Hot Topics - Cross-scale linkages

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- Sorry for some slides in Portuguese.
- They were drawn directly from official reports and publications prepared for (or by) subnational governments (and in one case a private association).
- Of course, I will do my best to translate them

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Proposed Questions/ Challenges

- ✓ **How do we ensure that decarbonization at the sub-national level “adds up” to satisfy the national goal?**
- ✓ **How do we ensure that short-term implementation supports the achievement of long-term goals?**
- ✓ **How can research support better consideration of cross-scale linkages in decision-making?**

Proposed Questions/ Challenges

How do we ensure that decarbonization at the sub-national level “adds up” to satisfy the national goal?

How do we ensure that short-term implementation supports the achievement of long-term goals?

How can research support better consideration of cross-scale linkages in decision-making?

How do we ensure that decarbonization at the sub-national level “adds up” to satisfy the national goal?

In “ancient times”, we developed Message versions for Brazilian State Energy Plans.
Advantages (+): detailing of industrial processes, demography, land use.
Challenges (-): data availability, consistency, leakage, and for continental-sized countries = computational effort/feasibility

In more recent studies, the emphasis has shifted from energy security (accessibility and affordability) to including decarbonization (and other SDGs).
In this case, and because we already have a set of IAMs (Global and National), we move to a “chain approach”.
However, we had to downscale country regions to the state/subnational and even city levels => Use of input-output models with disaggregated information on economic activity and the development of sector-specific modeling (industrial processes, including refining; transport modeling, land use...)

NOWADAYS

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How do we ensure that decarbonization at the sub-national level “adds up” to satisfy the national goal?

(EI)

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Why Brazil and the Northeast before **Pernambuco**?

Figura 1. Diagrama da consistência metodológica

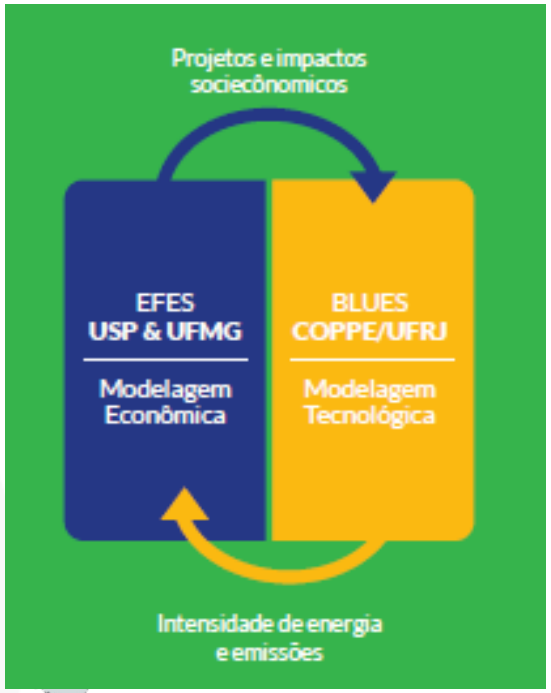
GCC

1. Mudanças climáticas globais
2. Papel do Brasil na descarbonização mundial
3. Detalhamento da descarbonização nacional
4. Detalhamento do papel da região Sudeste
5. Posicionamento do Estado de Minas Gerais no âmbito da descarbonização nacional

Garantir consistência

Atenção ao transbordamento ou transferência de emissões

Why Brazil and the Southeast before MG?



ambuco

> Aiming at consistency

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How do we ensure that decarbonization at the sub-national level “adds up” to satisfy the national goal?

