IV ELEVATE INTERNATIONAL STAKEHOLDER WORKSHOP

Forging a Net-Zero Future: Unlocking technological and economic innovations to bridge the implementation gap

Thursday, 6th of March

11:00 – 15:30 CET

Online(Zoom)

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Agenda

	Start Time	End Time	Agenda Item
Part One			**Transformative interventions to bridge the implementation gap**
	11:00	11:15	**Welcome and introduction to the event:** **How can we bridge the climate policy implementation gap?** *Detlef van Vuuren, PBL*
	11:15	12:00	**Delivering climate commitments: lessons from global and regional Scenarios + Q&A** *Elena Hooijschuur, PBL*
	12:00	12:25	**Context factors enabling effective sectoral climate policies** *Rahel Mandaroux, PIK*
	12:25	13:00	**Panel Discussion: obstacles and enablers for innovation towards net-zero** *Moderated by Elmar Kriegler, PIK*
	13:00	13:30	**Lunch**
Part Two			**Leveraging carbon pricing and international trade measures to achieve rapid decarbonization**
	13:30	13:50	**Unveiling the topics of the Interactive Sessions**
	13:50	14:40	**Assessing the economic implications of EU CBAM** *Zoi Vrontisi, E3M* **Exploring the distributional consequences of carbon pricing on households** *Jan Steckel, MCC/PIK*
	14:40	14:50	**Report back from Interactive sessions**
	14:50	15:20	**Discussion: What role do market-based and financial instruments play on the pathway to net-zero?** *Moderated by Detlef van Vuuren, PBL*
	15:20	15:30	**Closing remarks**

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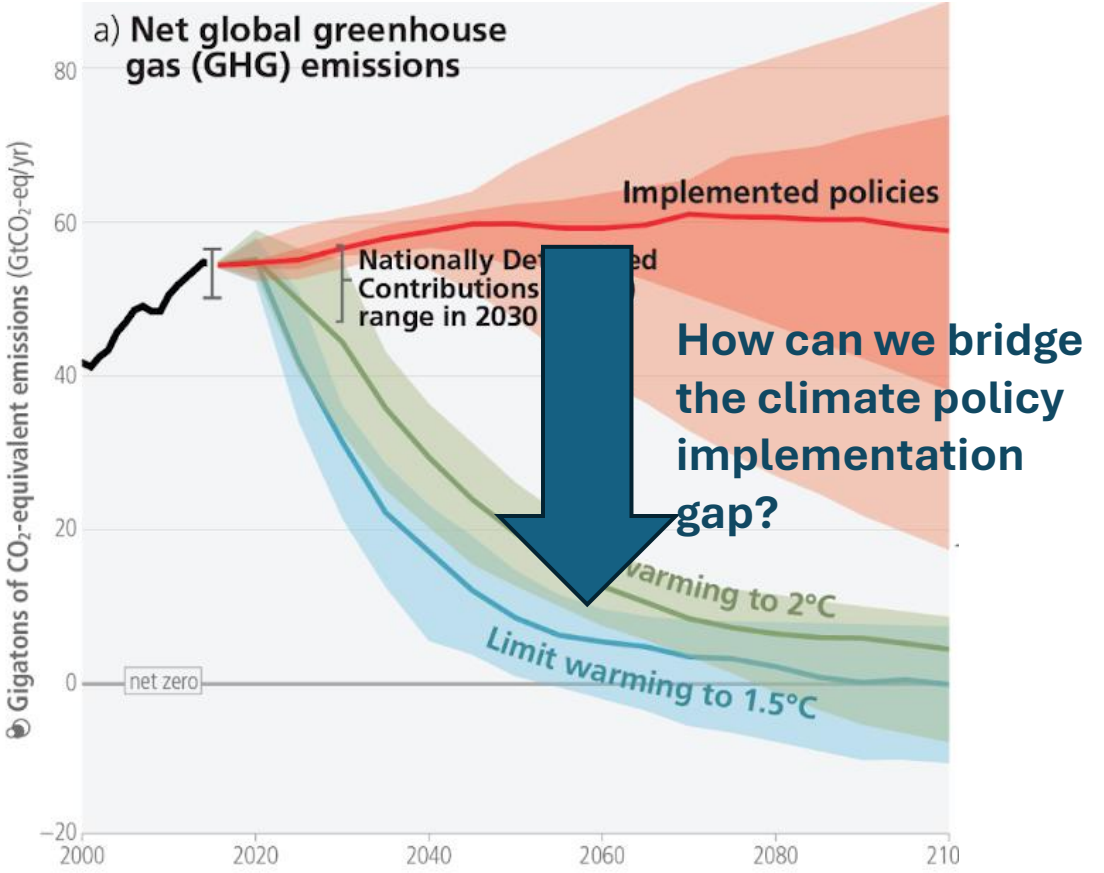
Detlef van Vuuren / Isabela Tagomori

Supporting international climate policy

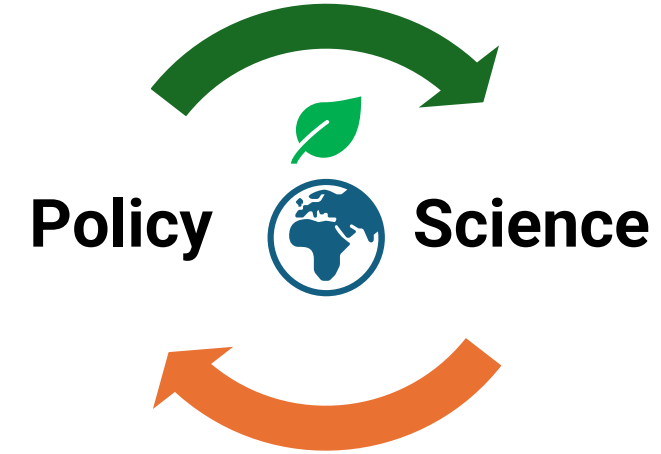
Stocktake… 2025

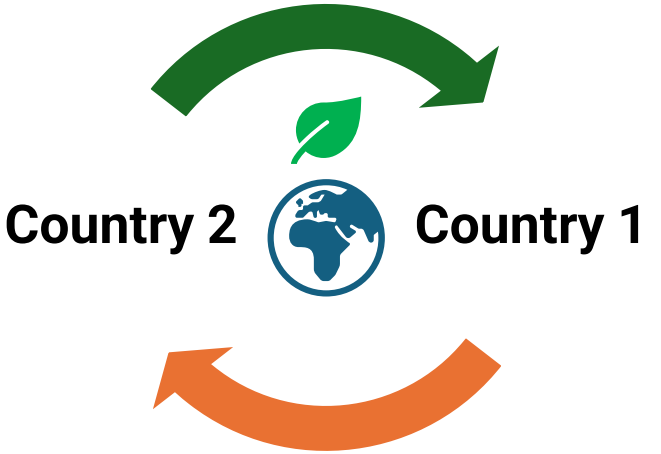
- In 2024, temperature was above 1.5 deg C (and temperature has been increasing rapidly in last few years)
- Climate impacts visible… and science shows that impacts become worse at higher levels
- Strong common interest in mitigating climate change
- Still large gap between current policies and pathways to 1.5 or well below 2 deg C.
- Emissions in 2024 increased….



ELEVATE's Objective

To develop transformative new scientific insights to support the preparations of NDCs and national climate policies focused on achieving net-zero emissions mid-century in line with the Paris Agreement





This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under grant agreement No 101056873.

ELEVATE's Objective

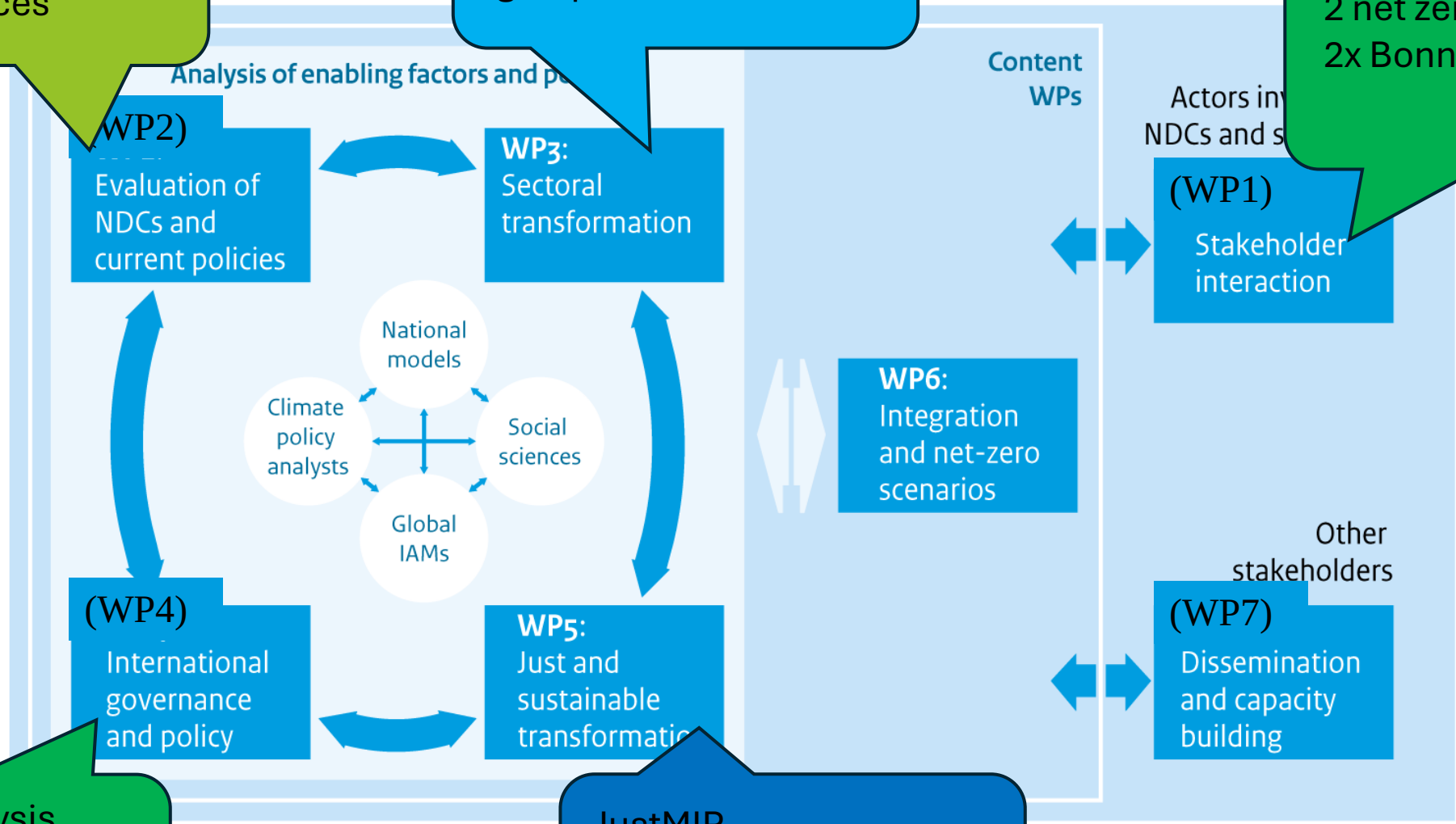
To develop transformative new scientific insights to support the preparations of NDCs and national climate policies focused on achieving net-zero emissions mid-century in line with the Paris Agreement

1. **interaction between researchers and stakeholders**
2. **Evaluation of policies and NDCs**
3. enhance understanding of the **technological & behavioural options** in different sectors
4. identify options to increase the effectiveness of **international climate governance and policy**;
5. represent **justice and sustainability** in climate mitigation pathways;
6. **develop a new national and global mitigation scenarios (focus on enabling factors)**;
7. **increase worldwide capacity for scientific support**

NDCs evaluation
Current polices
Good practices

Entry points for policies
Barriers per country group

2 net zero reports
2x Bonn, 1-2 COPs



Article 6 analysis
Governance of climate intervention

JustMIP
Sustainability Analysis

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Annual net-zero reports

2025

Low, S., Brutschin, E., Baum, C.M., Sovacool, B.K. (2025) **Expert perspectives on incorporating justice considerations into integrated assessment modelling** *Nature Climate Action*. https://doi.org/10.1038/s44168-025-00218-5

Pelz, S., Ganti, G., Pachauri, S., Rogelj, J., Riahi, K. (2025) **Entry points for assessing 'fair shares' in national mitigation contributions** *Environ. Res. Lett.* https://doi.org/10.1088/1748-9326/ada45f

2024

Baum, C.M., Fritz, L., Low, S. & Sovacool, B.K. (2024) **Like diamonds in the sky? Public perceptions, governance, and information framing of solar geoengineering activities in Mexico, the United Kingdom, and the United States.** *Environmental Politics*. https://doi.org/10.1080/09644016.2023.2301262

Calcaterra, M., Alelula Reis, Fragkos, P., Briera, , de Boer, H.S., Egli, F., Emmerling, J. Iyer, G, Mittal, S., Polzin, F.H.J., Sanders, M.W.J.L., Schmidt, T.S., , Serebriakova, A., Steffen, B., van de Ven, D.J. van Vuuren, D.P., Waldelich, P., and Tavoni, M. (2024) **Reducing the cost of capital to finance the energy transition in developing countries.** *Nature Energy*. https://doi.org/10.1038/s41560-024-01606-7

Missbach, L., Steckel, J.C., Vogt-Schilb, A. (2024) **Cash transfers in the context of carbon pricing reforms in Latin America and the Caribbean.** *World Development*, 173. https://doi.org/10.1016/j.worlddev.2023.106406

Nascimento, L., Godinho, C., Kuramochi, T., Moisio, M., den Elzen, M., Höhne, N. (2024) **Climate policy in 2023.** *Nat Rev Earth Environ*. https://doi.org/10.1038/s43017-024-00541-1 (The publication can be accessed here)

Tavoni, M., Andreoni, P., Calcaterra, M., Calliari, E., Deubelli-Hwang, T., Mechler, R.m Hochrainer-Stigler, S., Wenz. L. (2024) **Economic quantification of Loss and Damage funding needs.** *Nat Rev Earth Environ*, 5(411–413). https://doi.org/10.1038/s43017-024-00565-7

2023

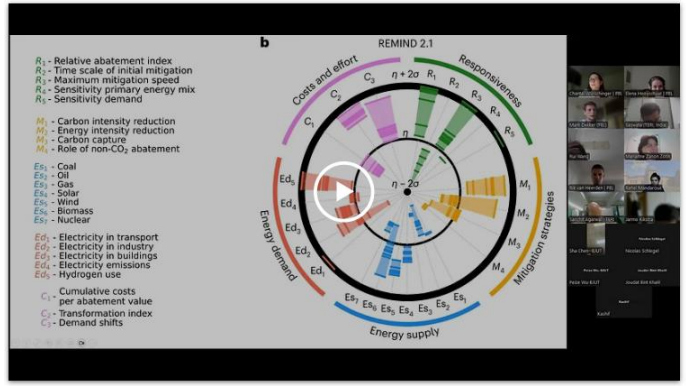
Alelula, L. & Tavoni, M. (2023) **Glasgow to Paris - The impact of the Glasgow commitments for the Paris climate agreement.** *iScience*, 26(2). https://doi.org/10.1016/j.isci.2023.105933

Manych, N., Müller-Hansen, F., & Steckel, J.C. (2023). **The political economy of coal across 12 countries: Analysing qualitative interviews with topic models.** *Energy Research & Social Science*, 101. https://doi.org/10.1016/j.erss.2023.103137

Nascimento, L. & Höhne, N. (2023) **Expanding climate policy adoption improves national mitigation efforts.** *npj Clim. Action*, 2(12). https://doi.org/10.1038/s44168-023-00043-8

Nascimento, L., den Elzen, M., Kuramochi, T., Woollands, S., Dafnomilis, I., Moisio, M., Roelfsema, M., Forsell, N., & Araujo Gutierrez, Z. (2023) **Comparing the Sequence of Climate Change Mitigation Targets and Policies in Major Emitting Economies.** *Journal of Comparative Policy Analysis: Research and Practice*. https://doi.org/10.1080/13876988.2023.2255151

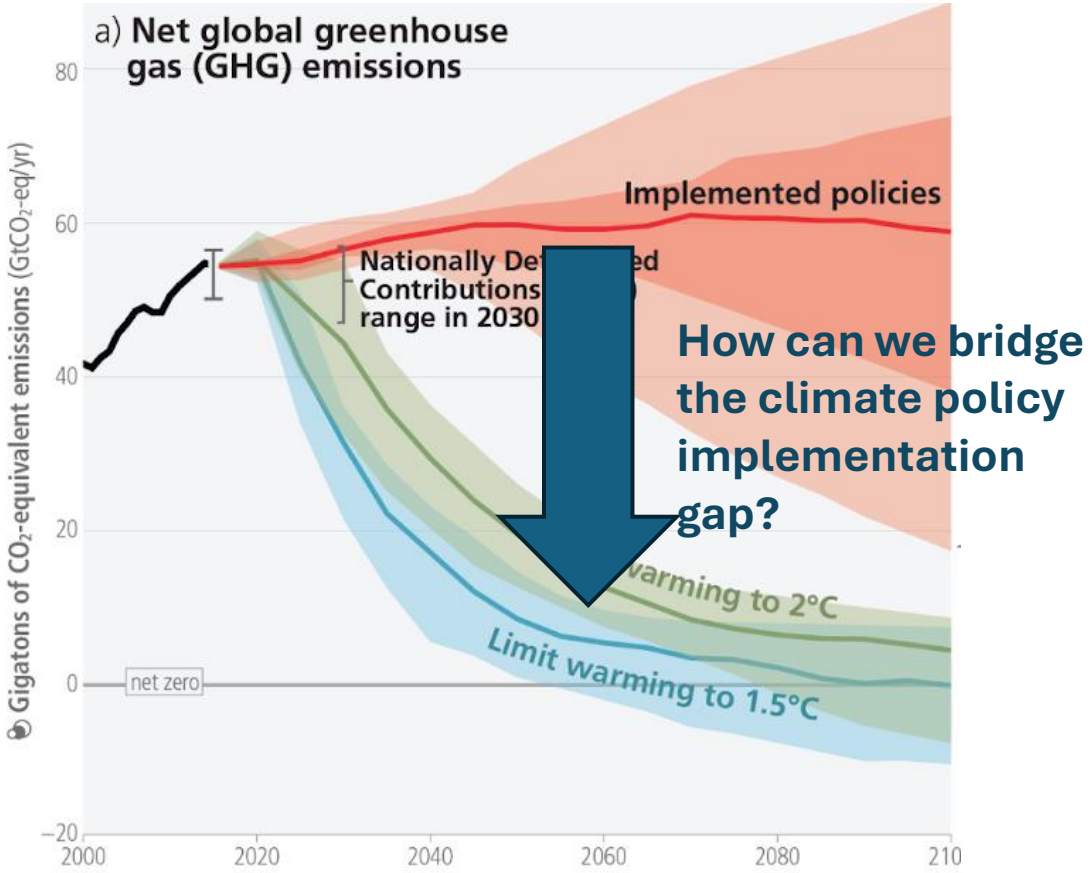
Ordonez, J. A., Jakob, M., Steckel, J. C., & Ward, H. (2023). **India's just energy**



Major challenges in international climate policy

- Complicated negotiations at the COP, related to justice, ambition and rate of mitigation… and finance
- New government in the USA will withdraw from UNFCCC/Paris and also withdraw the NDC
- Increasing geopolitical tensions / trade restrictions might have important consequences for climate policy
- Yet, climate problem accelerating… and it is still in the joint interest of everybody (economically) to stay as close to 1.5 deg C as possible.

Agenda



- Current policy scenarios
- Context factors that enable sectoral climate policies
- International governance: CBAM, Carbon pricing policies
- What can market instruments help?

