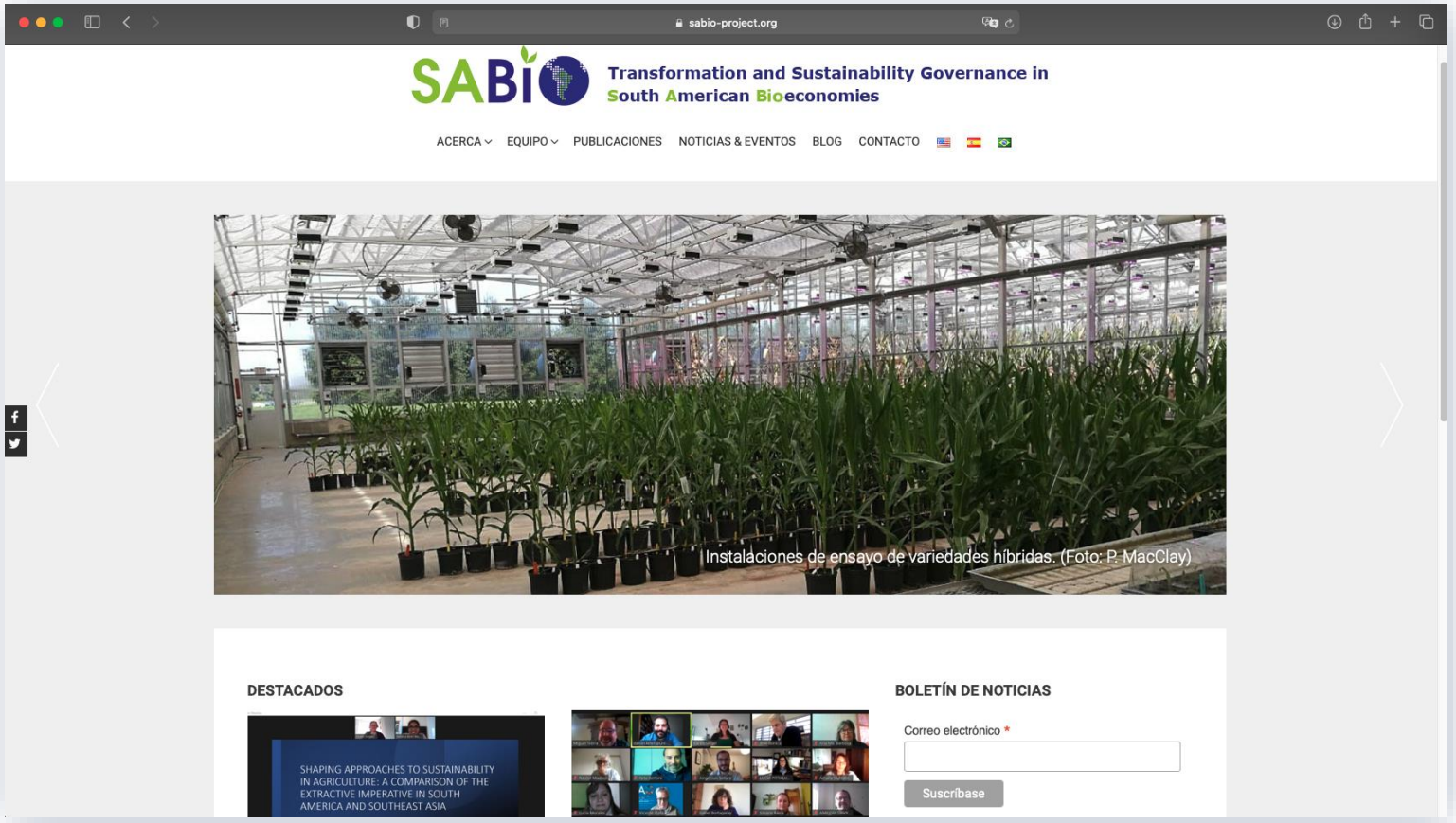


Examples

1st gen biofuels Biogas from crops	1st gen biofuels Biogas from crops or ag residues	Bioenergy from manure, agricultural residues or industrial residues.	1st and 2nd gen bioplastics 2nd gen biofuels Molecular farming applications	Synthetic Biology Applications: Non-animal food proteins Food ingredients. Nutraceuticals. Cosmetics. Flavor & Fragrances.	Microbial active components as agricultural inputs . Next generation of Seed Traits Biosimilars Biopharmaceuticals

Source: Mac Clay and Sellare (2022, *ZEF Discussion Paper Series*)

https://sabio-project.org/



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