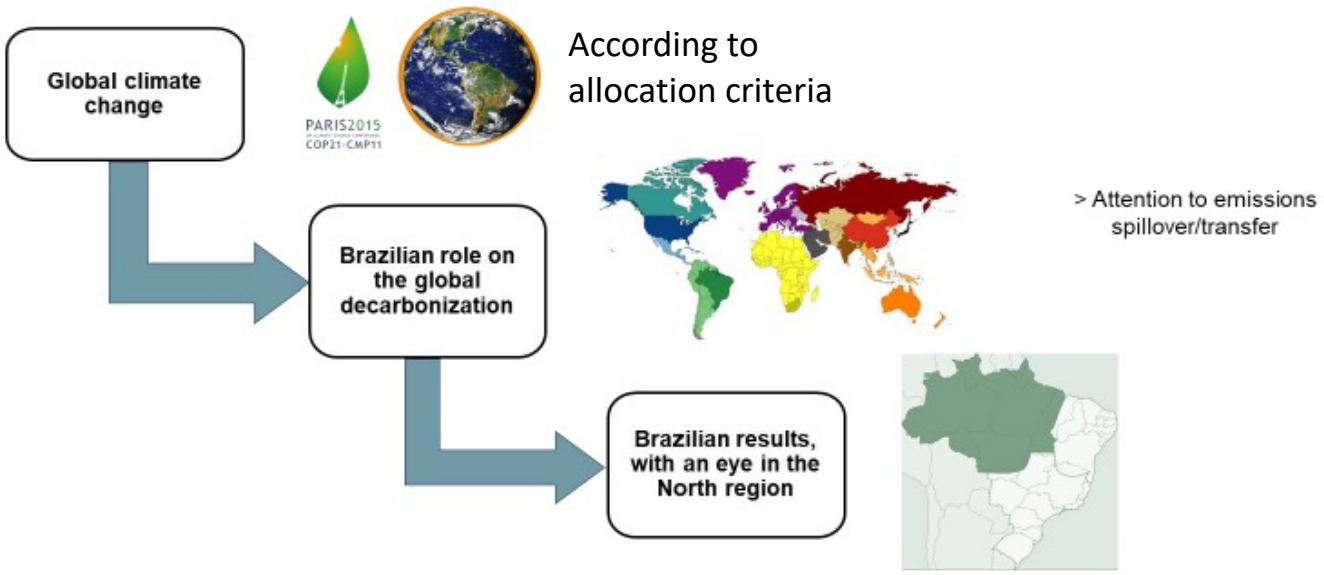
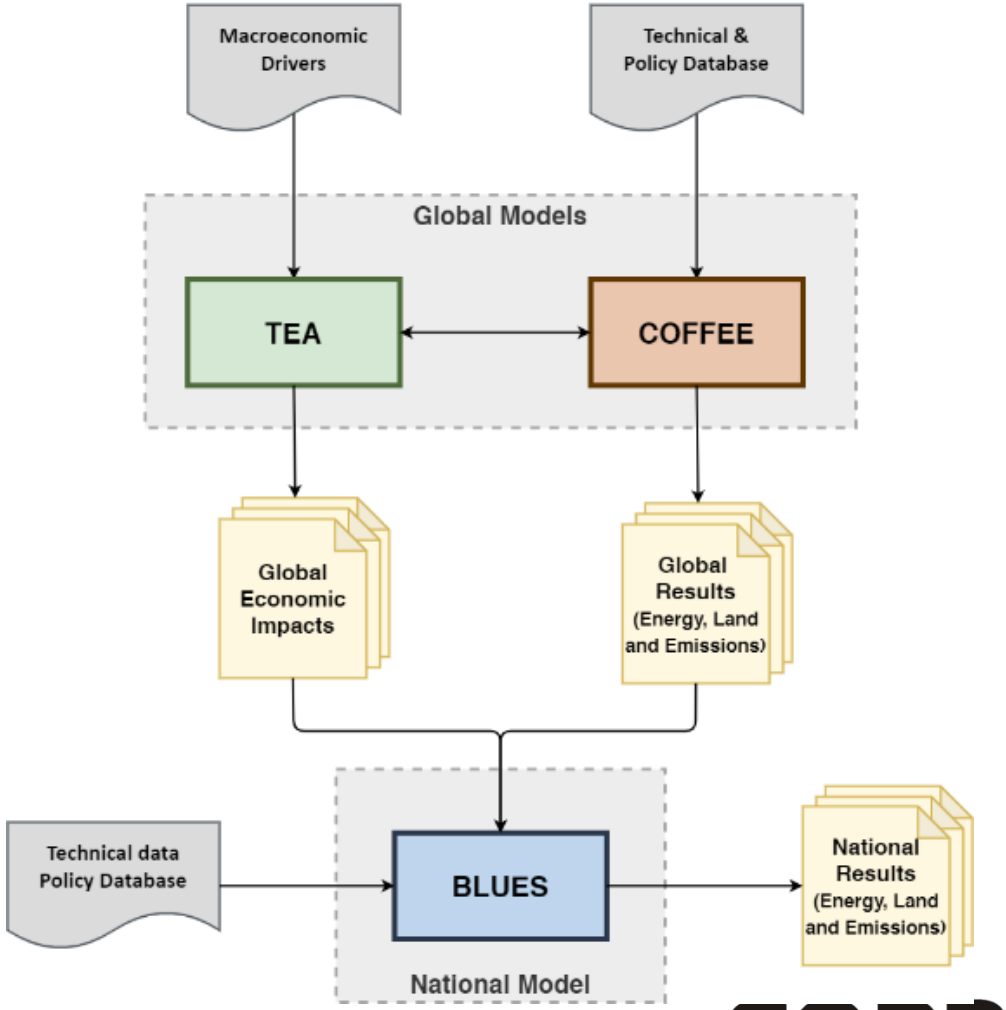


Figure 1: Methodological consistency diagram



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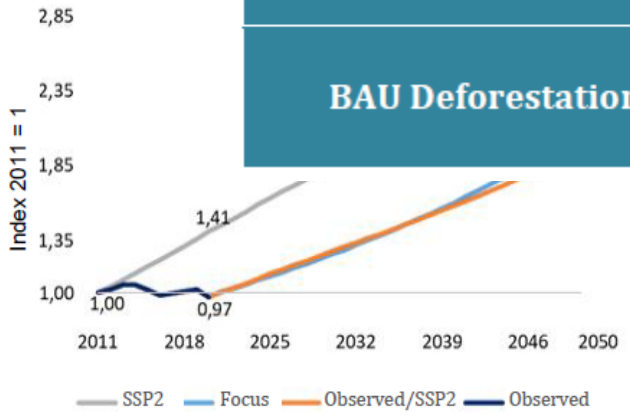
Deforestation \ Climate Ambition	CurPol (CP)	1.5°C (1
Zero deforestation	Scenario 1: CP_Zero	Scenari 1.5C_Z
BAU Deforestation	Scenario 3: CP_Defo	Scenario 4: 1.5C_Defo



Projection of Brazilian GDP between 2020 and 2050 based on the SSP2 scenario (Index 2011=1)

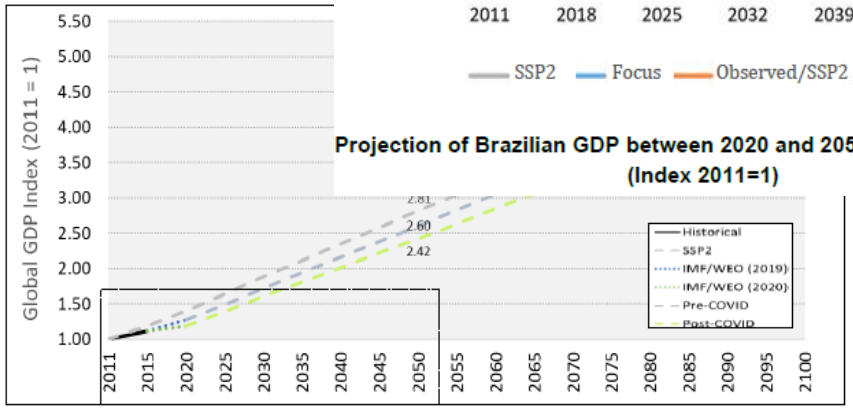


Figure 2: Global GDP projections between 2020 and 2100 from the SSP2 scenario.

Figure 4: Regional scheme from BLUES

How do we ensure that decarbonization at the sub-national level “adds up” to satisfy the national goal?

Note: 1.5C_Defo scenario was infeasible

Figure 8: GHG emissions in the North region detailed by gas

Proposed Questions/ Challenges

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How do we ensure that short-term implementation supports the achievement of long-term goals?

How can research support better consideration of cross-scale linkages in decision-making?