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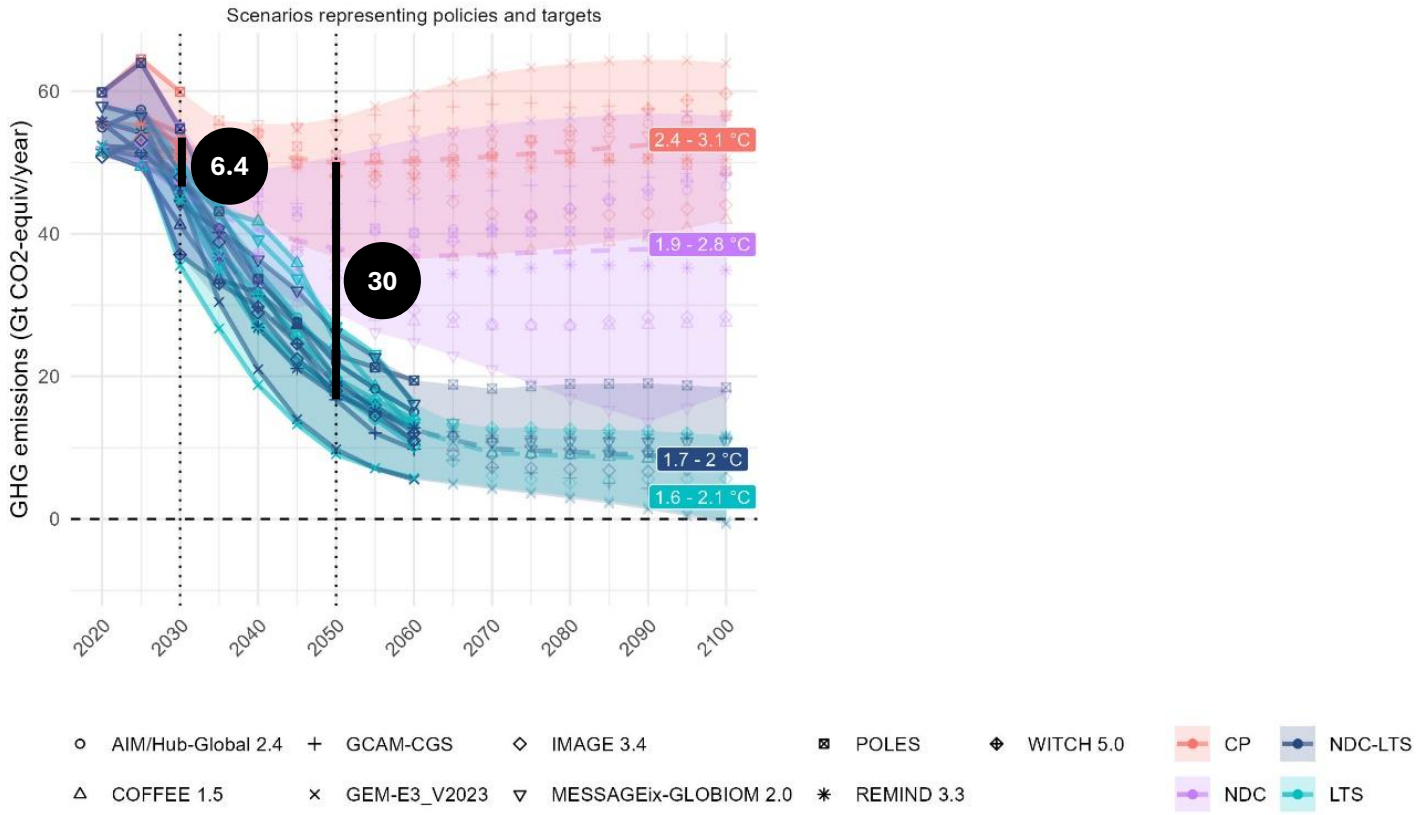
ELEVATE - ENABLING AND LEVERAGING CLIMATE ACTION TOWARDS NET ZERO EMISSIONS

Delivering Climate Commitments: Lessons from Global and Regional Scenarios

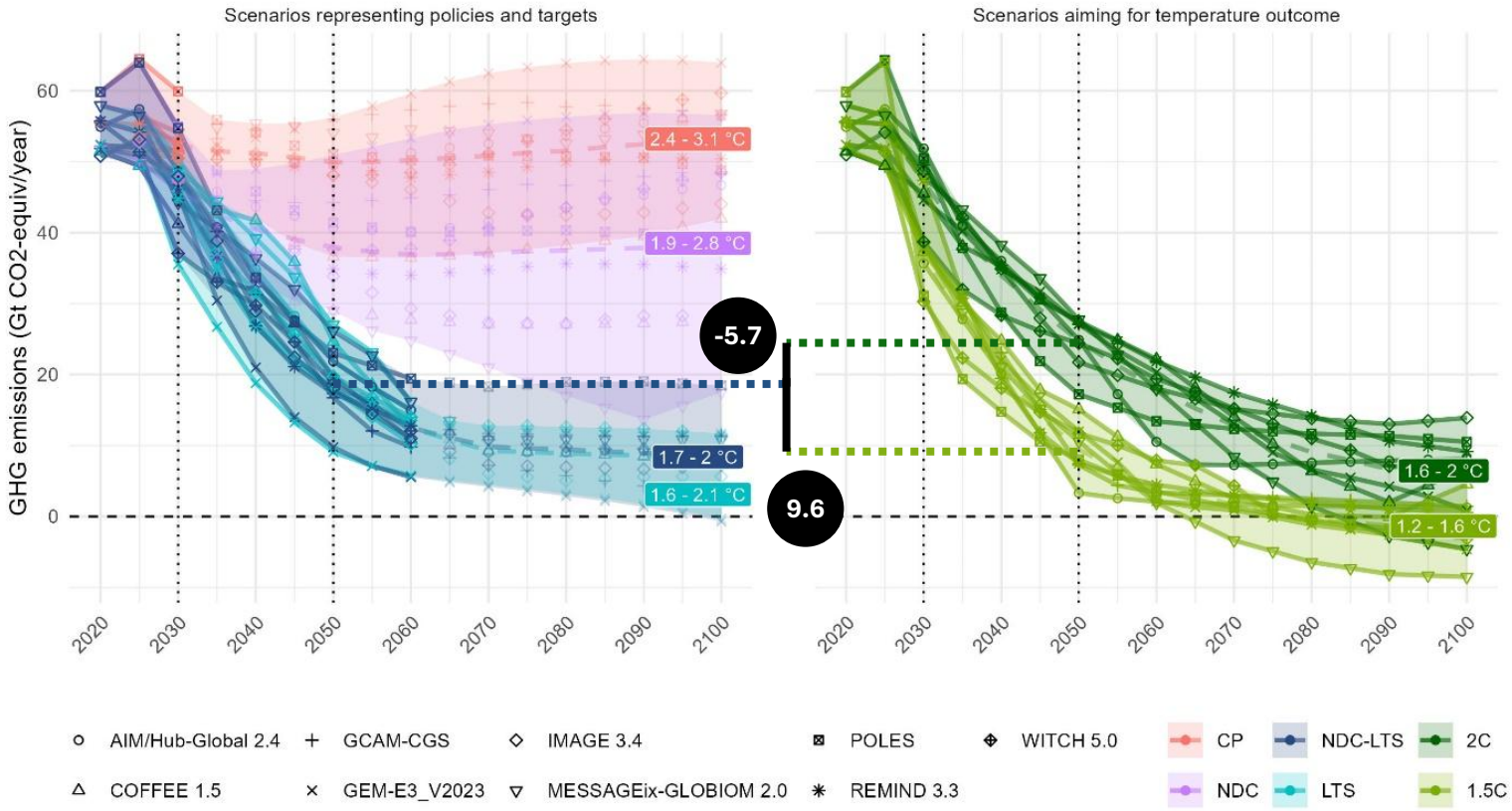
Elena Hooijschuur

ELEVATE 4th International workshop – March 6th 2025

Implementation gaps are still significant



Ambition by 2050: between 1.5 and 2 °C



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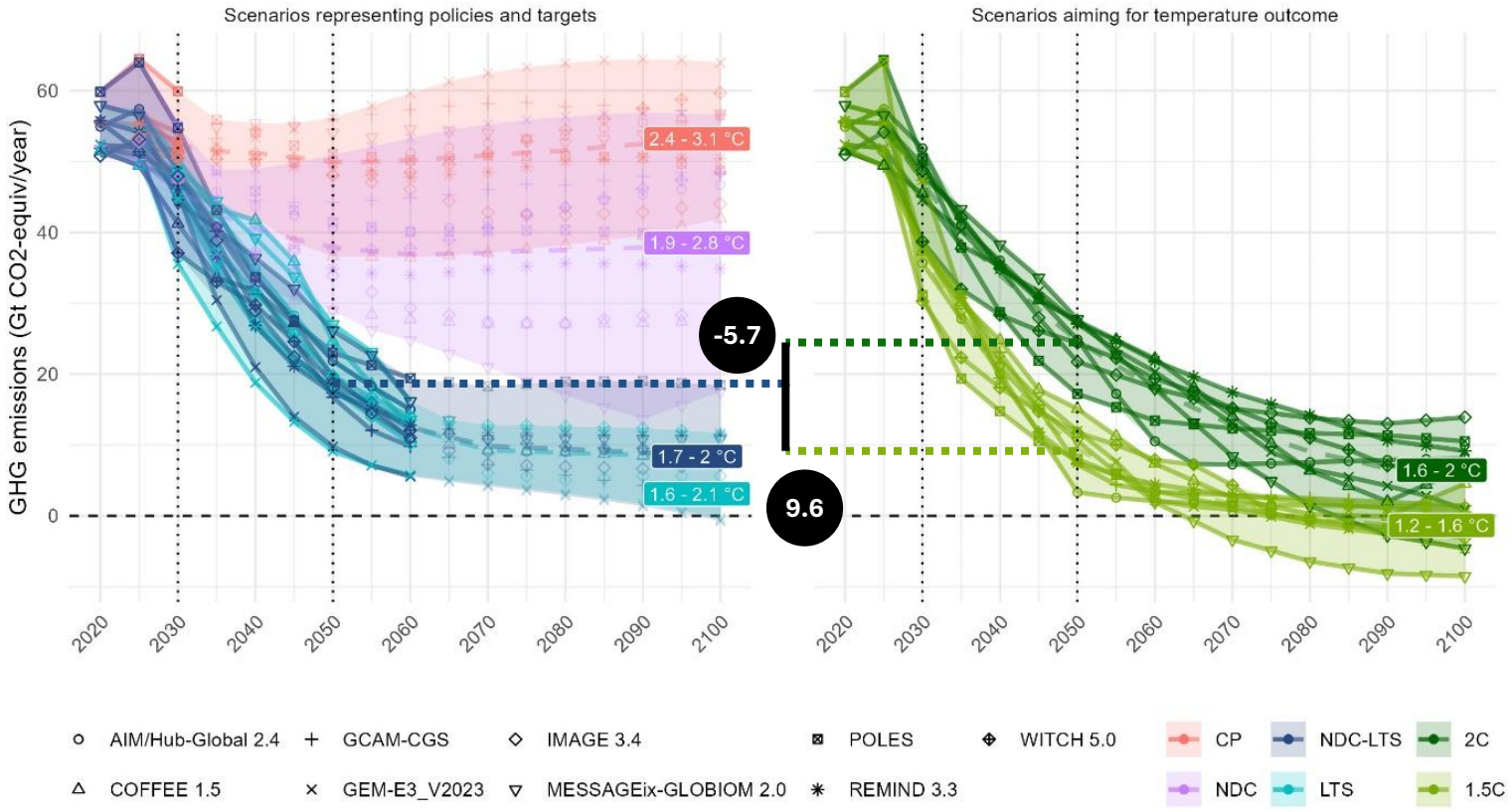
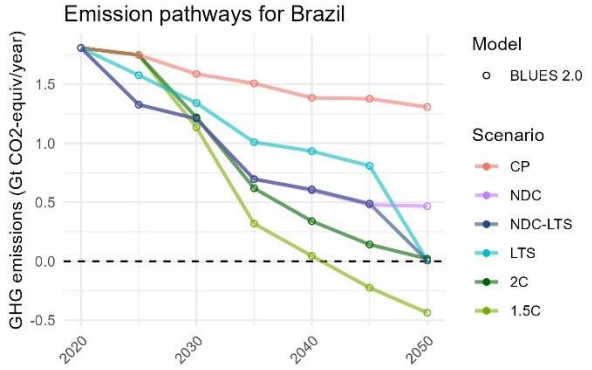


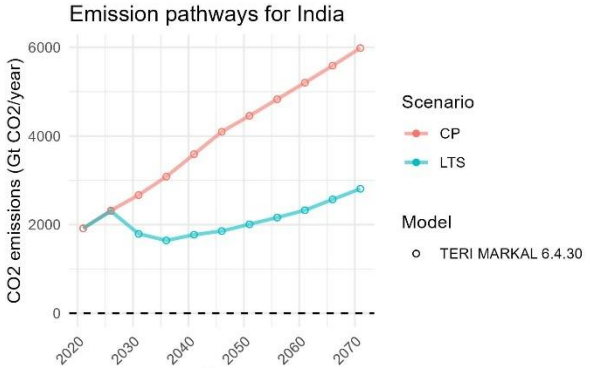
ELEVATOR Pitch: Uncertainty of Net-Zero Emissions Formulations

- Delayed action
- Emission scope (especially CH4 and N2O)
- Conversion metrics
- Negative emissions

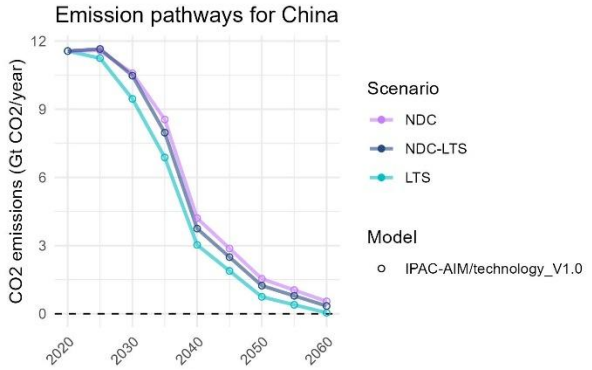
Primary energy use



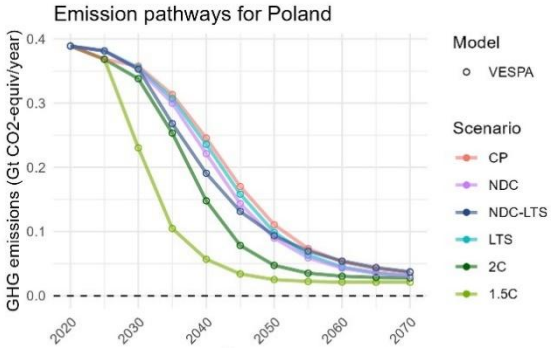
- **Brazil's AFOLU sector** transitions from largest emitter by 2020 to main mitigator by 2050 across scenarios



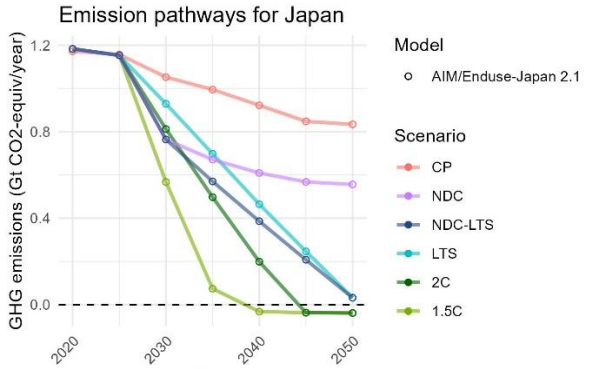
- **India's** LTS scenario shows a significant increase in **demand for clean energy** by 2070 and a phasedown of coal and natural gas



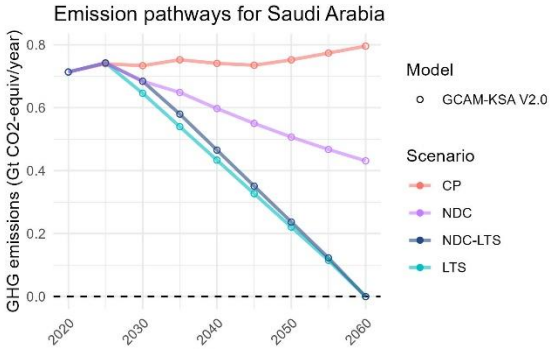
- For **China** to reach its targets, scenarios show a critical role of **CCS technologies** in the energy sector by 2060.



- **Poland's use of coal for heating** is significantly reduced across scenarios by both increased use of biomass and natural gas, and reduced demand



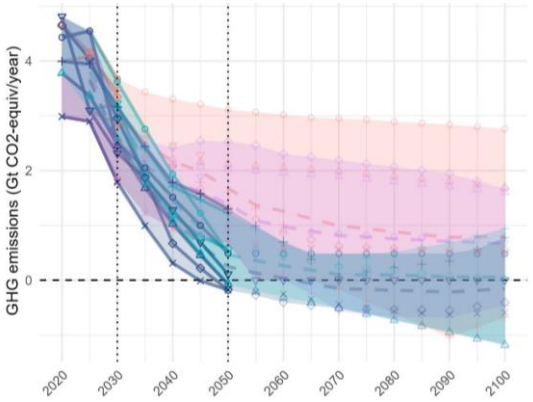
- **Japan's electricity sector** shows largest emission reductions in the 2°C scenario - the 1.5°C scenario depends on higher electrification combined with CCS and DACs.

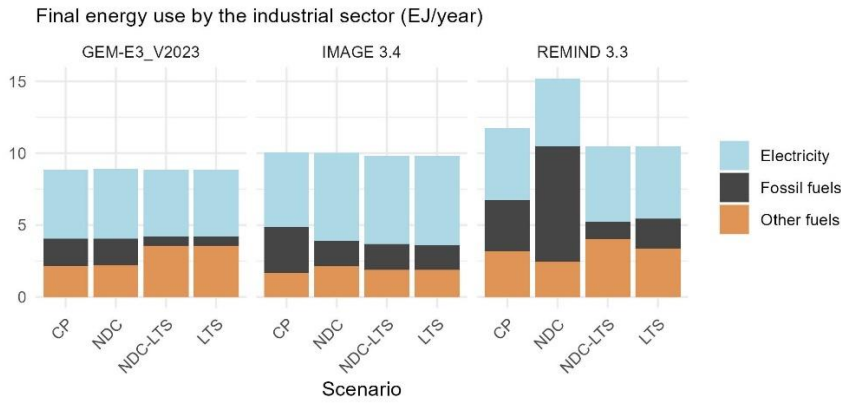


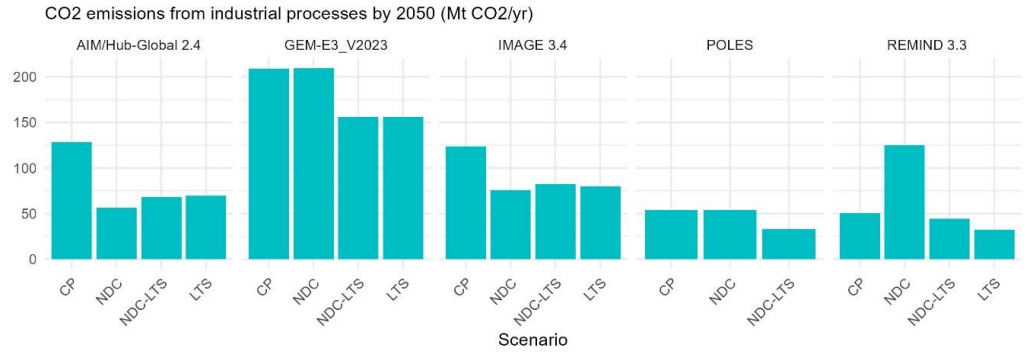
- Next to renewable and clean energy technologies, **Saudi Arabia's** LTS scenario projects implementation of **CDR measures** to reach net-zero by 2060

Fossil fuels in industry by 2050 (net-zero year) for EU and USA

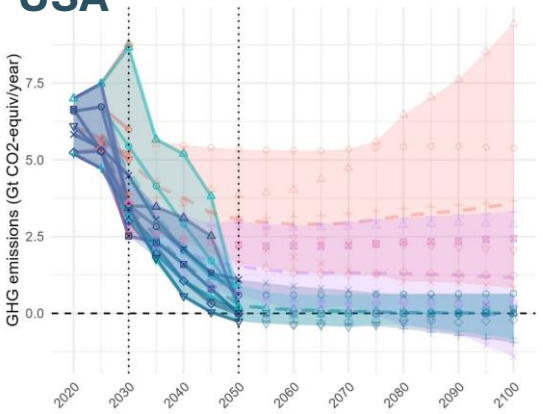
Europe

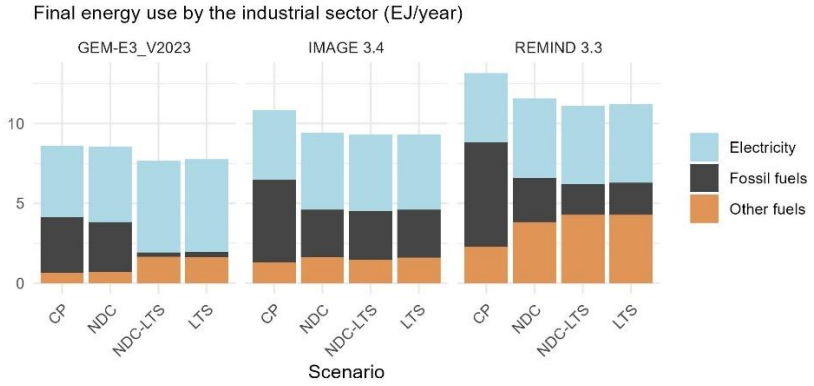


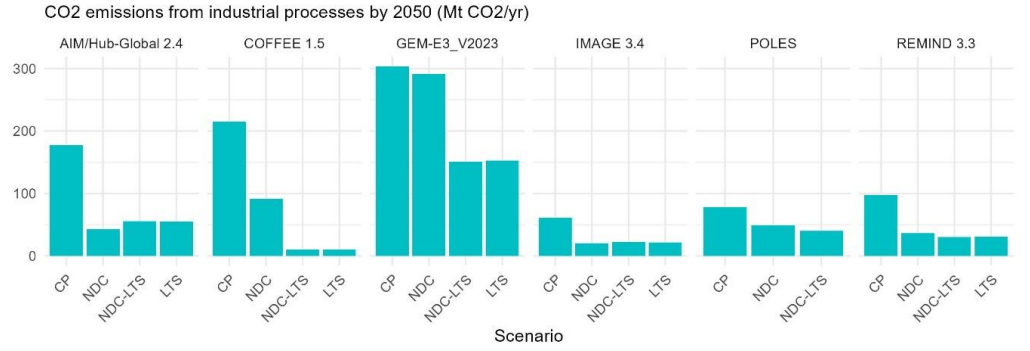




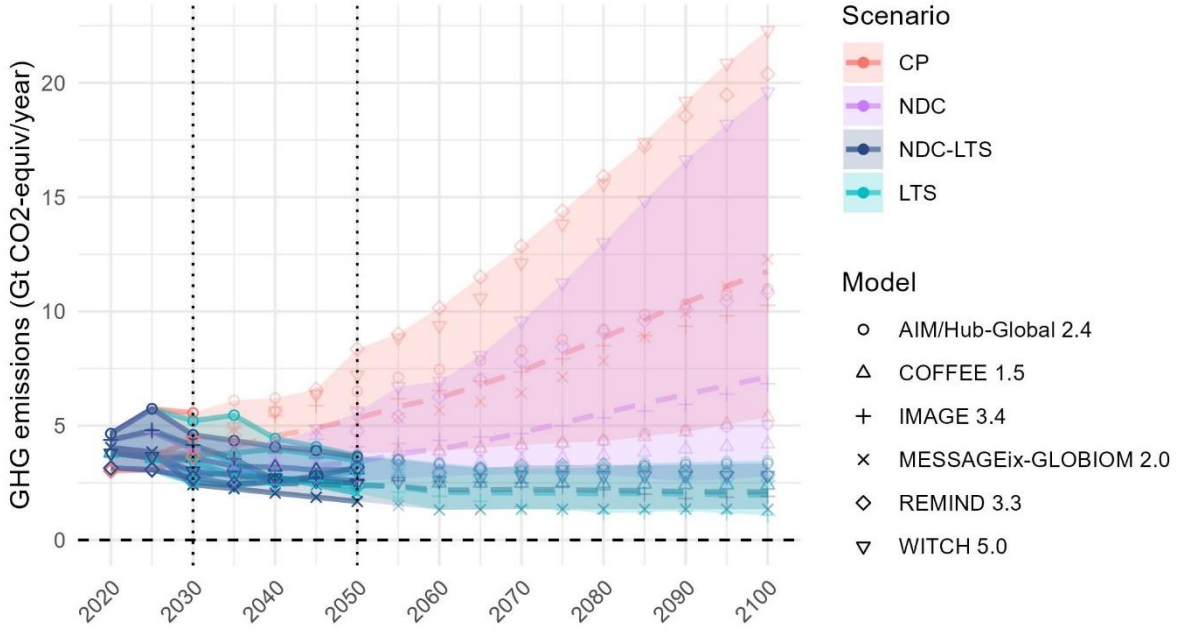
USA

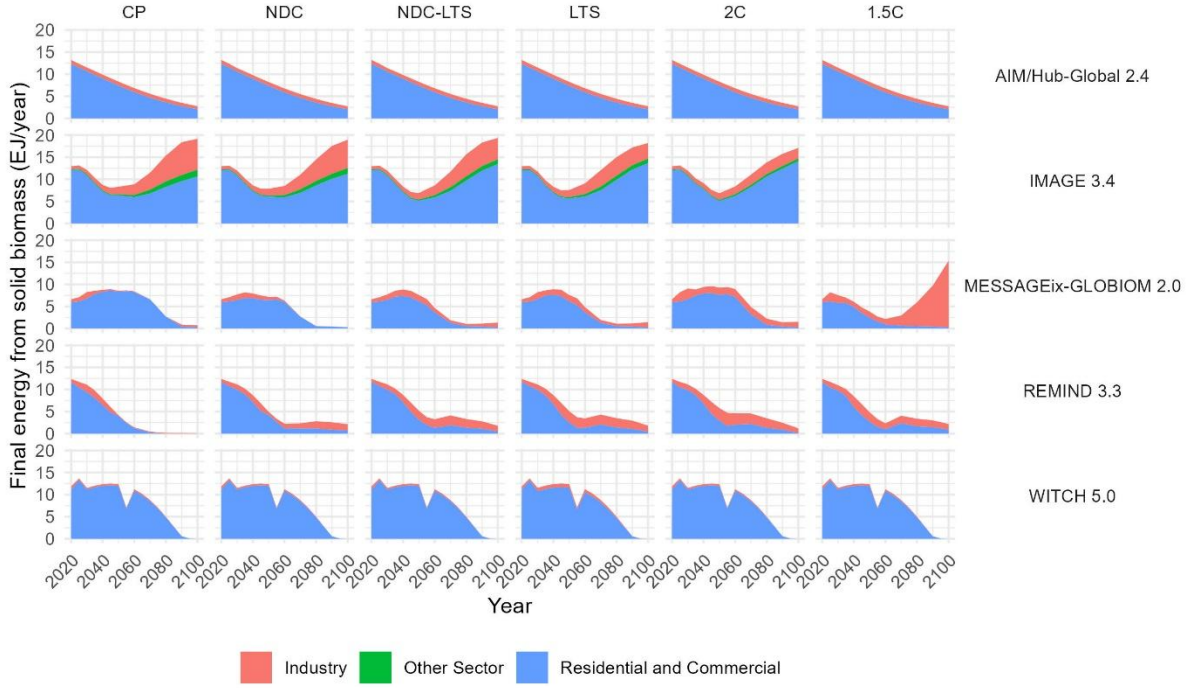




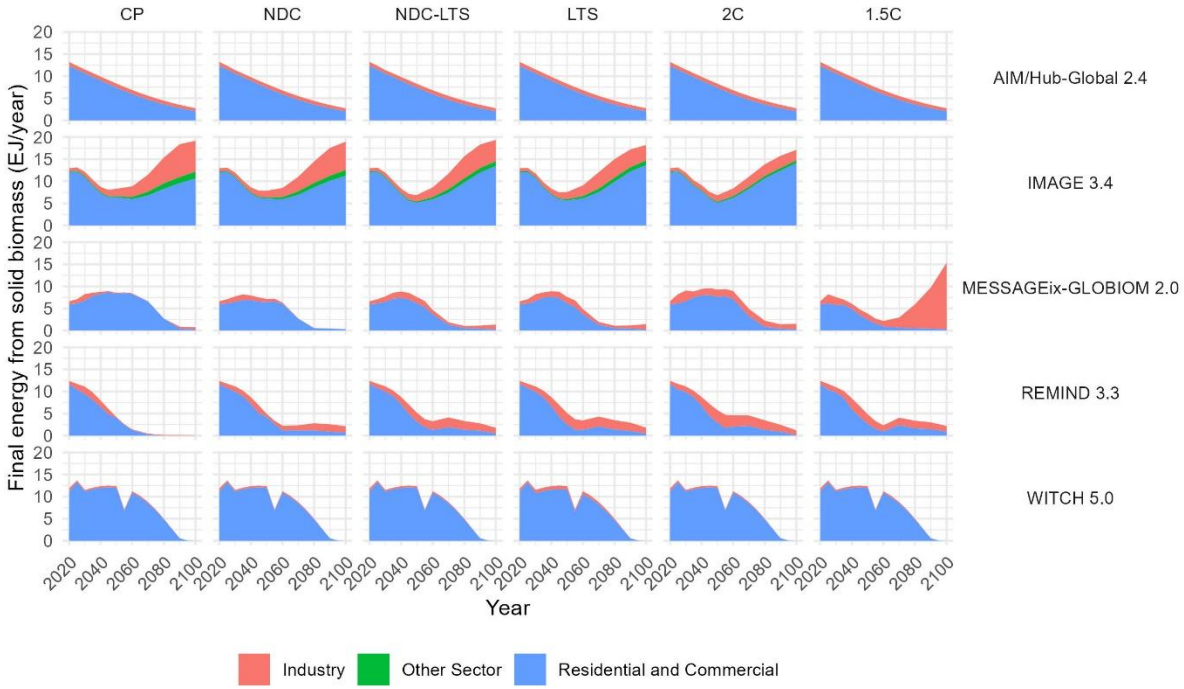


African region: solid biomass use





Solid biomass substituted by electricity in residential sector



What do you think?

- How can these results help you in working on the transition to net-zero?
- How could results help you better?
- How is your country currently working to bridge the implementation gap?

Thank you for your attention

Elena Hooijschuur

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Disclaimer

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Discussion

How can these results help your country in transitioning to net-zero?
How is your country working to bridge the implementation gap?

Respondents:

- **Maciej Cygler**, Chief Expert, National Centre for Emissions Management (KOBiZE) Poland
- **Veena Balakrishnan**, Co-Founder, Youth Negotiator Academy (India)
- **Gabriel Kapka**, Deputy Director-General and UNFCCC National Focal Point, Sierra Leone Meteorological Agency (Sierra Leone)

Moderator: Isabela Schmidt Tagomori, ELEVATE researcher (PBL)

ELEVATE - ENABLING AND LEVERAGING CLIMATE ACTION TOWARDS NET ZERO EMISSIONS

Context factors enabling effective sectoral climate policies: A taxonomy of entry points

Rahel Mandaroux

IV ELEVATE International Stakeholder Workshop, 6 March 2025

Context factors enabling effective sectoral climate policies: A taxonomy of entry points

Which combinations of policy instruments and enabling factors are identified in the literature as contributing to the deployment of mitigation technologies or transitioning away from fossil fuels?

Article search

Database: Web of Science & Scopus

Search terms: SPIDER framework

Sample of 7,997 potentially relevant articles

Article screening

In- and exclusion criteria

Abstract screening: manually screened 2,924

Full-paper screening: authors 207

Data extraction of 89 articles

Coding of qualitative topics (motivation, context, entry) & measurements of policy effectiveness

Brutschin et al., (2021) classification of enablers/barrier.

Synthesis

Entry point grouping by qualitative classification of central policy strategies.

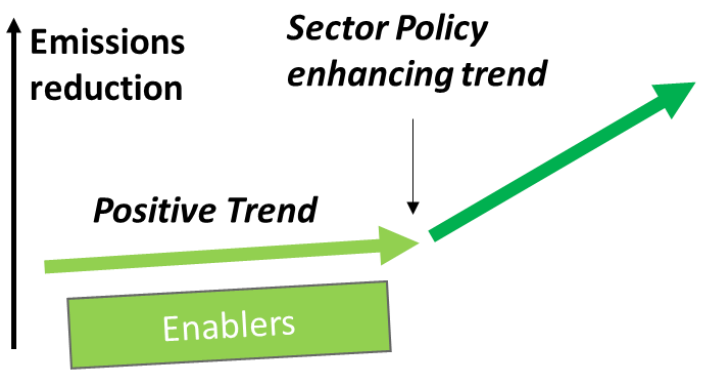
Robustness checks by random forest predictability clustering measure.

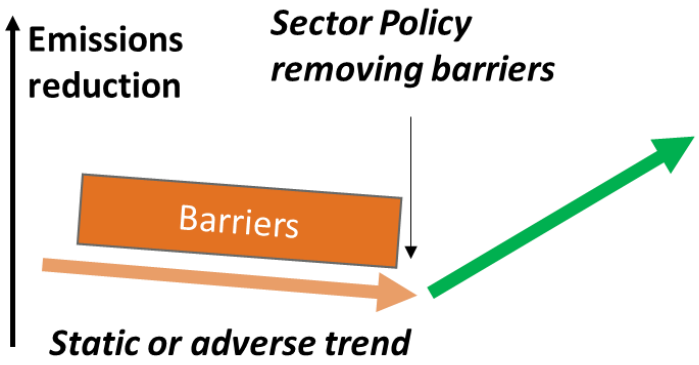
Terminology and definitions

Context factors – enablers / barriers: enablers that make the policy possible / barriers the policy addresses

Entry: (policy) intervention

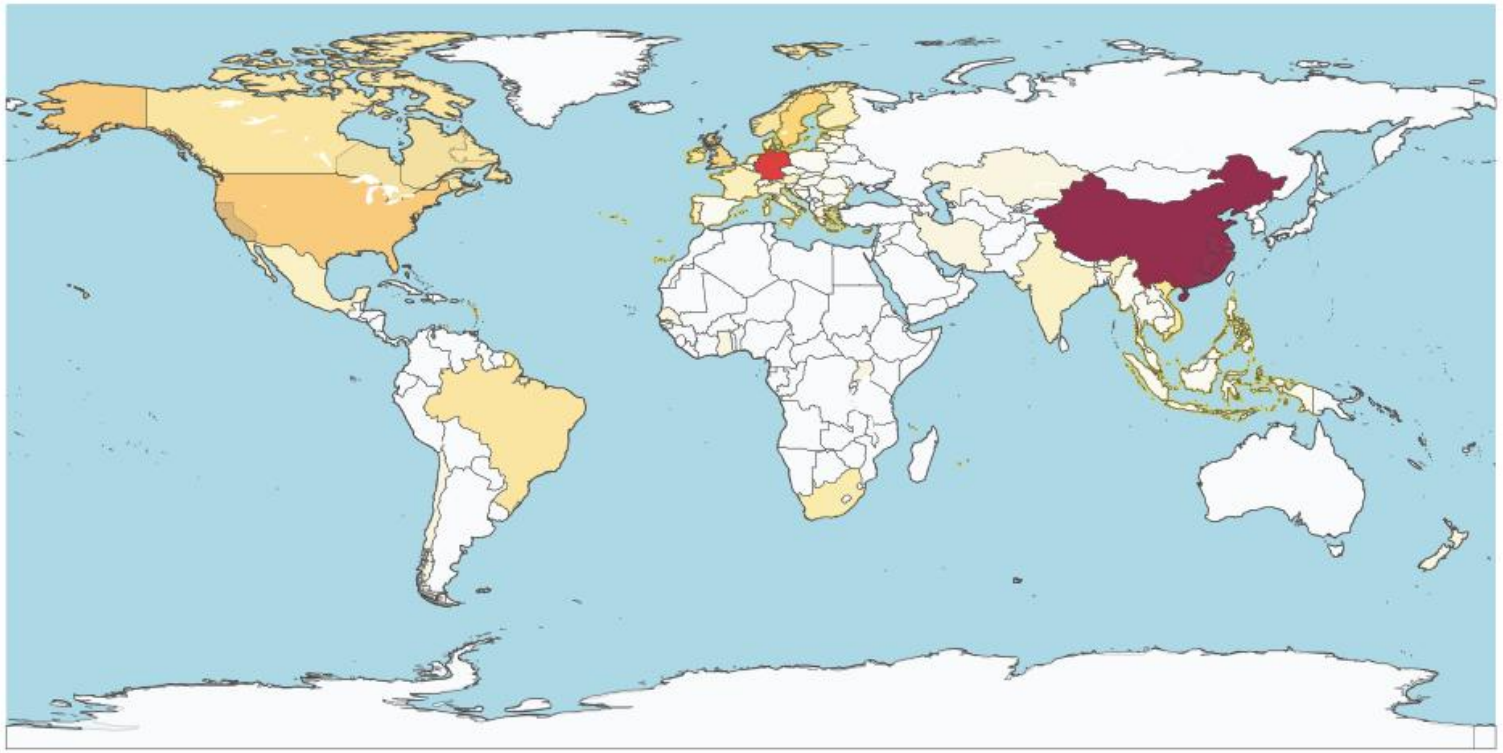
Entry point: context-specific opportunity to overcome a barrier or leverage an enabler for sectoral decarbonization through a policy intervention





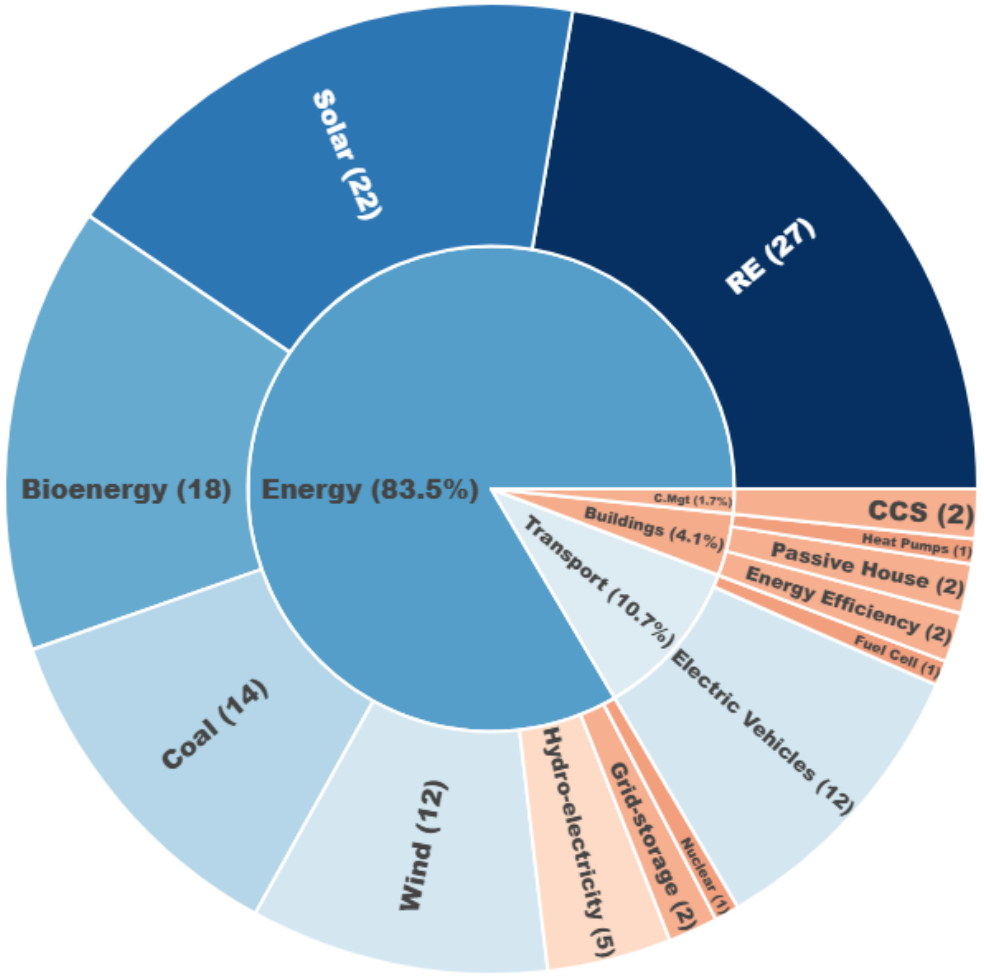
Regional coverage

Frequency of research by region



- Cases of effective climate mitigation policies
- National and state policies
- Scarce report for East Asia and South America despite high-impact climate policies

Sector and technology coverage



Legend

RE: Renewables General
CCS: Carbon Capture and Storage
CMgt: Carbon Management

Assessment groups

- RE (wind, solar)
- Coal
- Transport
- Buildings
- Bioenergy
- Less studied technologies (CCS, Hydro, Grid, Nuclear)

Sectoral policy strategies: Solar and Wind (I)

Instrumentalists

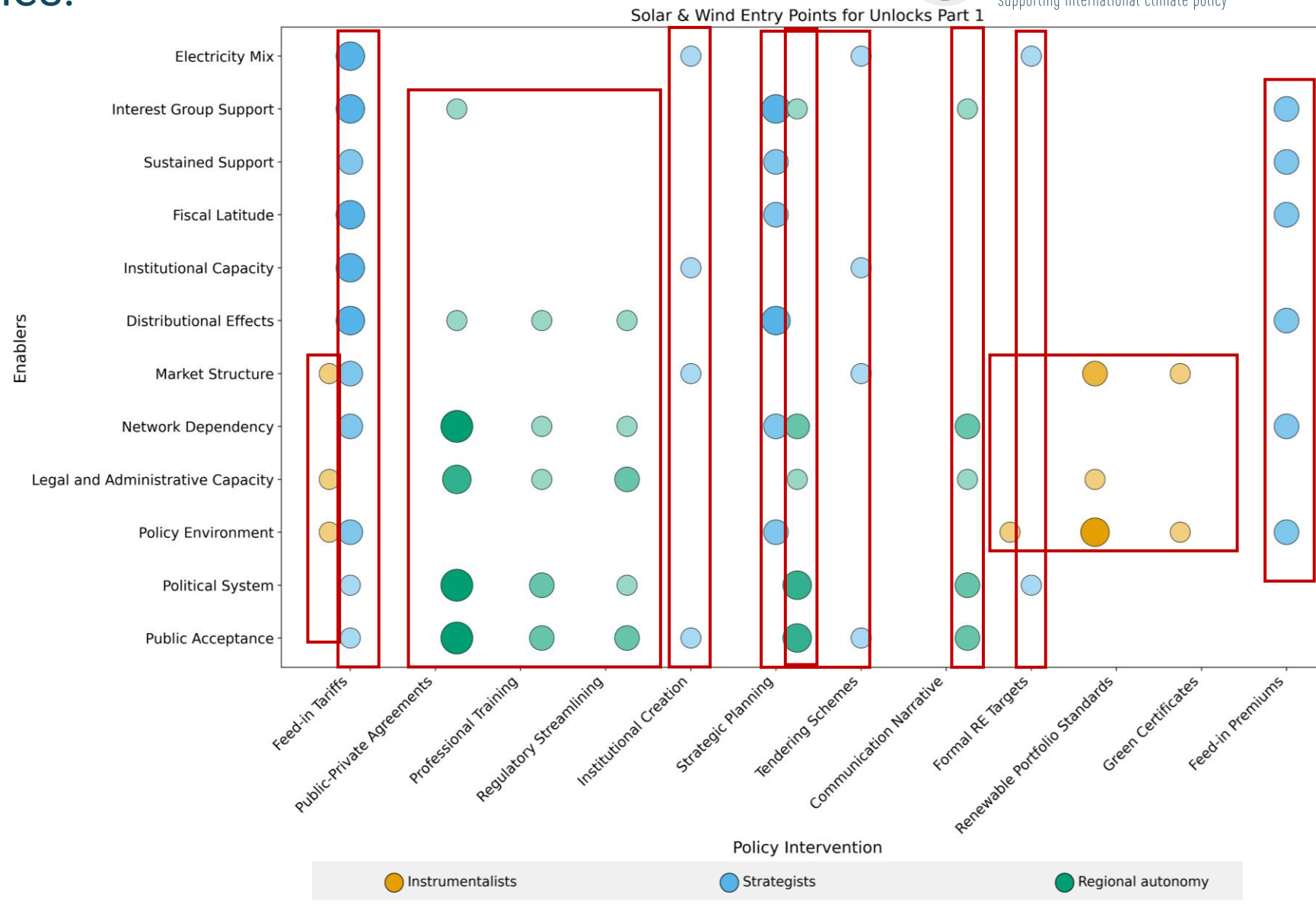
- Rely on liberal market structure and mature financial markets for economic and regulatory instruments (RPS & certificates).