How do we ensure that short-term implementation supports the achievement of long-term goals?

- ✓ This involves the Modeling Platforms (e.g. Optimization vs Simulation) and the way they are used (e.g. Recursive dynamic vs Perfect foresight)
- ✓ How to deal with hard-to-abate sectors, even the transient phase between what we have now and what is desired?
- ✓ This also has to do with unburned fossil resources (≠ stranded assets), carbon lock-in and even equity (just transition) issues
- ✓ For major low and middle income oil producing countries what matters is the discounted cash flow instead of the unburned resources (there is a relation between them, but they are not an identity)... This has implications for comparing peak-budget with full-century scenarios.

How do we ensure that short-term implementation supports the achievement of long-term goals?

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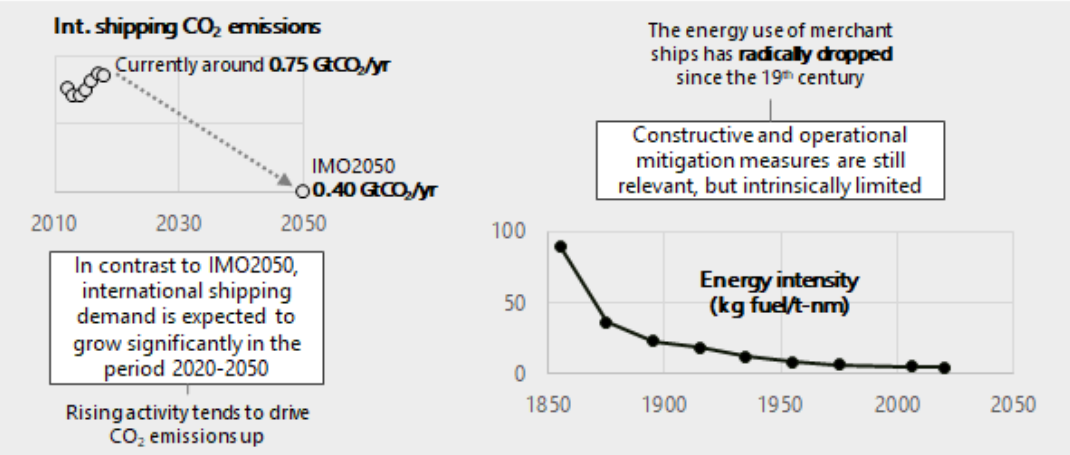
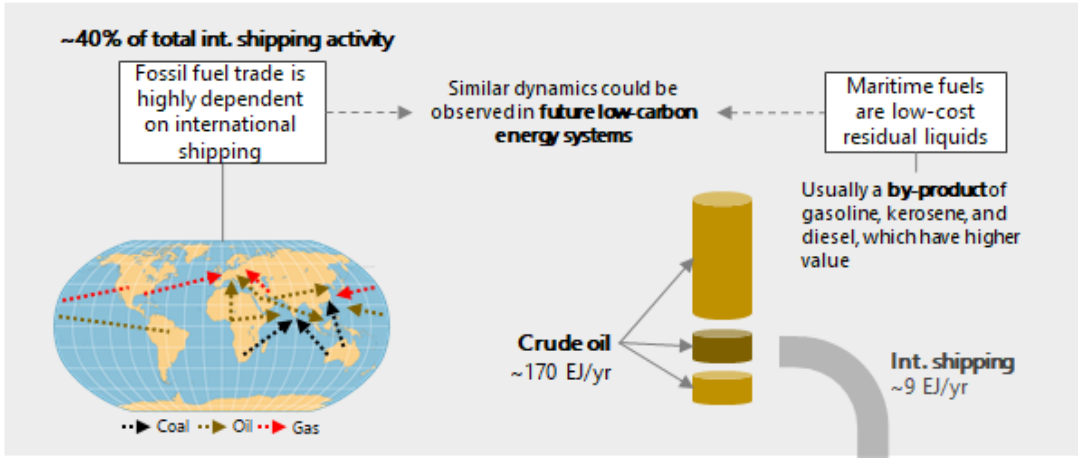
1

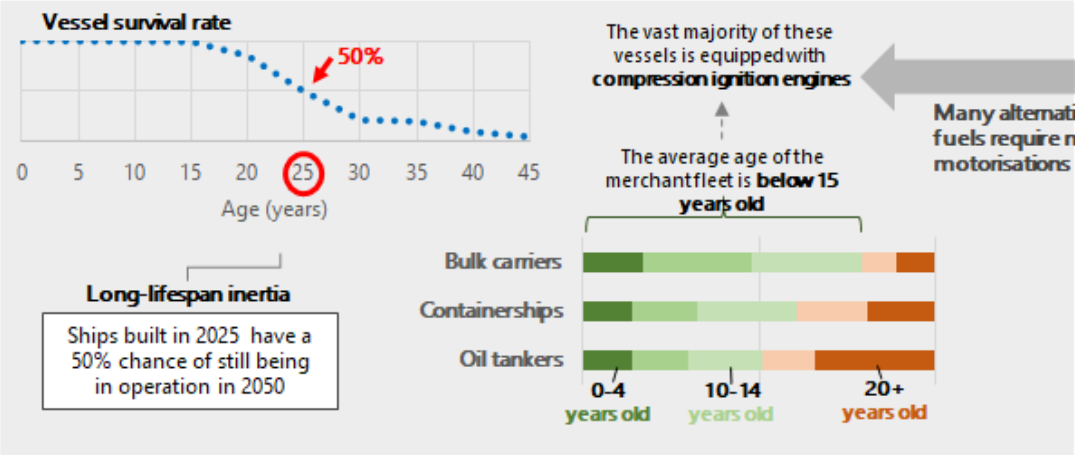
A decreasing energy efficiency potential



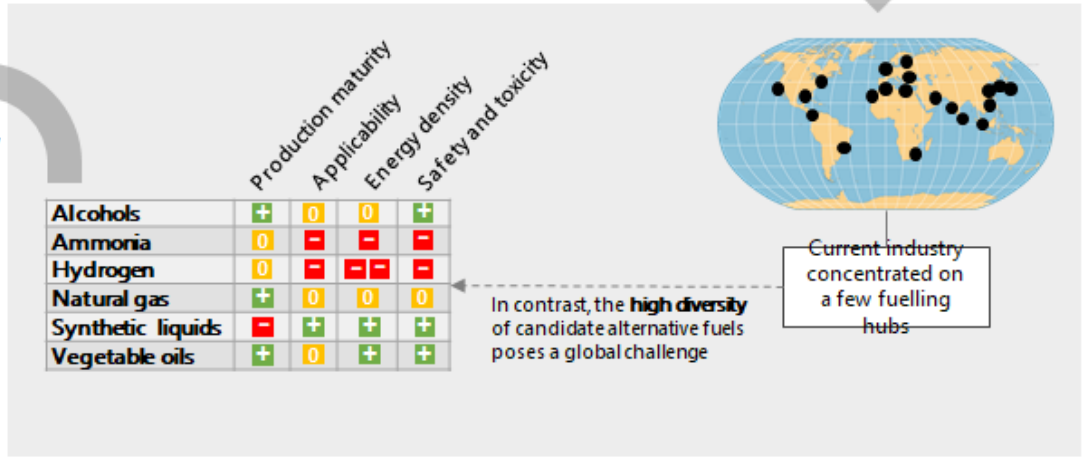
Strong interactions with the energy system



Technological inflexibility



Obstacles to alternative fuels



Muller-Casseres, E. et al (2023) - International shipping in a world below 2°C. Under submission. Paper from the Navigate Project.

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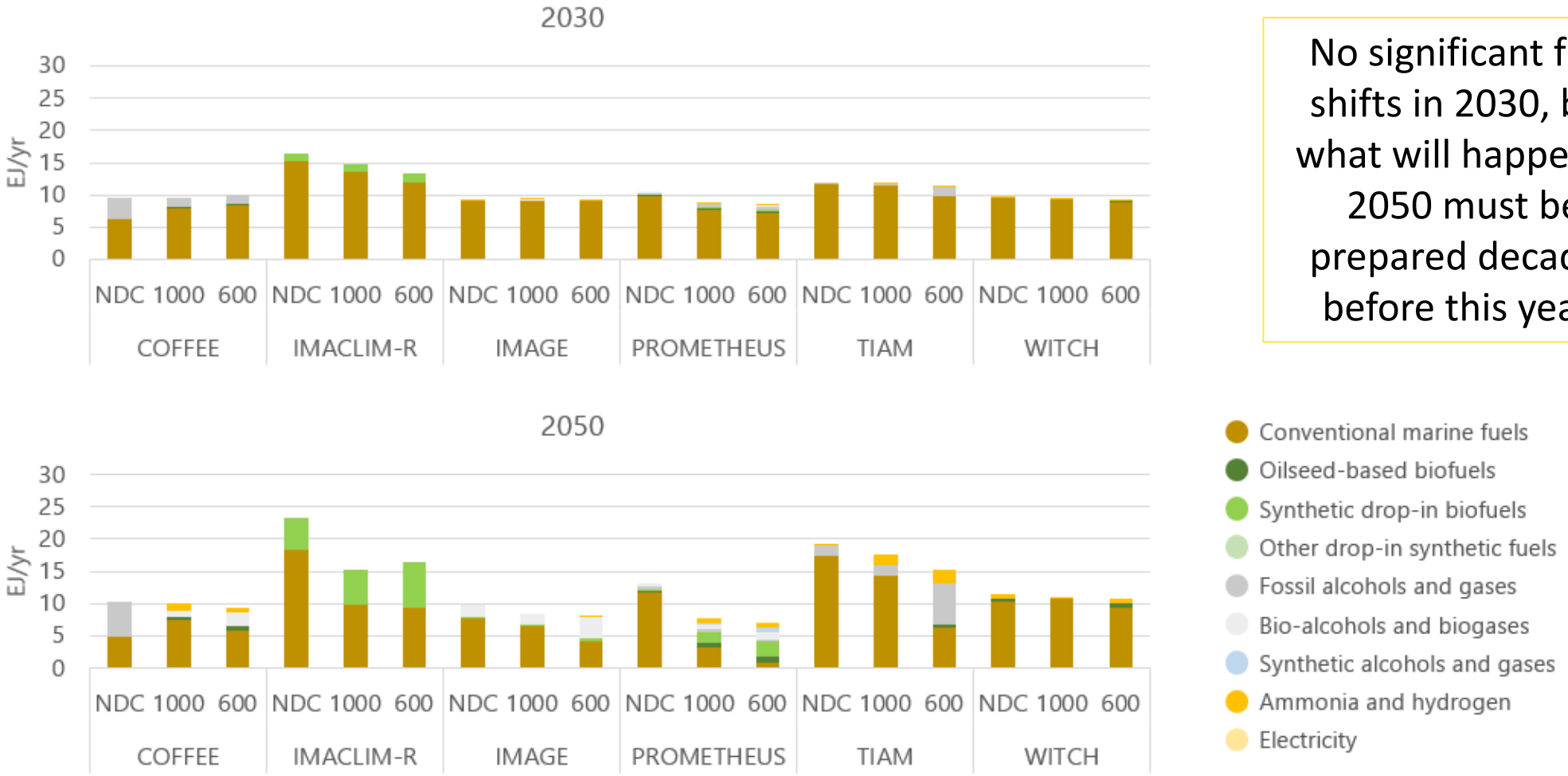

No significant fuel shifts in 2030, but what will happen in 2050 must be prepared decades before this year!

Muller-Casseres, E. et al (2023) - International shipping in a world below 2ºC. Under submission. Paper from the Navigate Project.