Strategists

- Long-term policy planning using FiTs or premiums enabled by institutional capacity, interest group support and a decentralized power market.

Regional autonomy

- Local authorities utilize their engagement e.g., by regional subsidies, grid integration, and community-based energy projects.



Sectoral policy strategies: Solar and Wind (I)

Planners

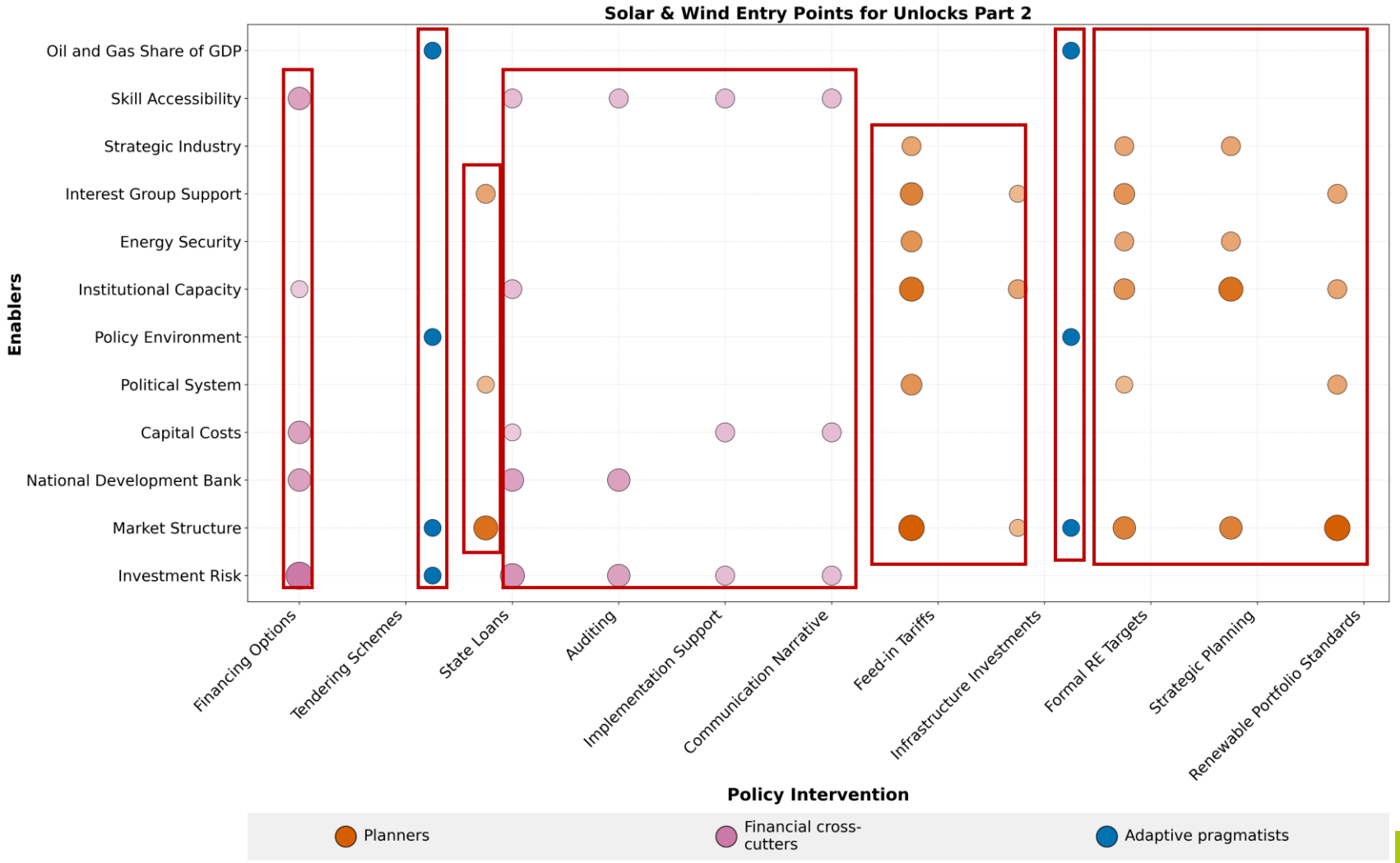
- Centrally planned or coordinated economies rely on top down approach with a high degree of public involvement in the energy sector.

Adaptive pragmatism

- RE as opportunity for economic growth and additional capacity for rising energy demand rather than as substitute for fossil energy.

Financial cross-cutters

- Refers to financial entry points providing stable, low-risk financing, such as through a national development bank.

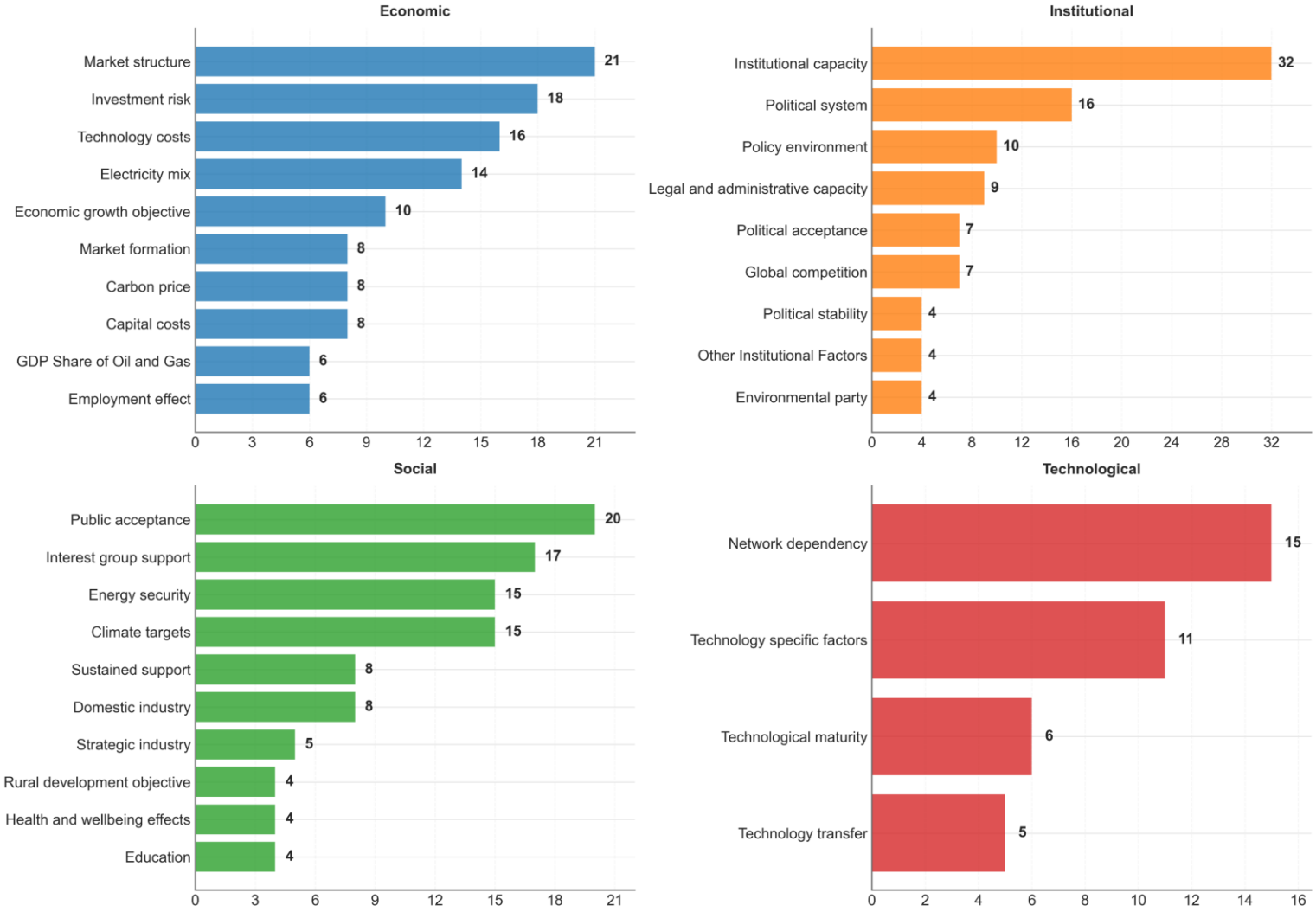


Mentimeter exercise

What are the most important factors for effective climate policy in your country?

To participate, please scan the QR code with your phone or follow the link in the chat.

Top Enablers by Dimension



Geographic Dimension omitted (single enabler: Resource Availability, 20 occurrences)

ELEVATE WEBSITE

Renewables (Solar & Wind) Transitioning away from coal Zero emission vehicles

Green Innovators | Heavily State-Subsidized Transition | Starters and Niche-Testers

Planned economy, characterized by the world's highest absolute EV sales and a strong conventional automotive industry.

Central Policy Strategy:

Driven by energy security, pollution concerns, and economic opportunities. Policies focus on subsidies, R&D, and non-financial demand-side incentives, including exemption from license plate lotteries.

Policy examples:

- China (2009): Ten Cities, One Thousand Vehicles Project
- China (2017): New Energy Vehicle (NEV) Mandate

Work in progress

MS3: List of key sectoral entry points for analysis in WP6 (joint responsibility of WP3 and WP6)

04/2025

https://www.elevate-climate.org/

Survey:
barriers and enablers for effective climate policy

ELEVATE
supporting international climate policy

Please consider the following barriers. Which have the worst impact on ambitious climate policy in your country? *

Please rank them all from 1-4:
1 - Very negative impact, it directly hinders ambition;
4 - Least negative impact, it has limited influence on climate ambition

	Lack of Institutional Capacity	High Economic Cost	Global Public Goods Dilemma	Competing Interests
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○

Is there another barrier that was not mentioned above and would be relevant for your country? What place would it occupy in the ranking?

Please follow the link in the chat to complete this brief survey.

Barrier	Definition
Lack of Institutional Capacity	Involves the lack of competencies, resources, and expertise of **governmental institutions**.
High Economic Cost	Implies high costs of **low-carbon technological** and behavioral change for private and public actors.
Global Public Goods Dilemma	Involves **free-riding** at the international level and lack of enforcement between vertical governance levels (communal, national, regional, and international).
Competing Interests	Implies **struggles between actor coalitions**, **interest group lobbying**, veto player action, lack of public support, and ideological clashes based on identity or deep-held beliefs and convictions

Adapted from Montfort, Fesenfeld, and Ingold (preprint)

Survey:
barriers and enablers for effective climate policy

ELEVATE
supporting international climate policy

Please consider these enabling factors. Which are the most promising ones for facilitating ambitious climate policies in your country? *

Please rank them all from 1-4:
1 - Very promising, it direcly enables climate ambition
4- Least promising, it has limited influence on climate ambition

	Public and Interest Groups Support	Low Economic Cost	International Cooperation	Strong Institutional Capacity
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○

Is there another enabling factor that was not mentioned above and would be relevant for your country? What place would it occupy in the ranking?

Please follow the link in the chat to complete this brief survey.

Enabler	Definition
Strong Institutional Capacity	Presence of competencies, resources, and expertise of **governmental institutions**. Creation of **stakeholder commission.**
Low Economic Cost	Implies **low costs** of low-carbon technological and behavioral change for private and public actors.
International Cooperation	Collaboration between countries, organizations, or individuals to **achieve shared goals**, address global challenges, and promote mutual benefits e.g., **JETPs, funds and technology transfers**.
Public and Interest Groups Support	Refers to legitimacy and trust by the **general public and organized interest groups** to support policies, decisions, or initiatives that reflect their collective interests or values.

Adapted from Montfort, Fesenfeld, and Ingold (preprint)

Discussion

- How do the policy strategies highlighted by the researchers might reflect your own national contexts?
- In your opinion, what are the barriers and enabling factors for ambitious climate policy in your country?

Respondents:

Ayael Alqarni, Senior Climate Change and Sustainability Specialist, Ministry of Energy (Saudi Arabia)

Anindya Bhattacharya, Executive Director, The Celestial Earth (India)

Keigo Akimoto, Chief Researcher, RITE Systems Analysis Group (Japan)

Moderator: Elmar Kriegler, Head of Research Department and ELEVATE researcher, PIK (Germany)

Survey results:

- **Top 3 barriers:**
- 1. Competing Interests
- 2. High Economic Cost
- 3. Lack of Institutional Capacity

- **Top 3 enablers:**
- 1. Low Economic Cost;
- 2. International Cooperation;
- 3. Strong Institutional Capacity/Public and Interest Group Support

Open discussion:

Which barrier or feasibility constraints for ambitious climate policies do you see in your country?

Rahel Mandaroux

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IV ELEVATE INTERNATIONAL STAKEHOLDER WORKSHOP

Forging a Net-Zero Future: Unlocking technological and economic innovations to bridge the implementation gap

Lunch break

We will resume at 13:30 CET

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IV ELEVATE INTERNATIONAL STAKEHOLDER WORKSHOP

Forging a Net-Zero Future: Unlocking technological and economic innovations to bridge the implementation gap

Part 2:
Leveraging carbon pricing and international trade measures to achieve rapid decarbonization

Unveiling the topics of the interactive sessions:

- Implications of EU CBAM
- Distributional consequences of carbon pricing on households

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Agenda

Part Two			**Leveraging carbon pricing and international trade measures to achieve rapid decarbonization**
↗	13:30	13:50	**Unveiling the topics of the Interactive Sessions**
↗	13:50	14:40	**Assessing the economic implications of EU CBAM** *Zoi Vrontisi, E3M* **Exploring the distributional consequences of carbon pricing on households** *Jan Steckel, MCC/PIK*
↗	14:40	14:50	**Report back from Interactive sessions**
↗	14:50	15:20	**Discussion: What role do market-based and financial instruments play on the pathway to net-zero?** *Moderated by Detlef van Vuuren, PBL*
↗	15:20	15:30	**Closing remarks**

ELEVATE - ENABLING AND LEVERAGING CLIMATE ACTION TOWARDS NET ZERO EMISSIONS

Implications of CBAM and Carbon Border Adjustment Mechanisms

Presented by Zoi Vrontisi (E3Modelling)

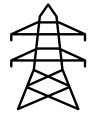
Contributions: Ioannis Charalampidis, Dimitris Fragkiadakis, Paola Rocchi, Edoardo Campo Lobat, Alice Di Bella, Valentina Bosetti, Régis Rathmann and Roberto Schaeffer

International trade measures and carbon clubs

- **Objective:** Quantitative ex-ante macroeconomic and trade impact assessment of EU CBAM and wider carbon border adjustment schemes, with a focus on major economies.
- **Method:** Three individual model-based analyses with global computable general equilibrium models (CGE): GEM-E3-FIT, FIDELIO, PAEG
    1. Assessing the economic and trade implications of a gradual adoption of CBAM by **major global economies** (E3Modelling)
    2. Expanding carbon pricing boundaries and the **EU** CBAM: insights into **China and India** (CMCC)
    3. Environmental and economic impacts of EU CBAM and SBCE on the competitiveness of the main **Brazilian** commodities on the international market (UFRJ/COPPETEC)
- **Output:** GDP, emissions, sectorial production/exports, bilateral trade

EU CBAM Regulation | Objectives and implications

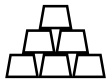
Sectors

Electric energy production 

Cement 

Aluminium 

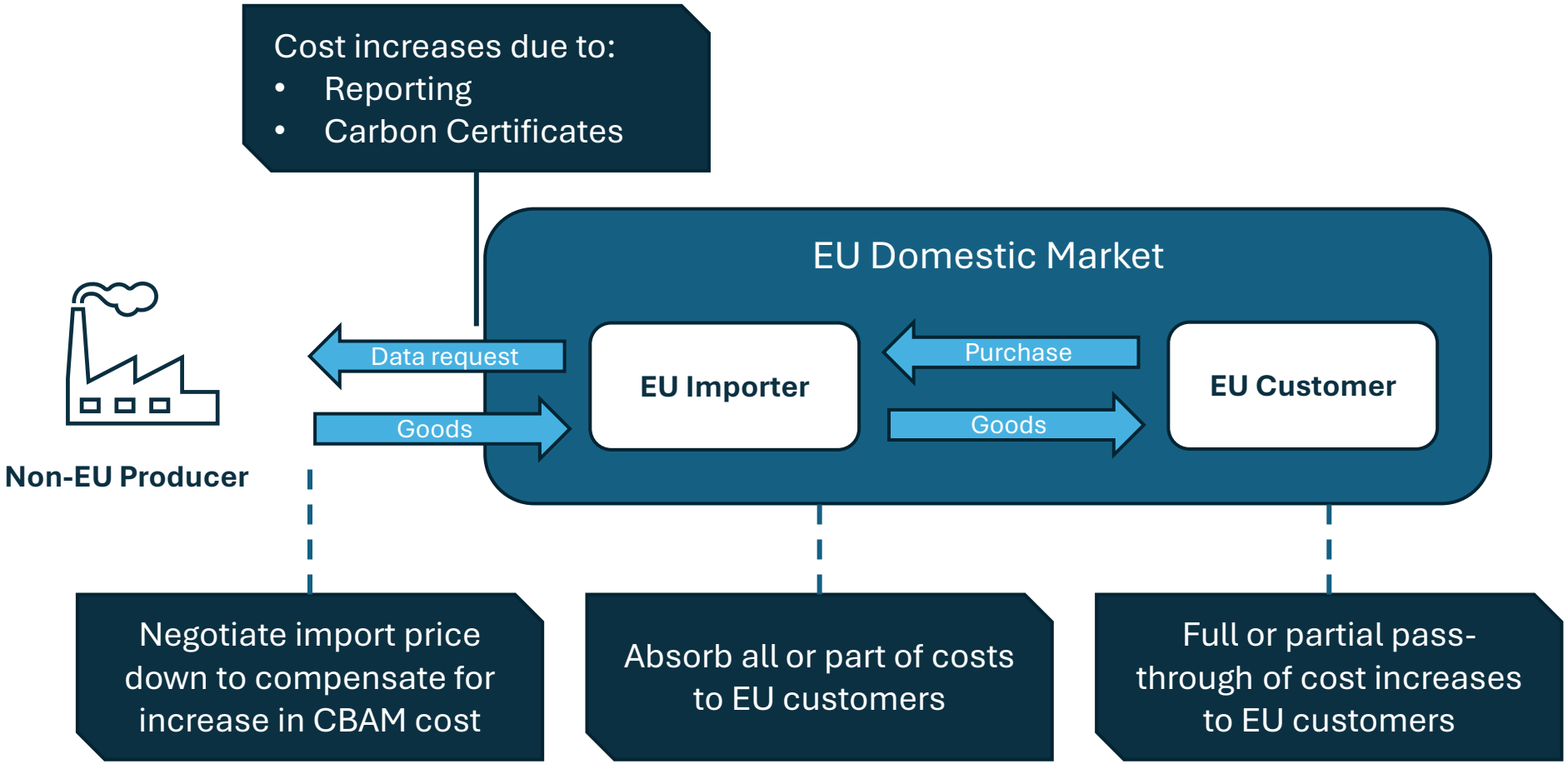
Fertilizers 

Iron & Steel 

Hydrogen H_2

- EU CBAM introduces charges for importers of eligible goods in 2026 and costs ramp up to 2034, with 2035 full phase in of CBAM
- Conceived as a replacement for free allocation within the EU ETS.
- Prevent carbon leakage by discouraging companies from relocating to countries with weaker environmental regulations.
- Protect EU companies that have invested in green technologies.
- Encourage increased climate ambition in other countries.
- Promote the implementation of carbon market policies in non-EU countries (to keep revenues within producer countries).
- Generate revenue that could be used to support climate policies in the EU or other countries
- Embodied emissions are liable according to a CBAM MRV methodology
- EU CBAM charges are based on the EU ETS carbon price
- Importers supplying goods produced under a carbon pricing regime can have those carbon costs deducted from their CBAM charge

CBAM impact & pass through rates



Global export shares

	Cement	Iron & Steel	Aluminium	Fertilizers
UK	0.5%	1.3%	1.0%	0.7%
Turkey	11.5%	2.2%	2.6%	0.8%
USA	1.7%	3.8%	5.1%	8.3%
Canada	4.8%	1.9%	6.9%	14.5%
China	2.4%	18.0%	13.2%	14.8%
India	0.4%	3.1%	4.1%	0.2%
Indonesia	0.4%	3.1%	4.1%	0.2%
South Korea	0.9%	6.0%	2.4%	0.7%
Japan	2.4%	6.5%	1.0%	0.2%
Australia	0.0%	0.2%	2.4%	0.3%
EU27	10.7%	8.6%	7.1%	8.4%

- **Chemical fertilizers:**
  - EU27 is again the main market of destination for Turkish and UK products
  - India is the main destination of Chinese and Indonesian fertilizers, accounting for approximately 17% and 15% of the respective country's total fertilizer exports.
- **Cement:** geographical proximity explains largely the pattern of trade.