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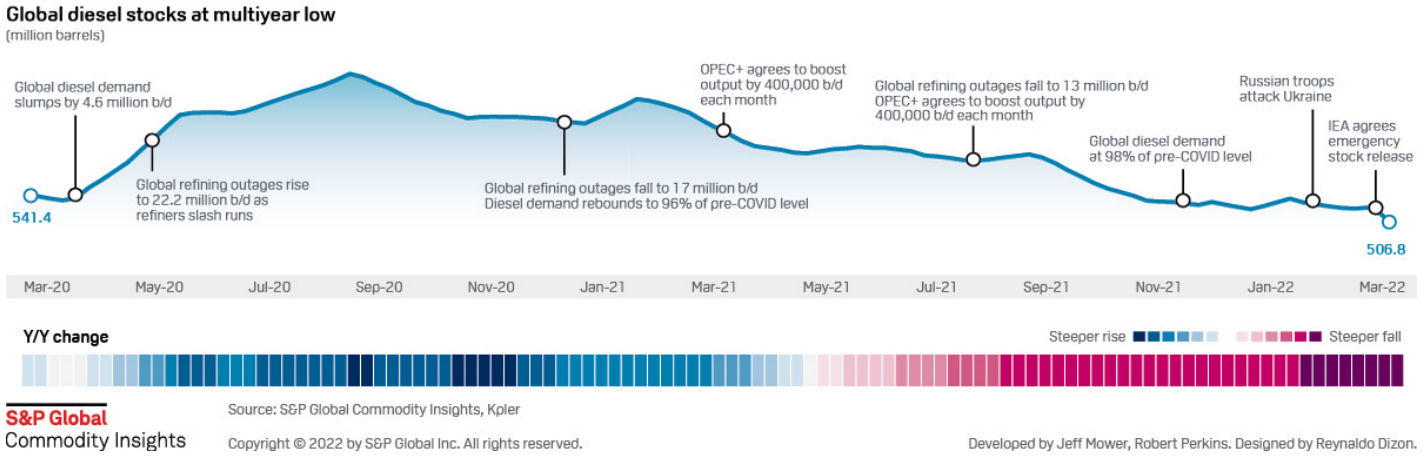
The transiente phase: We have to meet the demand for premium fuels (increasingly premium) that has recovered from Covid (as have we, I hope), at least until 2030, in addition to dealing with the Russia-Ukraine war(affects oil, distillates and natural gas), the closure of refineries (around 4 mbpd), the delay of greenfield and brownfield projects, and the concern with the risk of stranded assets! Countries have also provided tax breaks for fossil fuel production and diesel (and sometimes gasoline) consumption to curb inflation and restore growth.



"When we are alive, it is death that is not present; on the contrary, when death is present, we are the ones who are not " (Epicurus)

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Stranded crude oil resources and just transition: Why do crude oil quality, climate ambitions and land-use emissions matter

Rebecca Draeger, Bruno S.L. Cunha, Eduardo Müller-Casseres, Pedro R.R. Rochedo, Alexandre Szklo, Roberto Schaeffer

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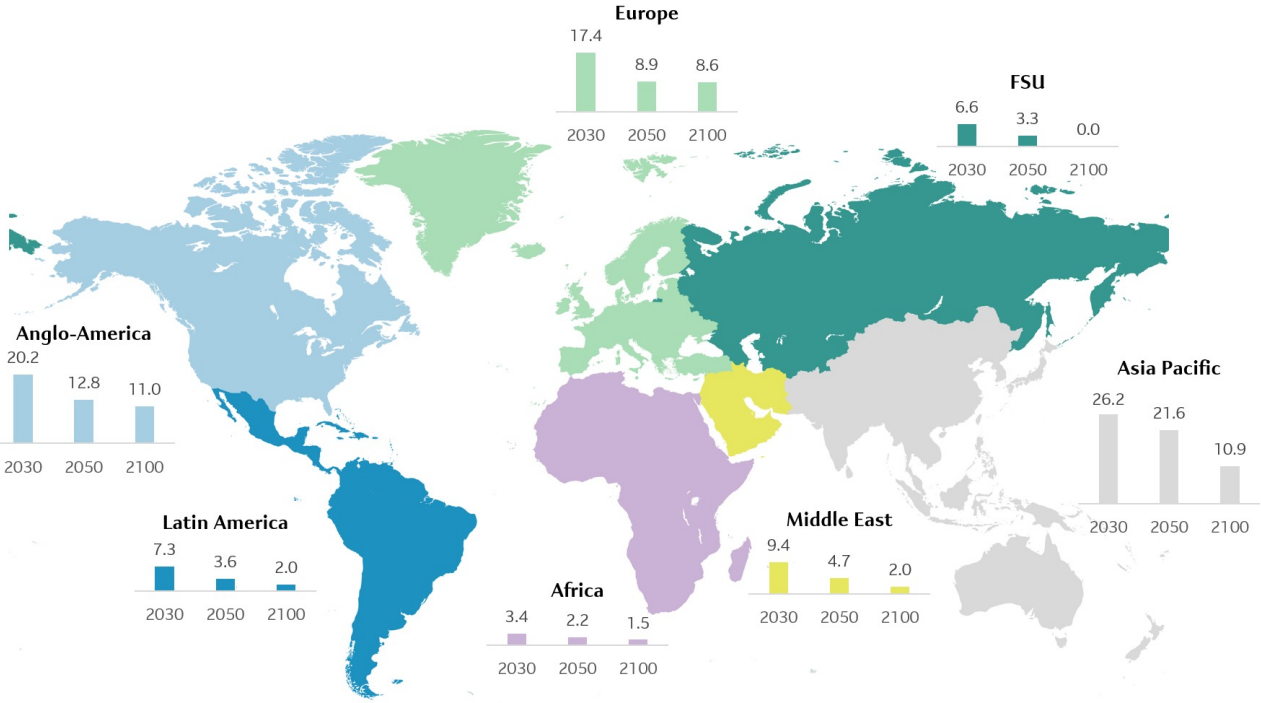
https://doi.org/10.1016/j.energy.2022.124451

"… in **the full-century scenario** Africa and Latin America produce more oil before 2050... … in **the peak budget scenario**, Africa and Latin America gain importance as remaining oil producers in 2100, which only apparently may seem good, as this maintains these regions as suppliers of a primary energy that no longer represents the standard energy of the global system, while roughly delays their revenues for the end of the century."

Besides...