- **Iron and Steel:**
  - To EU : Turkey 33%, UK 65%, India 33% of total exports
  - To China: Indonesia 66% of total exports
  - To US: Canada 93% of total exports
  - ToBrazil from USA and EU27 (59%).
- **Aluminum:**
  - Exports to the EU account for 64% of total Turkish exports, 72.4% of United Kingdom's total exports and 14% of total Indian exports.
  - Chinese exports are relatively evenly distributed among regions with Europe receiving 6% of aluminum produced in China, and USA, India and Japan approximately 5%.

Iron and steel bilateral trade (bl $ 2023)

	Australia	Brazil	Canada	China	India	Indonesia	Japan	Rep. of Korea	Turkey	United Kingdom	USA	EU27	Total
Australia	0	0	19	6	17	25	1	4	3	7	247	99	774
Brazil	6	0	331	1368	68	22	361	227	160	130	7120	2113	15567
Canada	17	14	0	39	30	2	3	12	3	9	8906	153	9570
China	864	2579	958	0	3750	4005	1790	7117	3552	335	1778	5453	88656
India	150	196	227	564	0	402	196	464	565	393	1263	4946	15070
Indonesia	200	24	18	18342	1648	0	34	355	447	52	164	649	27561
Japan	184	270	213	3560	1389	2256	0	4394	598	138	2155	1942	32017
Rep. of Korea	347	289	624	2703	2533	976	3354	0	1654	285	3706	4124	29580
Turkey	63	48	281	5	22	2	45	13	0	295	378	3624	10992
United Kingdom	26	89	75	92	62	9	23	35	266	0	490	4086	6318
USA	95	217	7434	391	153	12	146	160	101	254	0	1330	18724
EU27	305	1351	1311	2188	1135	508	250	617	3615	5616	8473	0	169590

Aluminum bilateral trade (bl $ 2023)

	Australia	Brazil	Canada	China	India	Indonesia	Japan	Rep. of Korea	Turkey	United Kingdom	USA	EU27	Total
Australia	0	2	17	62	40	104	802	1147	0	2	306	118	3502
Brazil	0	0	1	2	0	0	362	1	0	0	133	308	1184
Canada	0	1	0	11	4	0	0	1	1	8	9417	300	10039
China	647	292	657	0	986	518	979	1586	258	311	894	1143	19159
India	22	104	29	222	0	48	402	816	188	53	380	810	5884
Indonesia	43	0	14	228	16	0	10	11	59	9	114	28	695
Japan	5	6	4	553	11	39	0	98	1	5	176	130	1417
Rep. of Korea	108	4	9	862	158	78	208	0	124	1	538	305	3508
Turkey	0	2	61	6	1	0	0	0	0	174	275	2441	3832
United Kingdom	7	5	6	19	34	3	11	13	15	0	112	1056	1458
USA	22	55	2073	127	51	9	243	234	66	125	0	341	7441
EU27	60	205	223	319	146	25	169	168	647	2426	1598	0	46212

Fertilizers bilateral trade (bl $ 2023)

	Australia	Brazil	Canada	China	India	Indonesia	Japan	Rep. of Korea	Turkey	United Kingdom	USA	EU27	Total
Australia	0	1	1	1	26	10	1	0	2	2	96	0	225
Brazil	1	0	6	0	1	0	0	0	0	0	8	2	244
Canada	30	1873	0	670	424	274	1	97	0	1	4581	310	9508
China	362	1559	5	0	2490	297	289	248	152	15	17	152	9673
India	0	15	0	1	0	1	0	0	0	0	2	2	106
Indonesia	90	8	0	0	197	0	1	16	0	1	19	1	639
Japan	10	2	1	10	9	1	0	9	0	0	19	4	116
Rep. of Korea	47	0	0	3	1	33	42	0	0	0	18	8	423
Turkey	0	8	0	2	1	0	0	1	0	5	0	108	501
United Kingdom	3	43	8	18	17	0	0	1	2	0	14	234	446
USA	256	1023	2047	236	43	29	62	115	12	54	0	270	5422
EU27	47	675	90	307	82	37	20	22	196	667	224	0	13758

Cement bilateral trade (bl $ 2023)

	Australia	Brazil	Canada	China	India	Indonesia	Japan	Rep. of Korea	Turkey	United Kingdom	USA	EU27	Total
Australia	0	0	0	0	0	0	0	0	0	0	0	0	3
Brazil	0	0	0	0	0	0	0	0	0	0	0	0	11
Canada	0	0	0	0	0	0	0	0	0	1	441	1	444
China	25	1	1	0	5	1	10	9	1	1	95	8	578
India	0	0	0	0	0	0	0	0	0	0	0	1	271
Indonesia	21	0	0	0	0	0	0	0	0	0	0	0	129
Japan	63	0	0	2	5	0	0	26	0	0	1	5	359
Rep. of Korea	0	0	0	0	0	0	11	0	0	0	24	0	106
Turkey	0	11	9	0	0	0	0	0	0	2	67	80	596
United Kingdom	1	1	0	2	0	0	2	0	0	0	2	50	66
USA	1	0	147	2	0	0	2	2	0	1	0	8	202
EU27	4	8	12	1	1	0	2	1	3	280	225	0	2823

Additional drivers of CBAM impacts

Energy intensity r.t. EU27	Aluminum	Cement	Fertilizers	Iron and steel
China	3.37	1.64	2.39	3.22
India	3.96	1.43	2.82	12.5
Indonesia	8.29	1.46	1.26	2.7
Japan	0.7	0.94	0.91	0.78
Korea, Rep.	0.48	0.99	0.94	1.13
Australia	4.23	0.91	1.11	1.03
Turkey	0.95	0.98	1.3	1.66
United States	0.94	1.08	0.81	1.27
Canada	1.27	1.15	1.12	2.38
Brazil	8.06	0.99	0.5	2.32
United Kingdom	0.22	0.95	0.53	0.77

Carbon price in NDC implementation by GEM-E3 model	2030	2040	2050
China	5	7	8
India	19	28	41
Indonesia	3	4	4
Japan	44	48	51
Korea, Rep.	75	84	88
Australia	146	187	234
Turkey	1	2	3
United States	65	74	84
Canada	35	43	52
Brazil	20	27	36
United Kingdom	226	272	331
EU27	168	286	403

Scenario frameworks

Analysis with GEM-E3 CGE model

Scenario dimension	Reference	NDC+EU CBAM	NDC+G1C BAM	NDC+G2C BAM
EU climate policy	Fit-for-55 extended to net zero GHG to 2050			
Global climate policy	NDC	NDC	NDC	NDC
EU CBAM	No	EU CBAM Regulation (EU) 2023/956	EU CBAM Regulation (EU) 2023/956	EU CBAM Regulation (EU) 2023/956
Other CBAM	No	No	Border Carbon Adjustment schemes in **Group 1** countries: **Australia, USA, UK and Japan,** considering domestic carbon pricing schemes or implicit carbon values from emission targets	Border Carbon Adjustment schemes in **Group 1 plus** Group2 countries: **Canada, China and India,** considering domestic carbon pricing schemes or implicit carbon values from emission targets
Sectors under CBAM	No	cement, iron and steel, aluminium, fertilisers, hydrogen, and electricity		

Analysis with FIDELIO CGE model

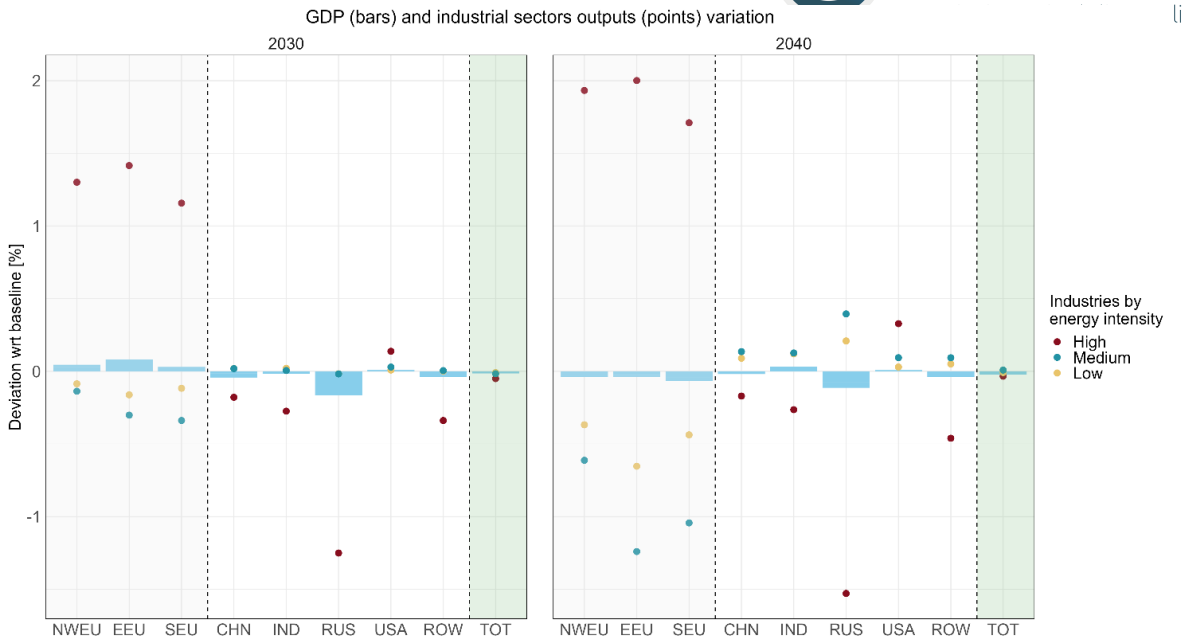
Scenario	Policy implemented
Baseline	Full EU ETS (it includes EU ETS allowances phasing out for EITE sectors).
CBAM	Full EU ETS and EU CBAM (the sectors covered in the CBAM scenario are iron and steel, aluminium, fertilisers, and cement).
Chinese ETS	Full EU ETS and Chinese ETS on CBAM industries (the Chinese ETS on the power sector becomes more stringent, with a higher carbon price up to 40 EUR per tonne of CO_2).
Chinese ETS + CBAM	Full EU ETS, Chinese ETS and CBAM.
Indian ETS	Full EU ETS and Indian ETS on CBAM and power sectors (with a carbon price up to 40 EUR per tonne of CO_2).
Indian ETS + CBAM	Full EU ETS, Indian ETS and EU CBAM.
Chinese and Indian ETS	Full EU ETS, Chinese and Indian ETS.
Chinese and Indian ETS + CBAM	Full EU ETS, Chinese and Indian ETS and EU CBAM.

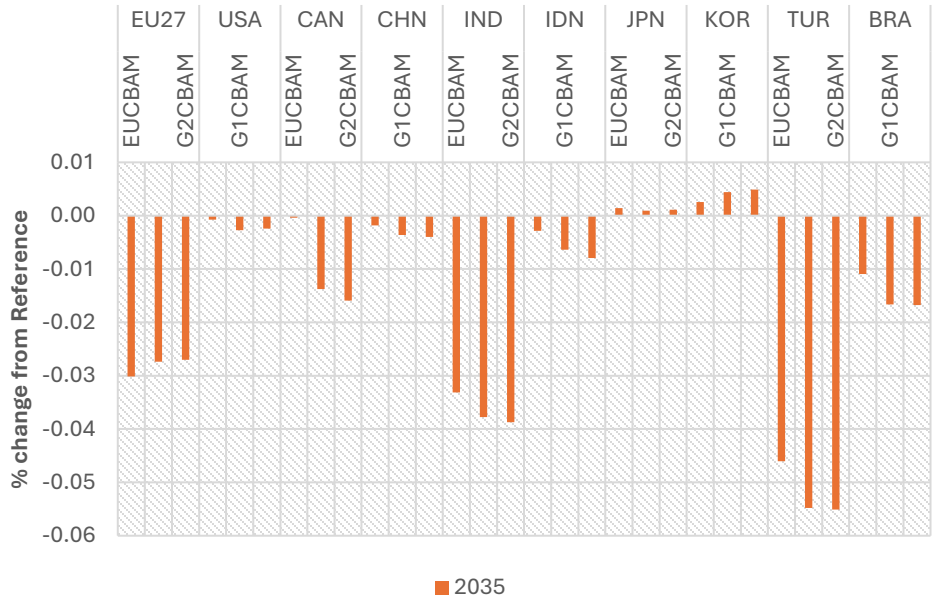
Analysis with PAEG CGE model

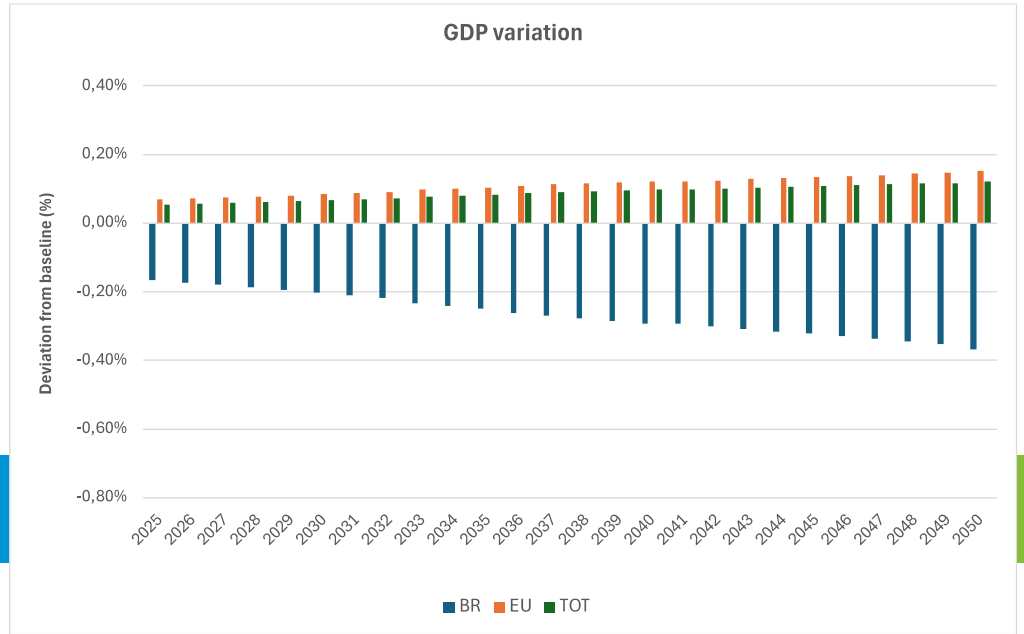
Scenarios	Policies implemented
Baseline	Full EU ETS
CBAM	Full EU ETS and EU CBAM (sectors covered: iron and steel, aluminum, fertilizers, cement, crude oil, and soybeans)
Brazilian SBCE + CBAM	Full EU ETS, CBAM and Brazilian SBCE on energy-intensive industries (the SBCE will be gradual and divided into five main phases, covering industrial facilities that emit more than 25,000 tCO_2eq per year). A carbon price up to 40 EUR per tonne of CO_2 is assumed (Rocchi et al., 2024).

Main findings

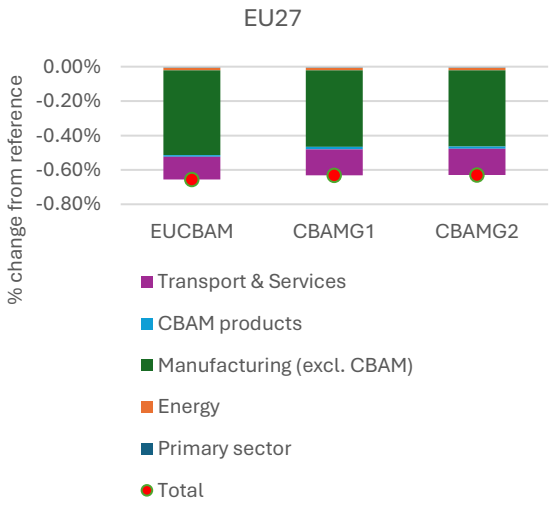
- All model-based analysis finds limited macroeconomic impacts at the national and global level
- Yet, GDP impacts vary across countries
- Sectoral implications are substantial both for CBAM and certain non-CBAM sectors (i.e. downstream or intermediate products of CBAM goods)
- Bilateral trade flows are significantly affected by CBAM policies and their expansion

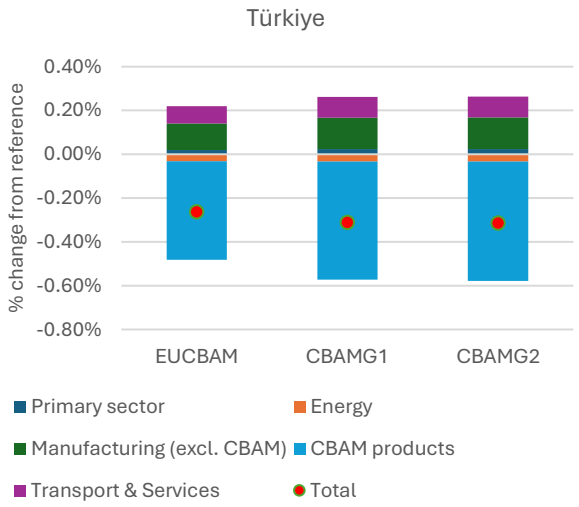


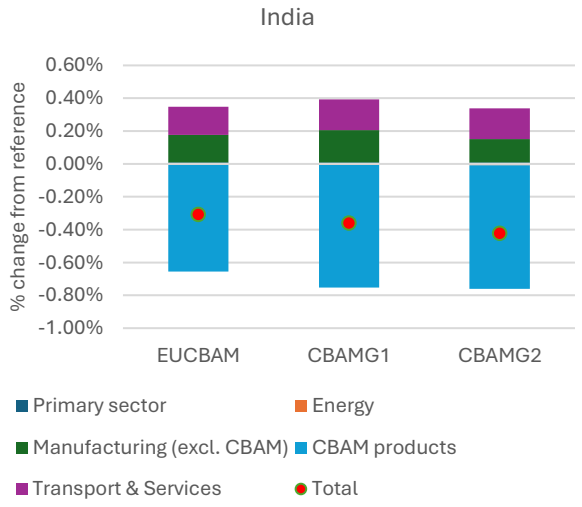


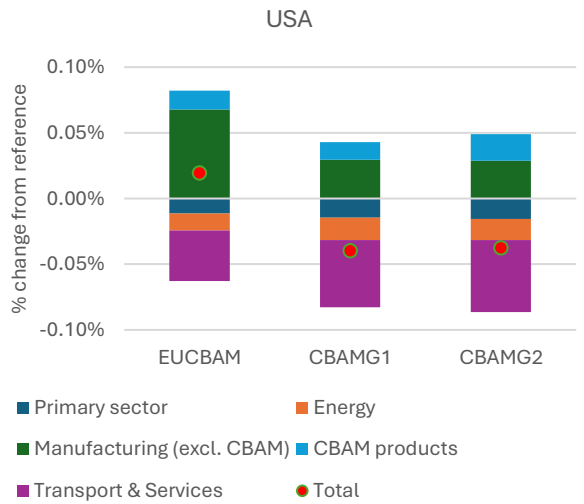


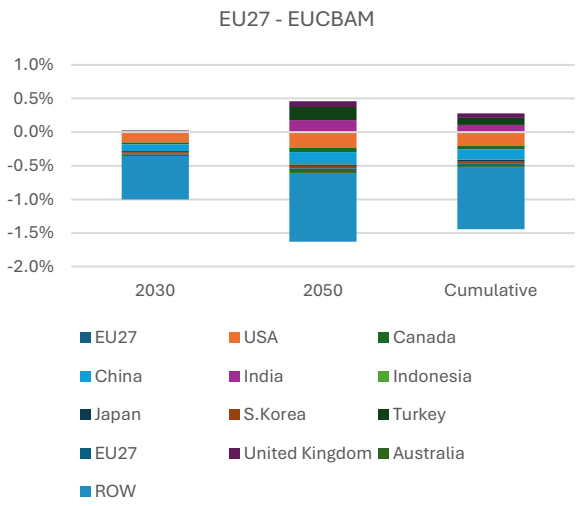
Sectoral and Bilateral Exports | Selected Country examples