While some existing refineries close reducing the total world crude oil throughput, greenfield refineries are still needed, mostly focused on hydrocrackers for medium distillates and/or petrochemical naphtha

Refinery capacities (Mbpd) per region in the full-century scenario



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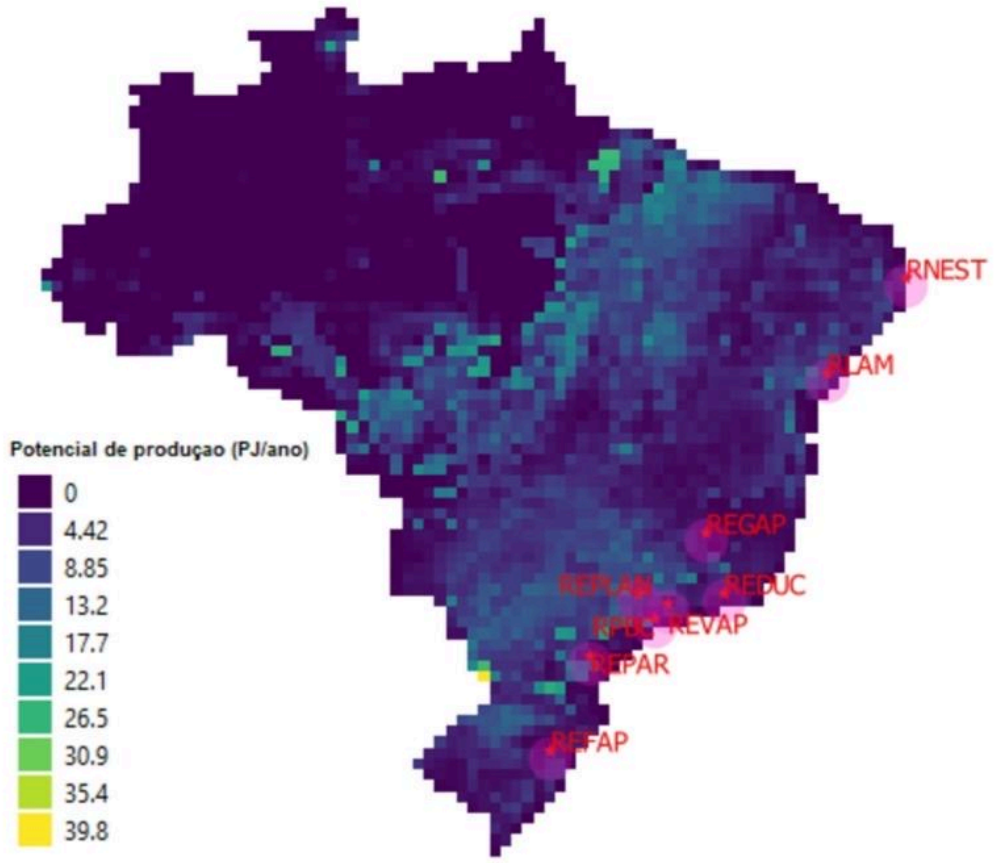
O SETOR DE ÓLEO E GÁS BRASILEIRO EM UM CONTEXTO DE EMISSÕES LÍQUIDAS NULAS (NET ZERO EMISSIONS)

https://www.ibp.org.br/personalizado/uploads/2022/08/relatorio-ibp-cenergia-coppe.pdf

Elaborada pelo Laboratório Cenergia/PPE/COPPE/UFRJ



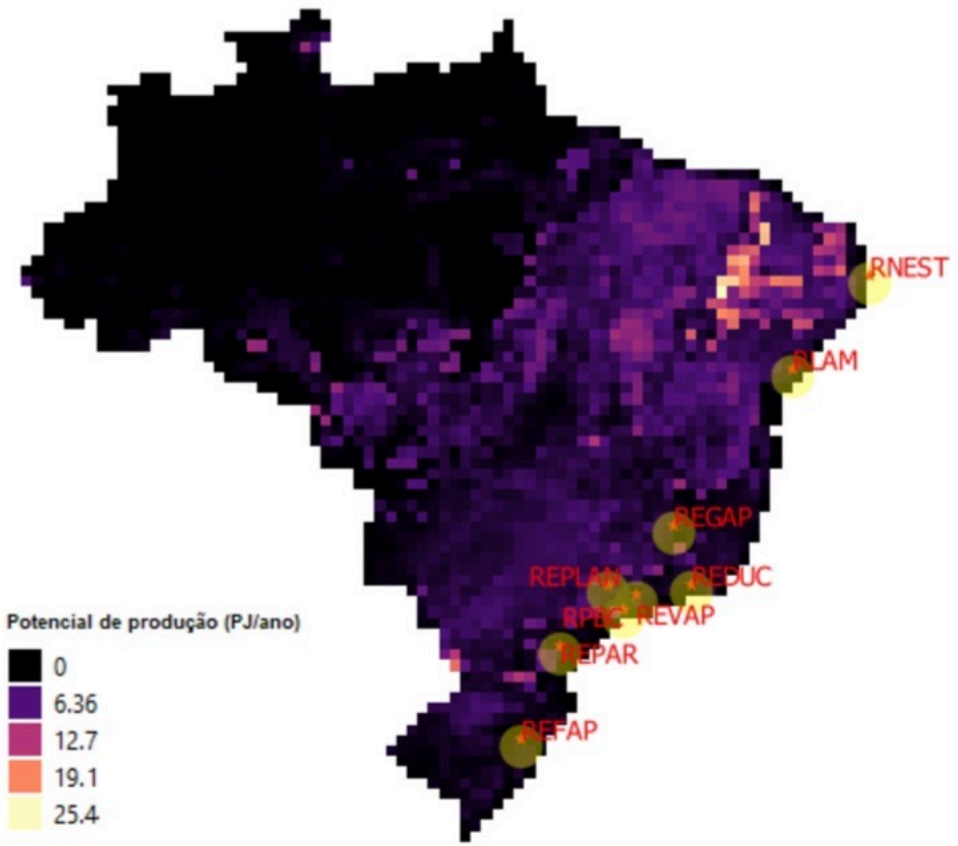
Petroleum refineries and woody biomass potential in 2050

Using data from Tagomori (2022)