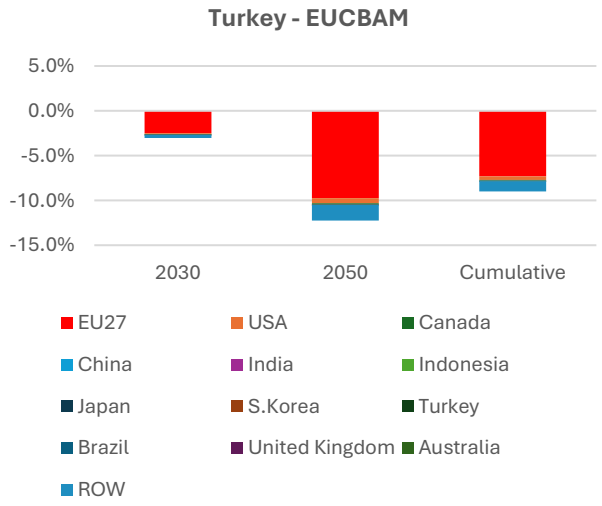


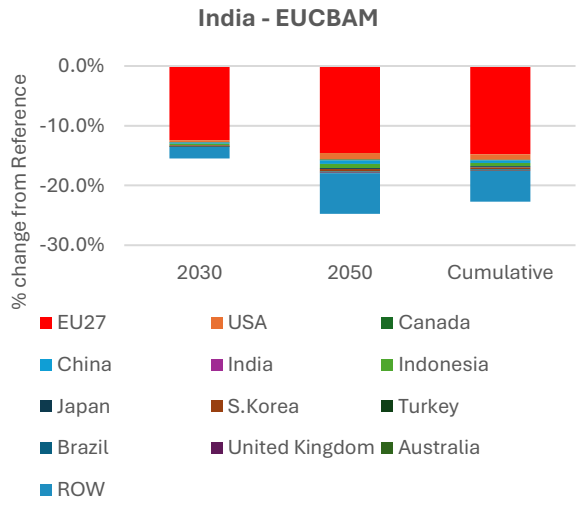


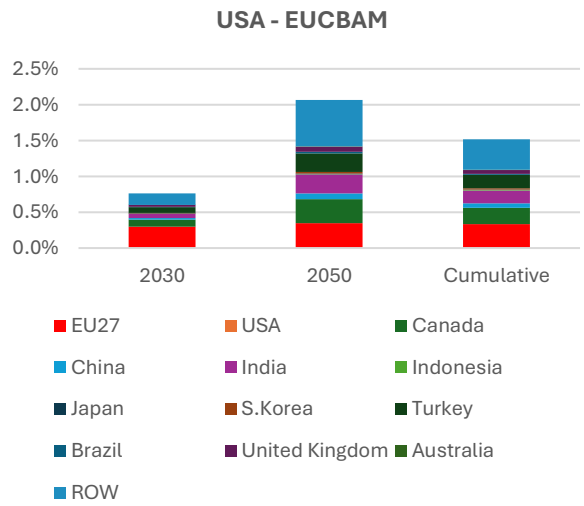




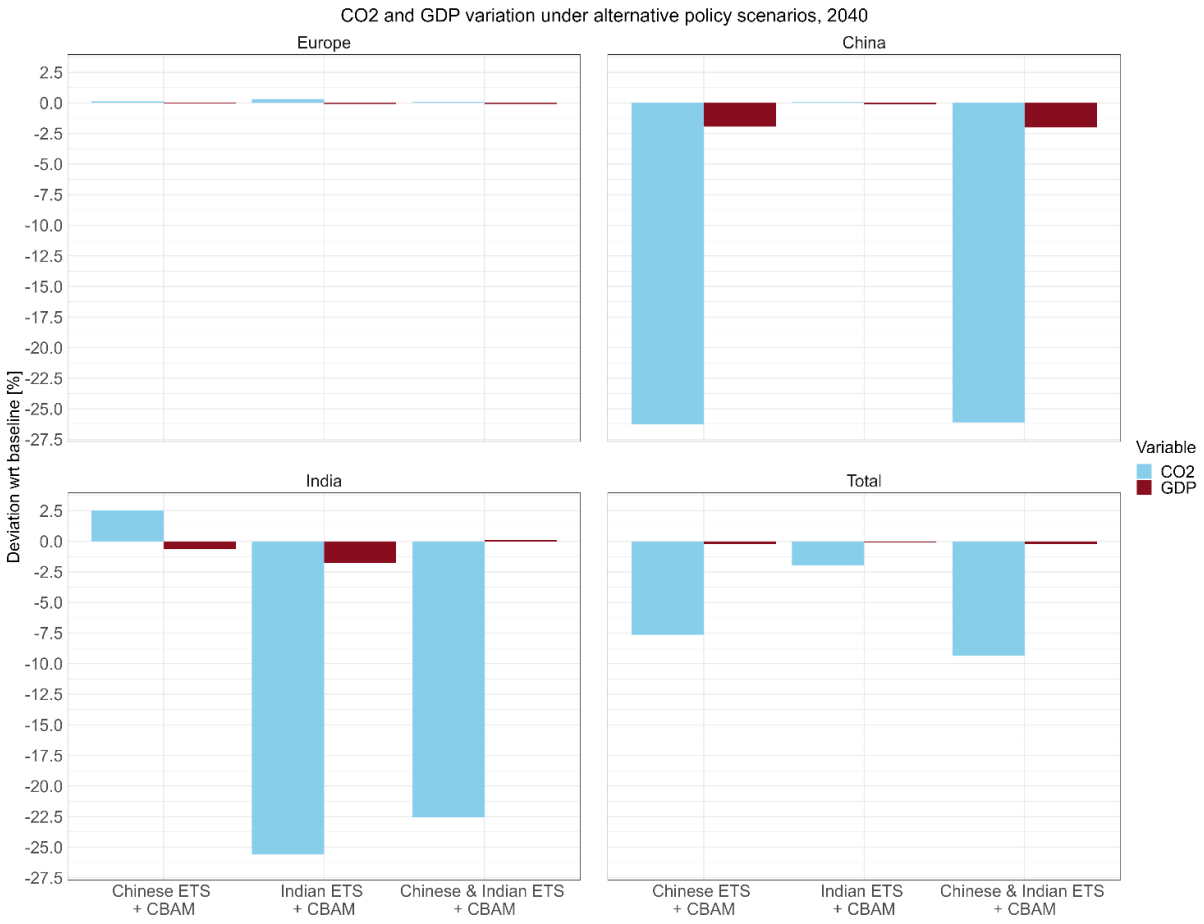


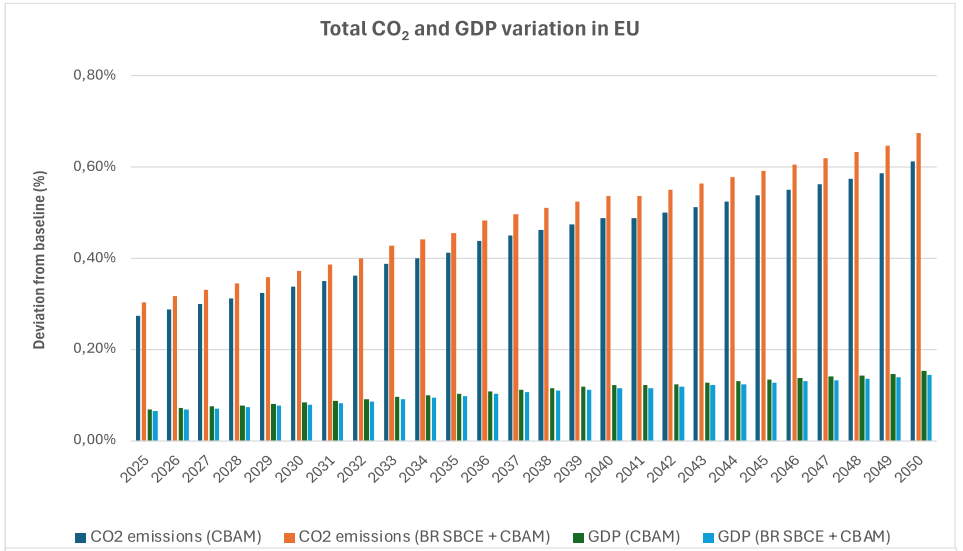


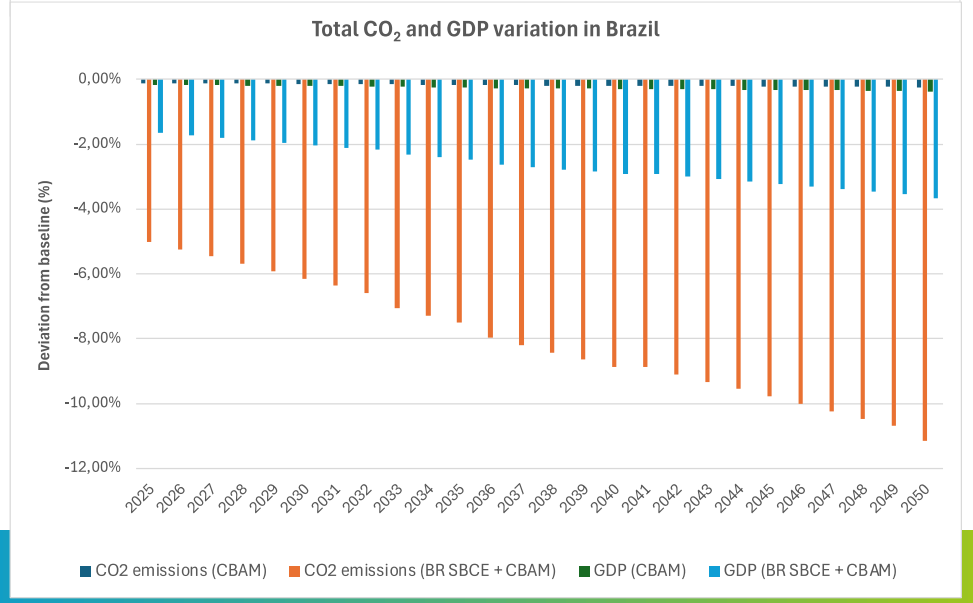




Expanding ETS and CBAM coverage







Thank you for your attention!

MCC

PIK

Potsdam Institute for Climate Impact Research

Distributional effects of carbon pricing

Facilitating socially just carbon pricing policies

Jan Christoph Steckel
6 March 2025, ELEVATE Workshop

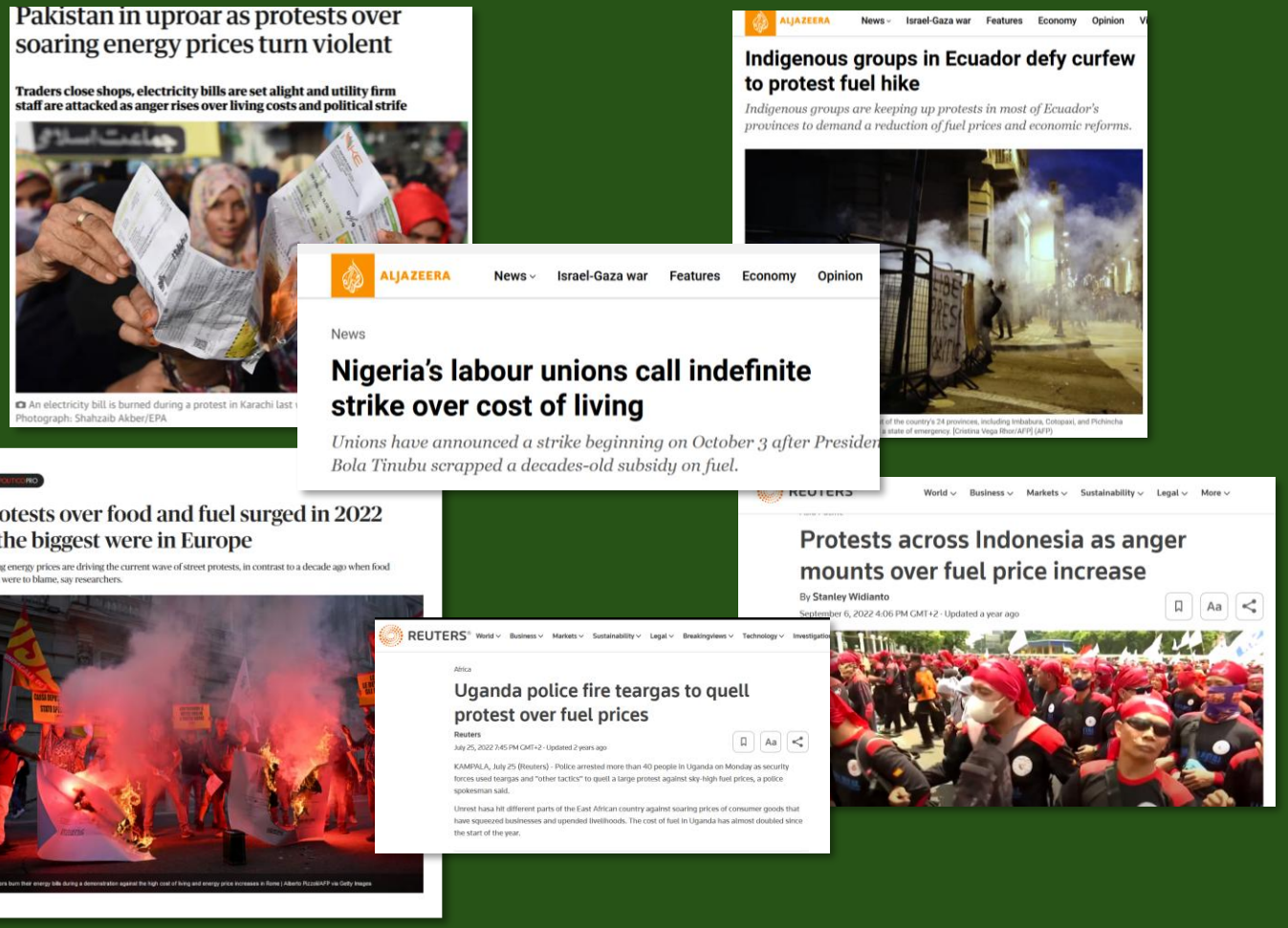
Leibniz Association

Part I: Carbon pricing and distributional effects

Lessons learned from theory and practice

MCC
PIK
Potsdam Institute for Climate Impact Research
Leibniz Association

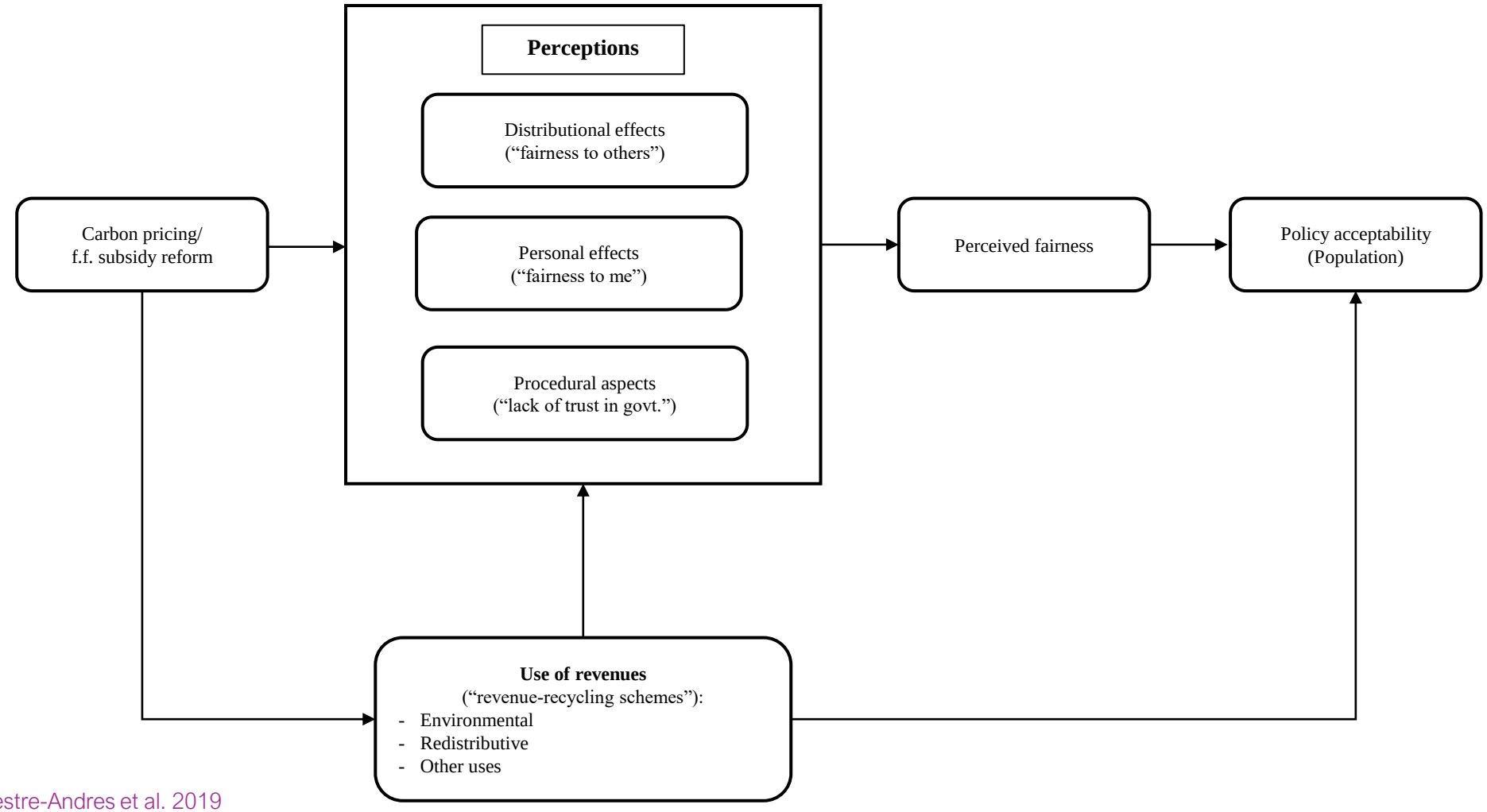
Experiences with fossil fuel subsidy reforms and carbon pricing in the past



- Broad-based resistance, e.g. to rising energy prices
- Immediate price increases can lead to large protests that have the power to stop the reform
- Despite reform (partly) being progressive, i.e. pro-poor!

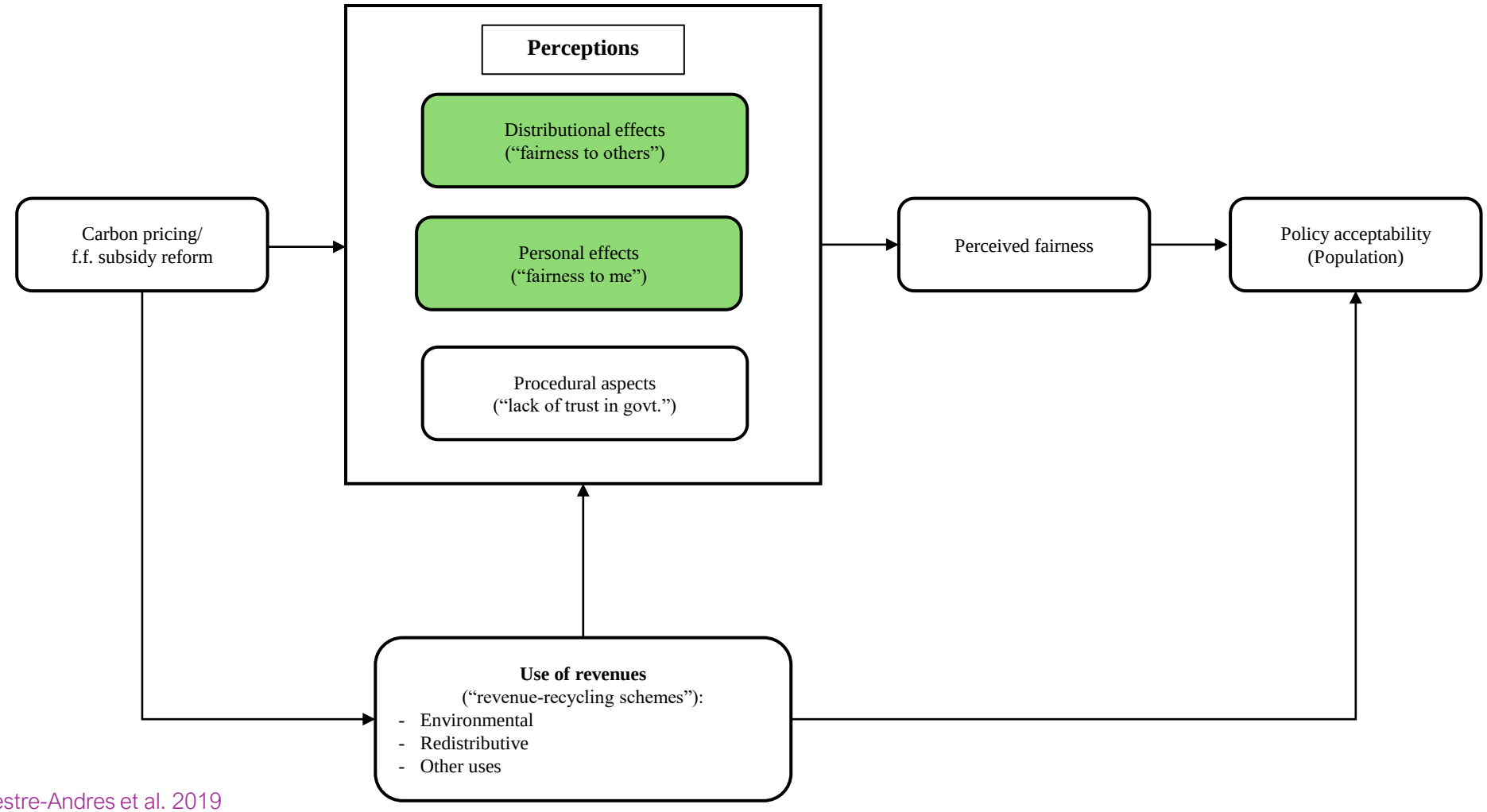
How to make carbon pricing policies acceptable?

What determines acceptability?



Modified from Maestre-Andres et al. 2019

What determines acceptability?



Modified from Maestre-Andres et al. 2019

Three dimensions of distributional effects

Segment of Population	Criterion	Dimension of Distribution	Guiding questions
The Lower-Income Groups	Distributional effects	Vertical Distribution	What cost falls on the poorest members of society?
Hardship Cases	Personal effects	Horizontal Distribution	Which households face the highest additional costs? What is the cost to households which are most important to political decision makers?*
Hardly Accessible	Procedural aspects + use of revenues	Possibility of receiving transfers from government	Which households could be compensated given institutional set-up?

*: Assumption: Additional costs matter to households and correlate with political support.

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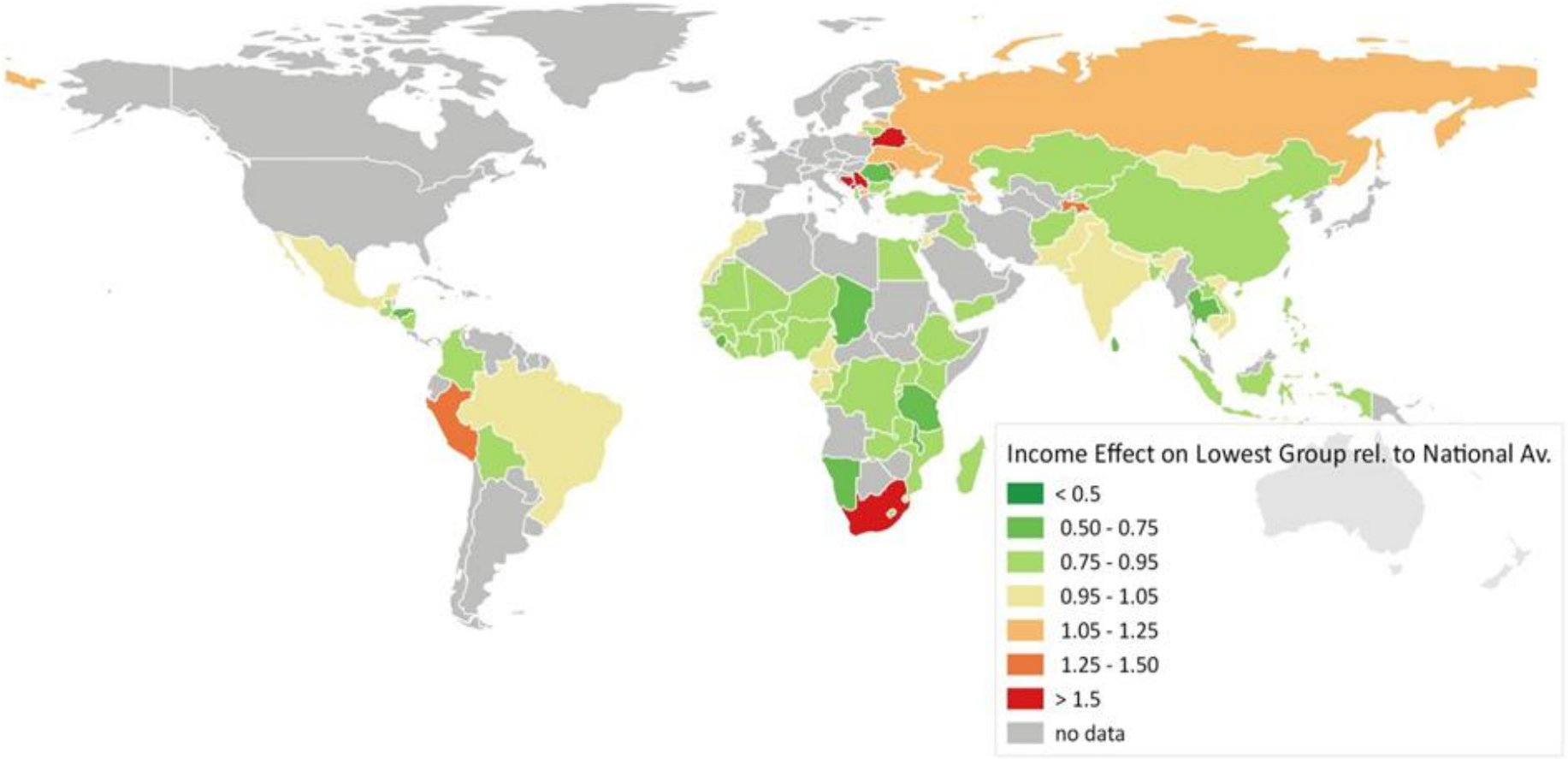
Vertical distribution: Progressive vs. regressive results



Dorband, Jakob, Kalkuhl & Steckel (2019, World Development)

Empirical analysis based on World Bank Global Consumption Database, covering 87 countries

Key result: Carbon pricing more progressive in poorer countries
Key mechanism: Differences in energy expenditures drive results

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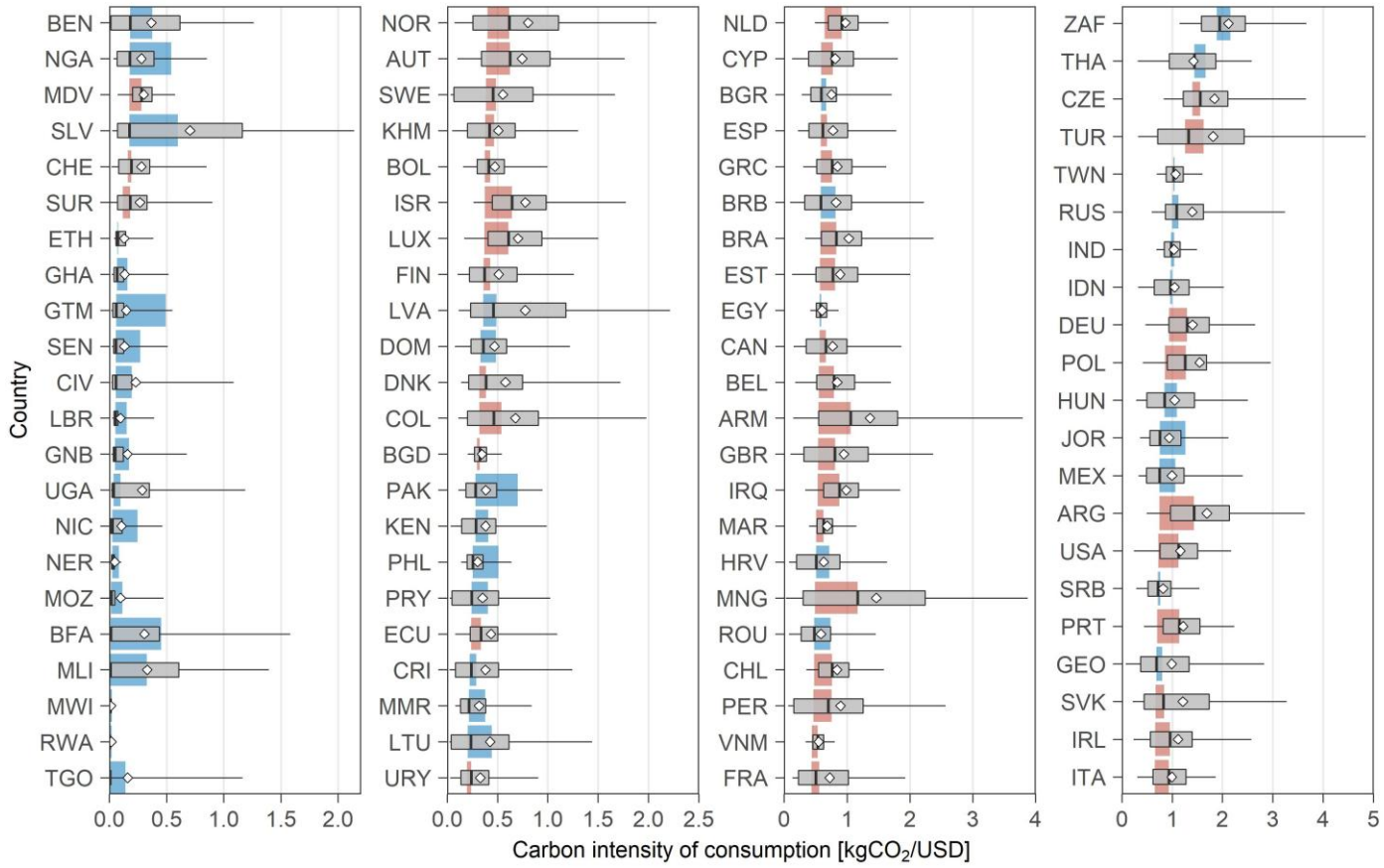
Who is affected by carbon pricing depends on country specifics

Comparison between vertical differences (in blue/red) and horizontal spread for first expenditure quintile in selected countries.



Source: Missbach & Steckel (forthcoming)

- Vertical differences (in red/blue) between poorest and richest households miss a large part of the heterogeneity.
- Whether specific households are affected depends on their specific consumption patterns, e.g. do they own a car? How do they heat? Where do they live? etc. …

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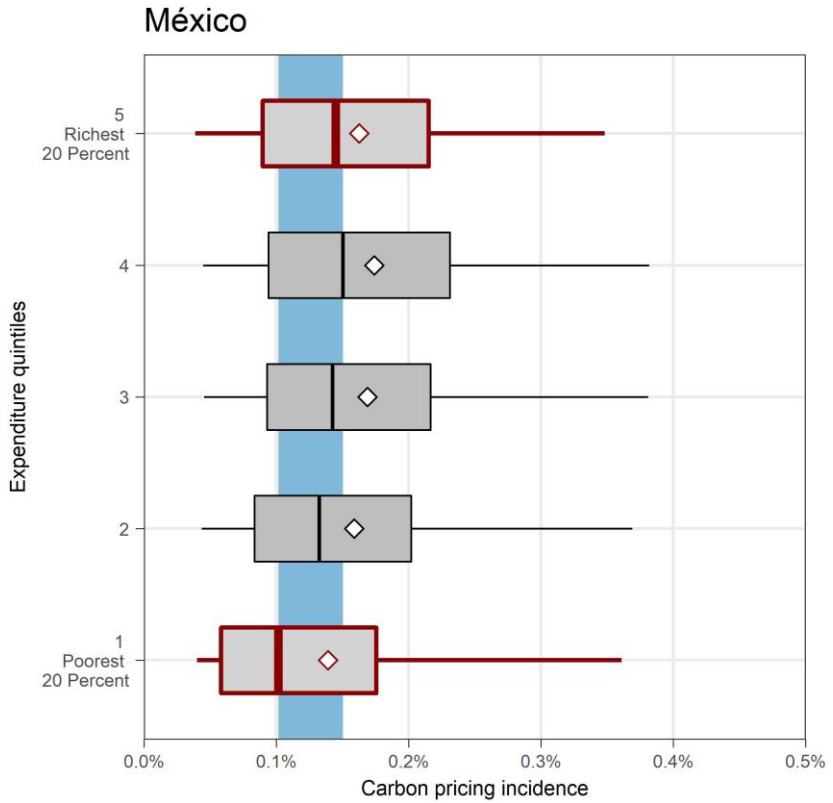
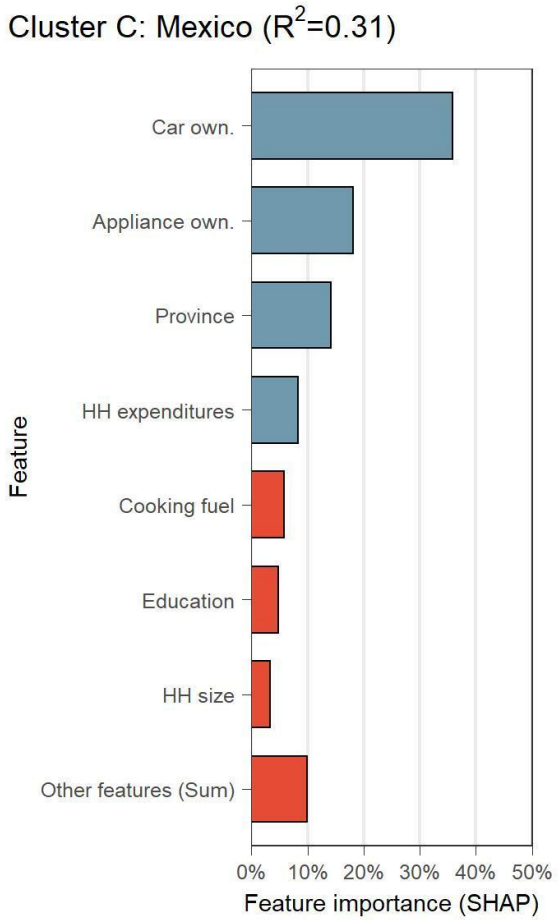
Who is affected by carbon pricing depends on country specifics





- Large differences within poorer and richer households
- Factors beyond income matter

Source: Missbach & Steckel (2024)

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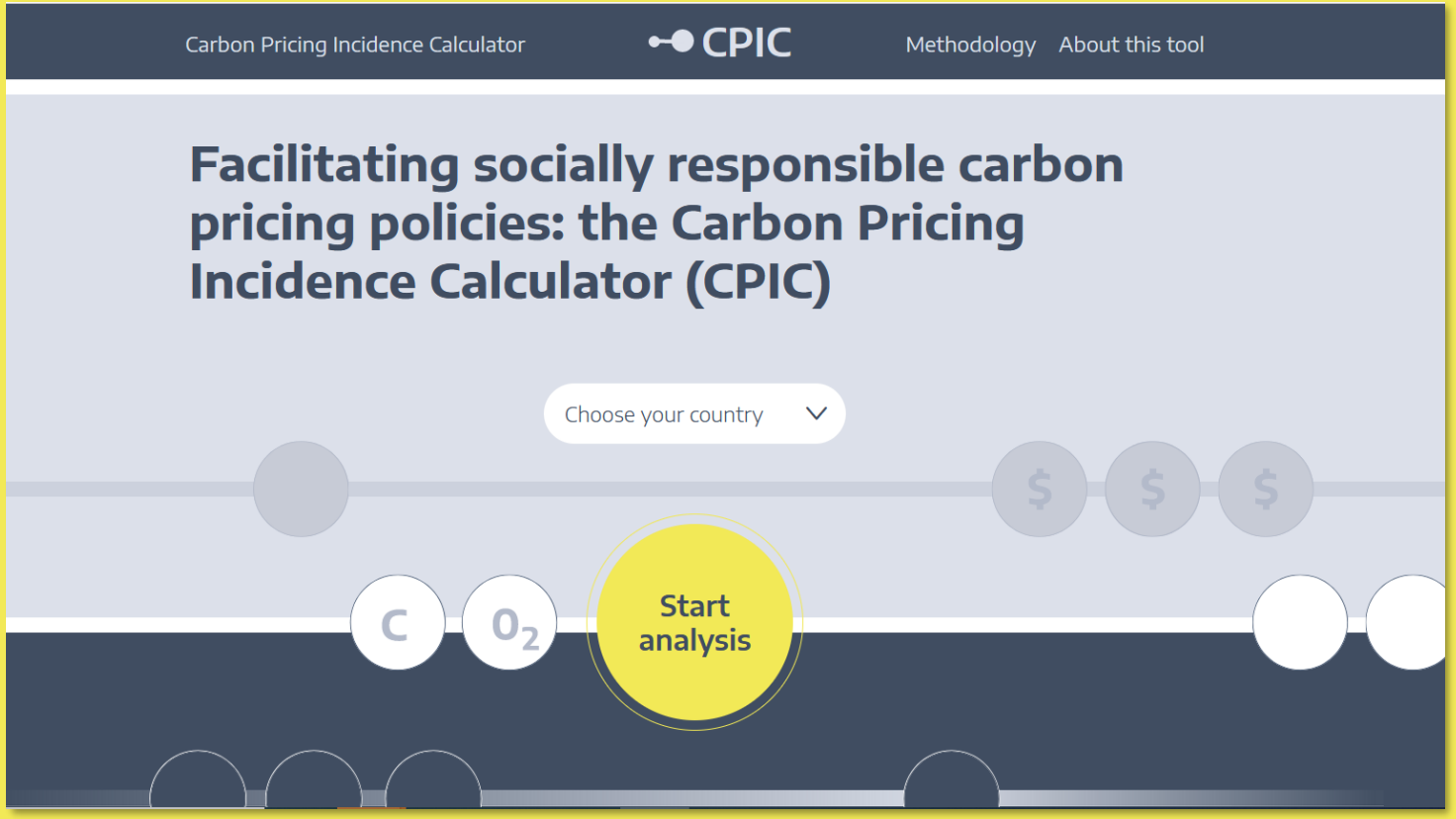
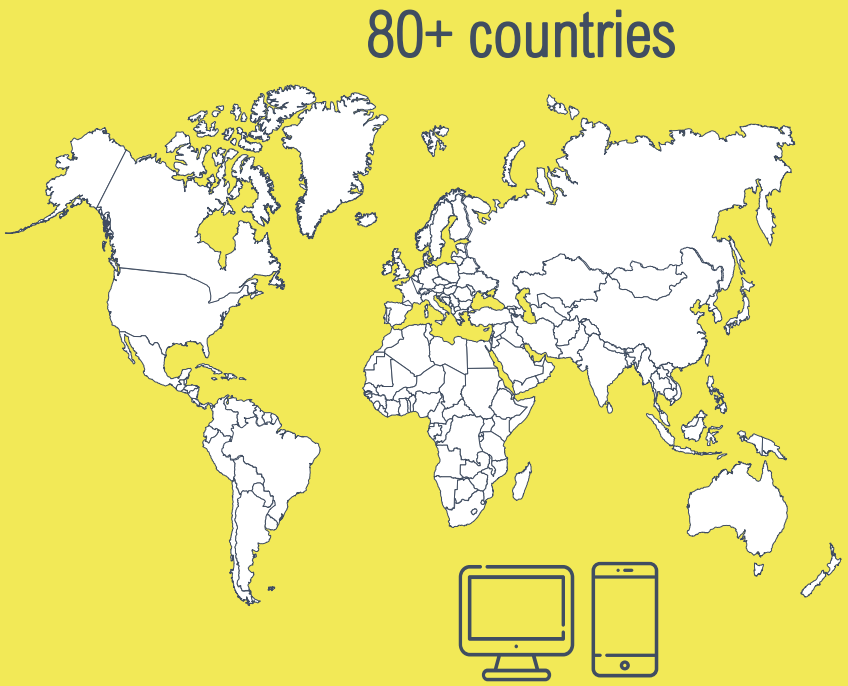
The Carbon Pricing Incidence Calculator (CPIC)





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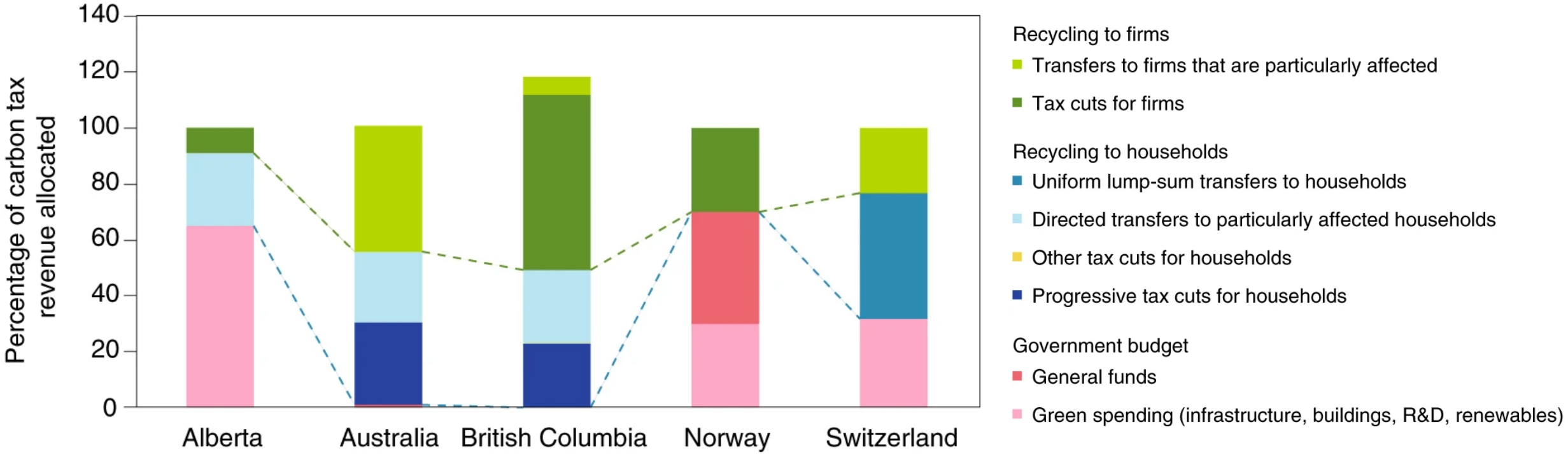
How governments use revenues



Klenert et al. (2018)

Social acceptance of revenue recycling

Mildenberger et al. (2022)

Table 1 | Average estimated and true rebate sizes for sample, by province

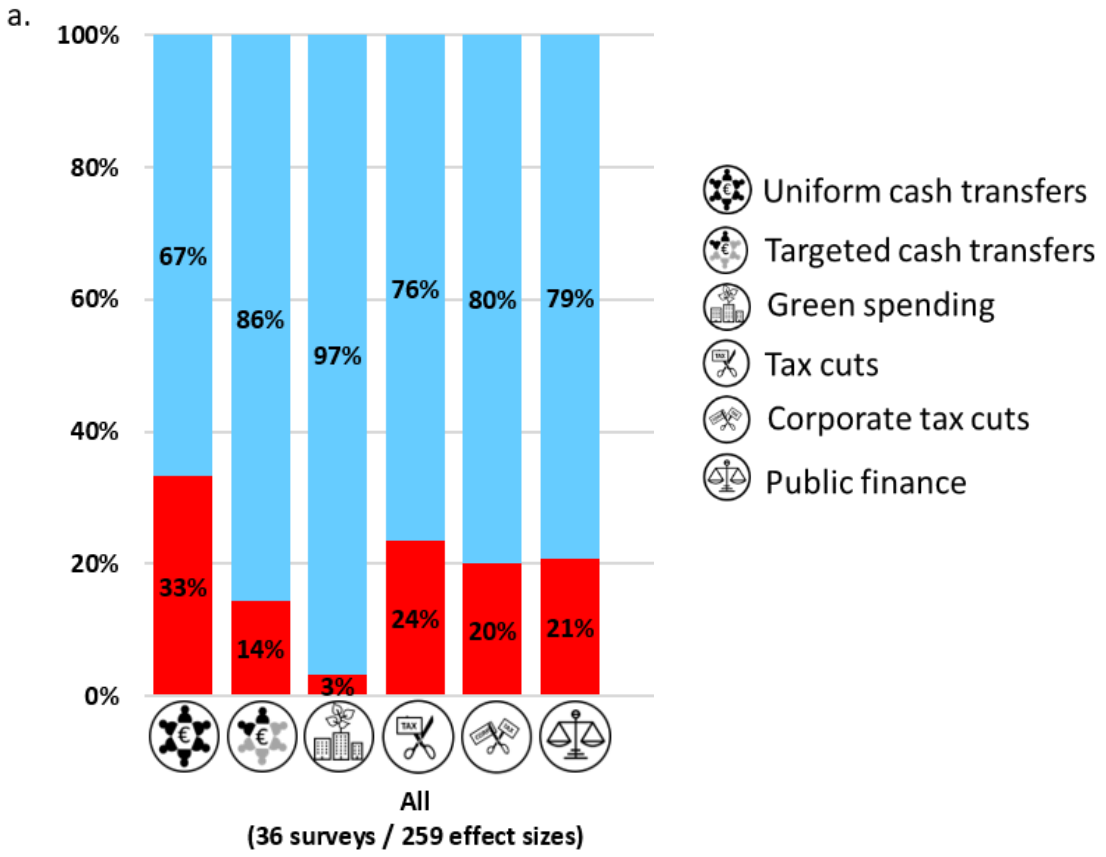
Province	Average perceived rebate (CDN$)	True average rebate (CDN$)
Received federal rebate		
Saskatchewan	268 (13)	444
Ontario	149 (11)	217
Did not receive federal rebate		
British Columbia	63 (9)	0
Alberta	83 (9)	0
Québec	54 (10)	0

Standard errors in parentheses. See Methods for details on calculating true average rebate.