PO in FCC units

Refinery	Cellulosic biomass demand (PJ/year)	Potential in 2050 (PJ/year)	
		Radius of 50 km	Radius of 100 km
REPLAN (SP)	**24.7**	18.5	92.4
Refinaria de Mataripe (BA)	**30.9**	13.1	62.8
REVAP (SP)	**21.6**	7.6	27.4
REDUC (RJ)	**12.4**	2.1	16.7
REPAR (PR)	**16.2**	25.1	63,1
REFAP (RS)	**18.4**	14.7	42.2
RPBC (SP)	**15.4**	17.7	30,9
REGAP (MG)	**12.2**	6.8	33.5
RNEST (PE)	**-**	4.0	23.4

SVO in HDT



Refinery	Oilseeds demand (PJ/year)	Soy potential in 2050 (PJ/year)		
		Radius of 100 km	Radius of 200 km	Radius of 300 km
REPLAN (SP)	**169.5**	41.4	155.8	317.5
Refinaria de Mataripe (BA)	**77.7**	18.9	84.6	308.1
REVAP (SP)	**95.4**	11.6	86.0	221.9
REDUC (RJ)	**74.2**	9.9	56.7	146.0
REPAR (PR)	**94.0**	26.5	97.1	244.0
REFAP (RS)	**79.1**	16.9	61.9	151.3
RPBC (SP)	**113.0**	15.5	64.5	197.6
REGAP (MG)	**98.7**	33.6	138.1	324.3
RNEST (PE)	**91.8**	15.6	102.2	256.8

REPAR, REFAP and REGAP already have units authorized to operate with SVO. In our study of Pernambuco, we have also evaluated UCOs and biomethane (in HGU) in RNEST. In REFAP we have studied e-H_2 + oxyfuel FCC w/CCU (paper published).

BLUES has soft links with **ORION** (Least-cost refinery model) **and BLOEM**.

Coprocessing and retrofit have been an usual decision for the transition phase.

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“all models are wrong but some are usefull” G. Box

“most people use statistics like a drunk man uses a lamppost; more for support than for illumination” A. Lang

How can research support better consideration of cross-scale linkages in decision-making?

PLANO DE DESCARBONIZAÇÃO DE **PERNAMBUCO**

CRESCIMENTO ECONÔMICO E BEM-ESTAR COM A DESCARBONIZAÇÃO

6% maior

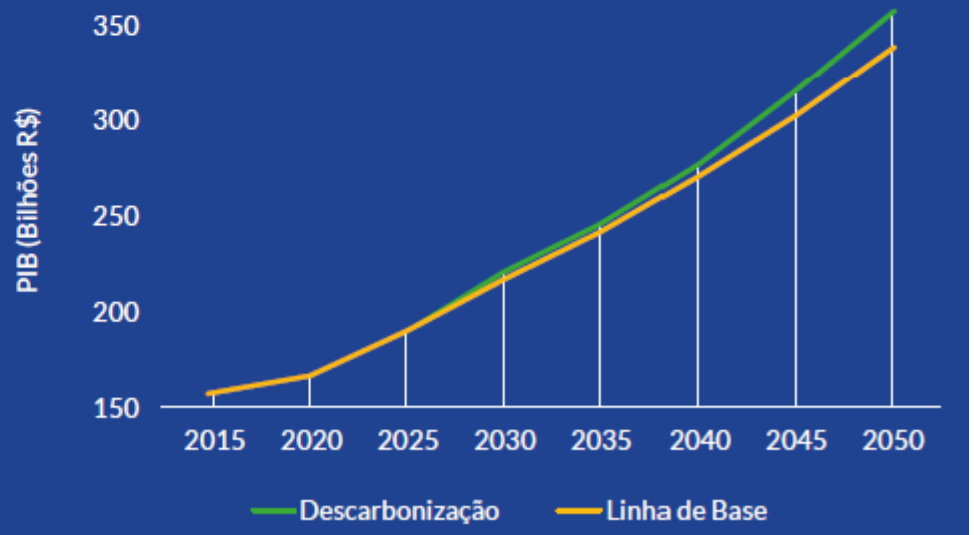
O PIB acumulado no cenário de descarbonização

R$20 bilhões a mais

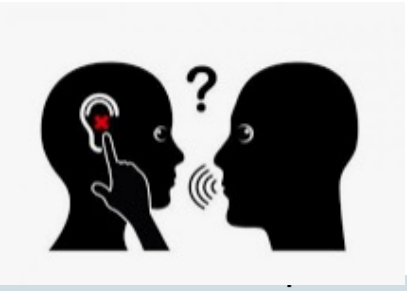
A projeção do PIB de PE em 2050 no cenário de descarbonização

R$30 bilhões a mais

O consumo das famílias de PE em 2050 no cenário da descarbonização



Communicate!



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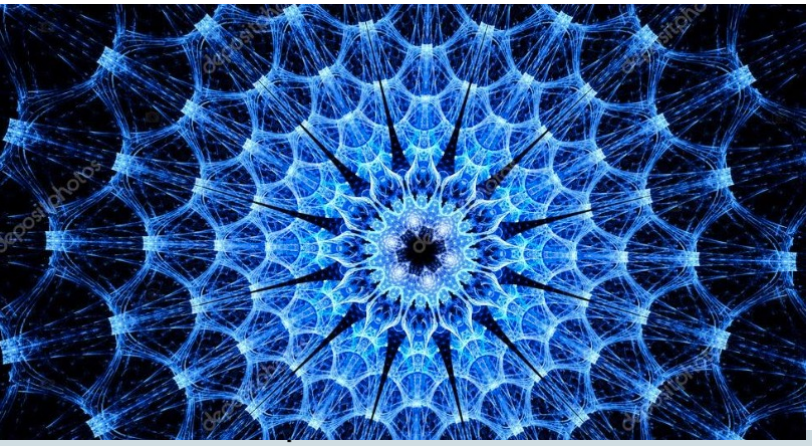
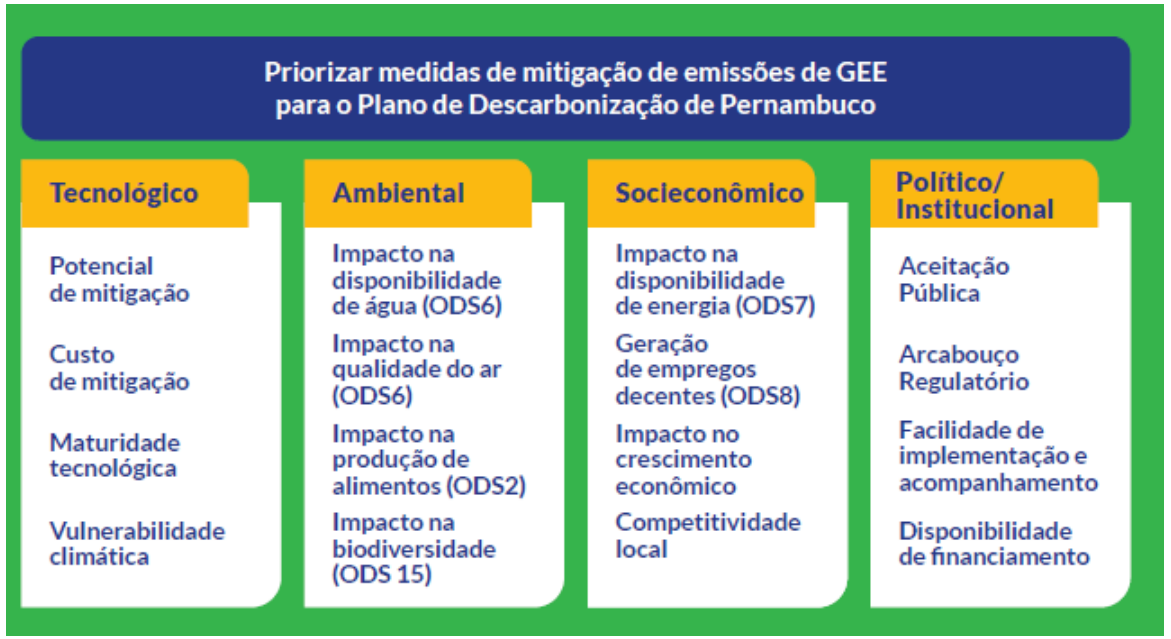
PLANO DE DESCARBONIZAÇÃO DE **PERNAMBUCO**

Decision has multiple Dimensions





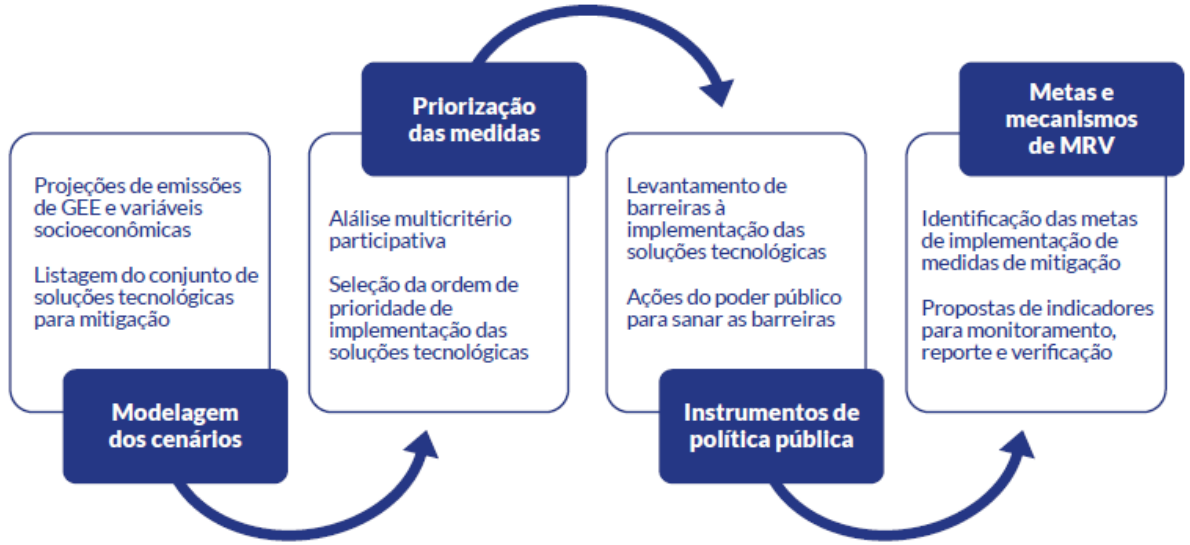


Figura 2. Esquema metodológico de construção do PDPE.

PLANO DE DESCARBONIZAÇÃO DE
PERNAMBUCO

» INDICADORES

Excelente / Muito positivo
Bom / Positivo
Regular / Neutro
Ruim / Negativo
Pésssimo / Muito negativo

	Tecnológico				Ambiental				Econômico				Político- Institucional			
	Potencial de mitigação	Custo de mitigação	Maturidade tecnológica	Vulnerabilidade climática	Impacto na disponibilidade de água	Impacto na qualidade do ar	Impacto na produção de alimentos	Impacto na biodiversidade	Impacto na disponibilidade de de energia	Impacto na geração de empregos	Impacto no crescimento econômico	Competitividade local	Aceitação pública	Arcabouço regulatório	Facilidade de implementação e acompanhamento	Disponibilidade de financiamento
Incentivo ao aumento de produtividade agrícola																
Promoção de sistemas integrados (com floresta plantada)																
Fomento ao manejo adequado de dejetos animais																
Fomento à intensificação e recuperação de áreas de pastagem																
Manutenção das estradas																
Promoção da condução econômica e eficiente (*eco-driving*)																
Implantação de tecnologias eficientes em atividades de suporte portuário																
Promoção de eco-driving em atividades de suporte portuário																
Incentivo à micromobilidade compartilhada																
Eletrificação da frota veicular leve (carros e motos)																
Classificação da Solução tecnológica #1																
Classificação da Solução tecnológica #2																

» INDICADORES
Série de critérios
comparam os ben
desafios da imple
das diferentes alt
tecnológicas

Código de cores: a depender do indicador considerado, pode representar o desempenho ou o impacto da solução tecnológica na temática abordada.						
	Desempenho:	Excelente	Bom	Regular	Ruim	Péssimo
	Impacto:	Muito positivo	Positivo	Neutro	Negativo	Muito negativo

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Thank you!

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Full Professor

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