- People are often not well-informed regarding the transfers they receive
- Subjective evaluation closely linked to political orientation (e.g. Douenne and Fabre 2022)

Using revenues to compensate households?

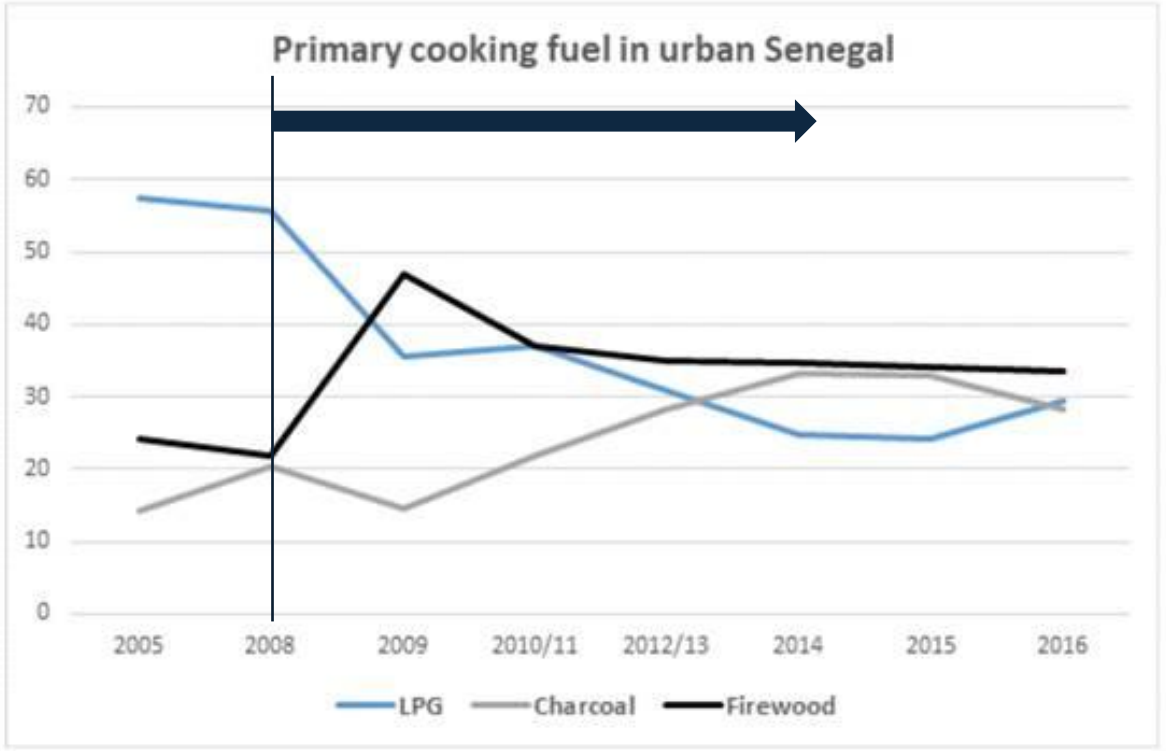
- Research finds that revenue recycling makes carbon pricing schemes generally more acceptable
- But: There are differences how acceptable various recycling schemes are for citizens
- Often uniform cash transfers are less acceptable than green spending



Source: Mohammadzadeh Valencia et al. (2024)

LMICs particularities: The role of biomass and air pollution

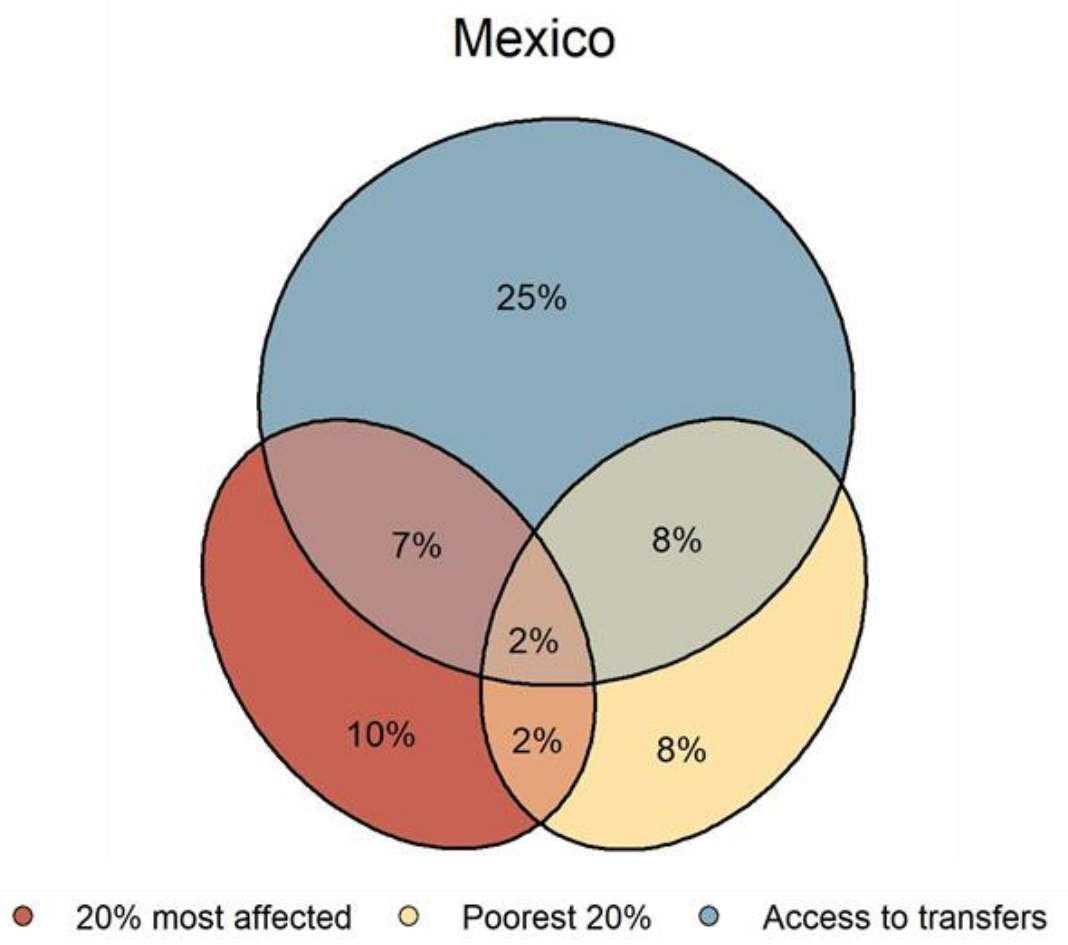
- Carbon pricing will lead to a reduction in fuel consumption
  - But, what's the alternative?
- Households may increase use of traditional biomass in response to higher fossil fuel prices
  - Adverse impacts on health through indoor air pollution
- In addition: potential shifts in diets; negative effects on calorie and nutrient intake (e.g. in Uganda)
- Transfers to protect from negative impacts are pivotally important



Source: Rose et al. 2022, Aggarwal et al. in press

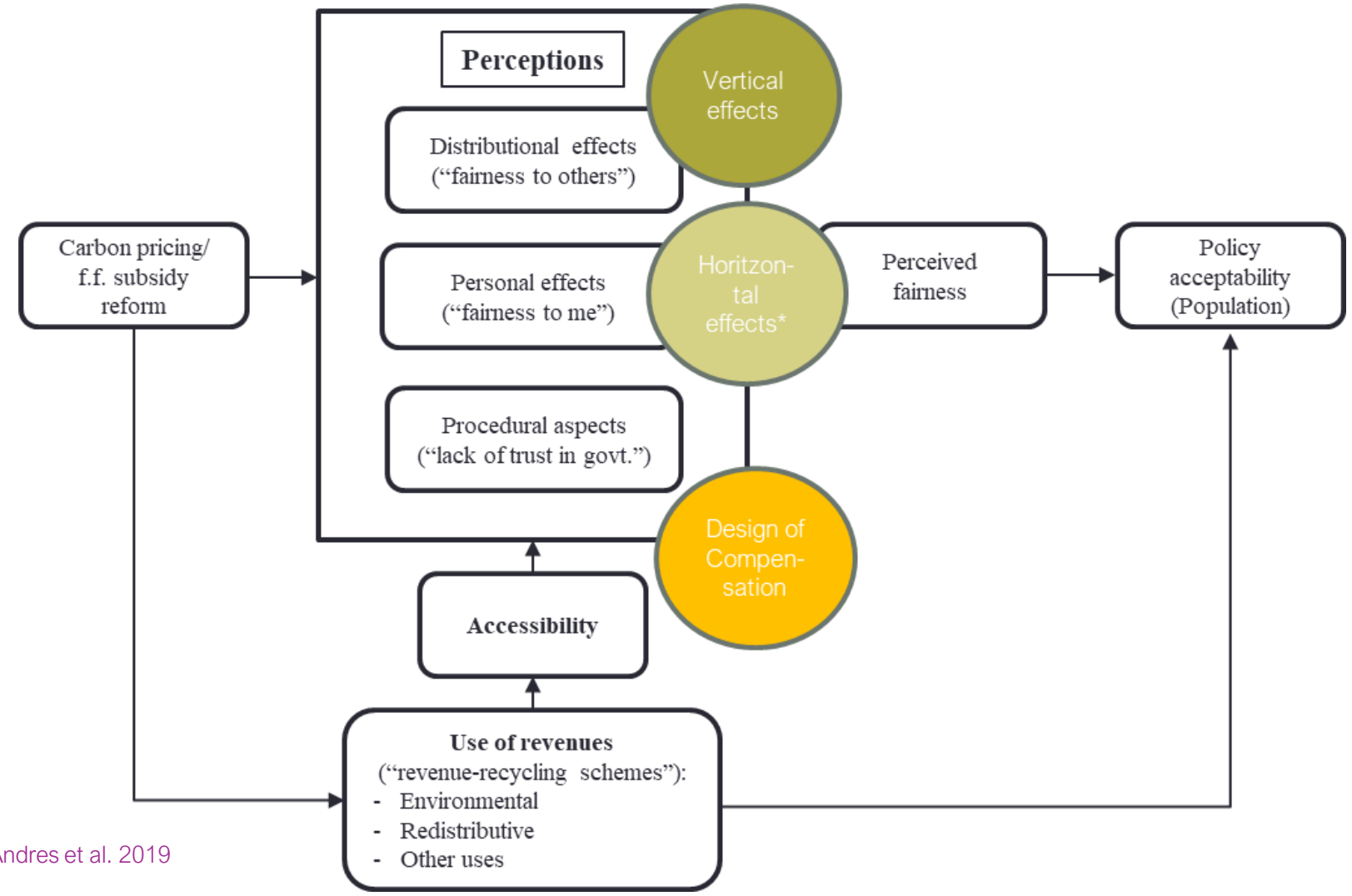
Using revenues to compensate households?

- Research finds that revenue recycling makes carbon pricing schemes generally more acceptable
- But not all of the most affected households have access to existing transfer programmes
- Need to expand coverage of existing transfer programmes or to design novel compensation mechanisms that target those that need to be targeted
- Successful implementation of revenue recycling requires careful consideration of local institutional limitations and pre-existing social assistance structures



Source: Missbach et al., 2024

What determines acceptability?



Modified from Maestre-Andres et al. 2019

IV ELEVATE INTERNATIONAL STAKEHOLDER WORKSHOP

Please select a breakout room:

Room 1: Implications of EU CBAM and carbon border adjustment mechanisms

Room 2: Distributional consequences of carbon pricing on households

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IV ELEVATE INTERNATIONAL STAKEHOLDER WORKSHOP

Forging a Net-Zero Future: Unlocking technological and economic innovations to bridge the implementation gap

Break-out room: Implications of EU CBAM and other Carbon Border Adjustment Mechanisms

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Mentimeter Exercise on CBAM

To participate, please scan the QR code or follow the link in the chat

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ELEVATE - ENABLING AND LEVERAGING CLIMATE ACTION TOWARDS NET ZERO EMISSIONS

Assessing economic and trade implications of gradual introduction of CBAM in major economies

Ioannis Charalampidis, Dimitris Fragkiadakis, Zoi Vrontisi (E3Modelling)

GEM-E3 model

- The GEM-E3 model is a **large scale sophisticated economic model** designed to evaluate the **effects of external shocks** on the economy.
- The model has been employed in the last 30 years by **international institutions** (**OECD, World Bank, European Commission, NGFS, IPCC**), **national governments** and the **private sector** for the assessment of transition and physical climate risks.
- It is frequently **peer-reviewed** and its results are published in top ranked scientific journals and included in latest **IPCC reports.**
- It is an applied global CGE model that provides a robust framework to capture the **complex energy-economy-climate interactions**
- The model provides results with **yearly frequency up to 2030 and 5-year time steps until 2050/2100.**
- The model features a high sectoral, regional and policy detail: **68 economic activities** per country (incl. *all* sectors assessed in the *2022 Climate Risk Stress Test*), **46 countries/regions** with all major economies and the EU27 MS with NUTS2 representation and all **GHG emissions**.

Topics of impact analysis

- ✓ Climate transition and physical risk analysis
- ✓ Energy, climate and transport policies
- ✓ Costs of climate change and adaptation
- ✓ Trade policies
- ✓ Circular industrial restructuring
- ✓ Value chain and fuel price shocks
- ✓ Investment and innovation strategies

GEM-E3 model overview

46 model regions:

- G20 countries
- EU27 Member States
- Global coverage

Interlinked via bilateral trade

68 economic activities:

- key economic sectors
- energy intensive industries
- fuels and energy
- clean energy technologies

Interlinked via value chains

4 economic agents:

- Households
- Firms
- Government
- International sector

Interlinked via institutional transfers

GEM-E3 model

GEM-E3-FIT Economy- Environment-Energy nexus

Economy

- 48 economic activities
- 46 countries/regions plus NUTS2 regional representation
- 10 Households per country
- 5 occupations per country
- Consistent sectoral projections via:
  - Linking all economic activities and countries with bilateral trade
  - Inter-dependencies across the value chain
  - Detailed budget accounting for Firms, Households, Government

Energy

- 10 fuels
- 12 power generation technologies
- Physical and monetary representation of all energy flows
- Explicit representation of energy mix in the production process of firms
- Representation of major energy policies (RES deployment, energy efficiency directive etc.)

Environment

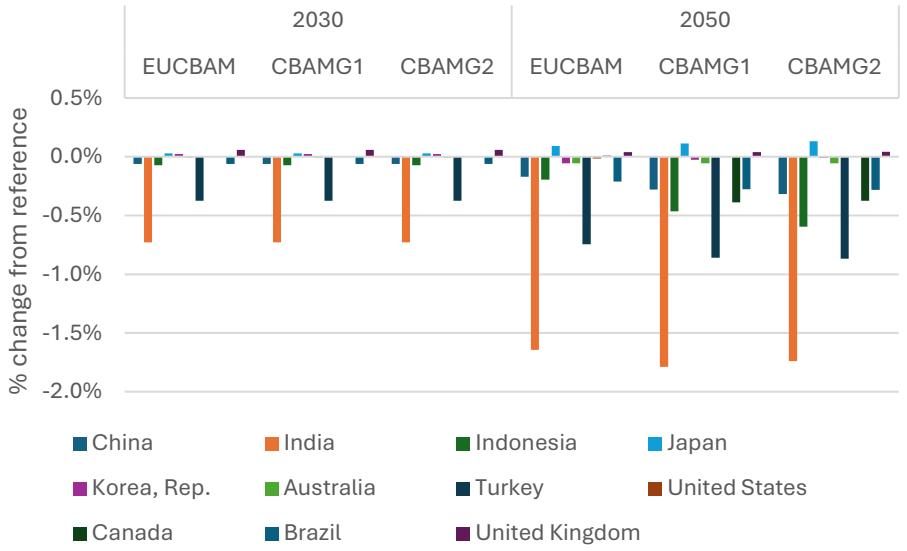
- Explicit representation of all GHG emissions (CO2, CH4, N2O, HFC, PFC, SF6)
- Bottom-up representation of key abatement options of GHG emissions
- Carbon pricing
- CO2 budgets and association with temperature impacts
- Explicit representation of Climate Policies (NDCs, Carbon Neutrality policies, Carbon clubs, CO2 standards)

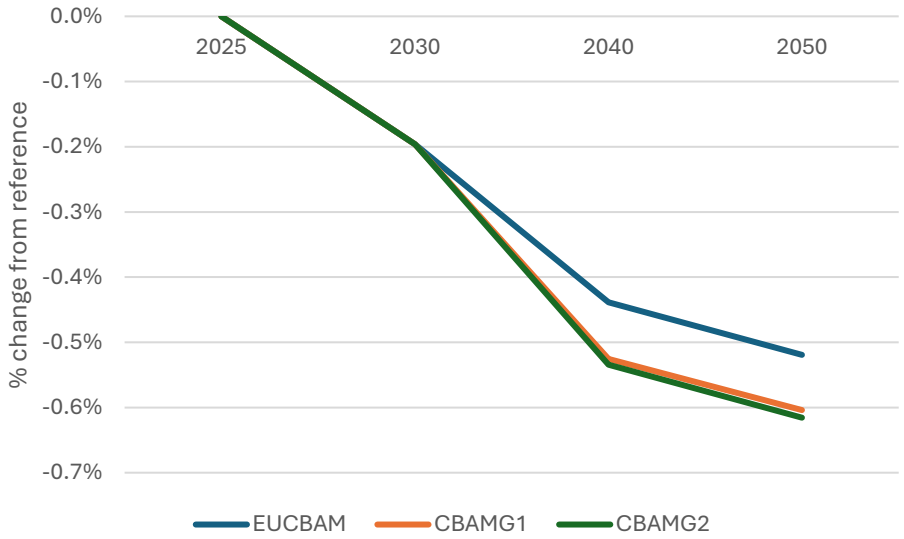
Scenario design

	Reference	NDC+EU CBAM	NDC+G1CBAM	NDC+G2CBAM
EU climate policy	Fit-for-55 extended to net zero GHG to 2050			
Global climate policy	NDC	NDC	NDC	NDC
EU CBAM	No	EU CBAM Regulation (EU) 2023/956	EU CBAM Regulation (EU) 2023/956	EU CBAM Regulation (EU) 2023/956
Other CBAM	No	No	Border Carbon Adjustment schemes in Group 1 countries: Australia, USA, UK and Japan, considering domestic carbon pricing schemes or implicit carbon values from emission targets	Border Carbon Adjustment schemes in Group 1 plus Group2 countries: Canada, China and India, considering domestic carbon pricing schemes or implicit carbon values from emission targets
Sectors under CBAM	No	cement, iron and steel, aluminium, fertilisers, hydrogen, and electricity		

GHG Emissions implications

- The CBAM implementation has limited impact on emissions
- Under the CBAMG2 scenario where most of the top economies introduce a CBAM global emissions fall by approximately 0.6%
- The effects are more pronounced in India where emissions in all scenarios fall by more than 1.5% in 2050

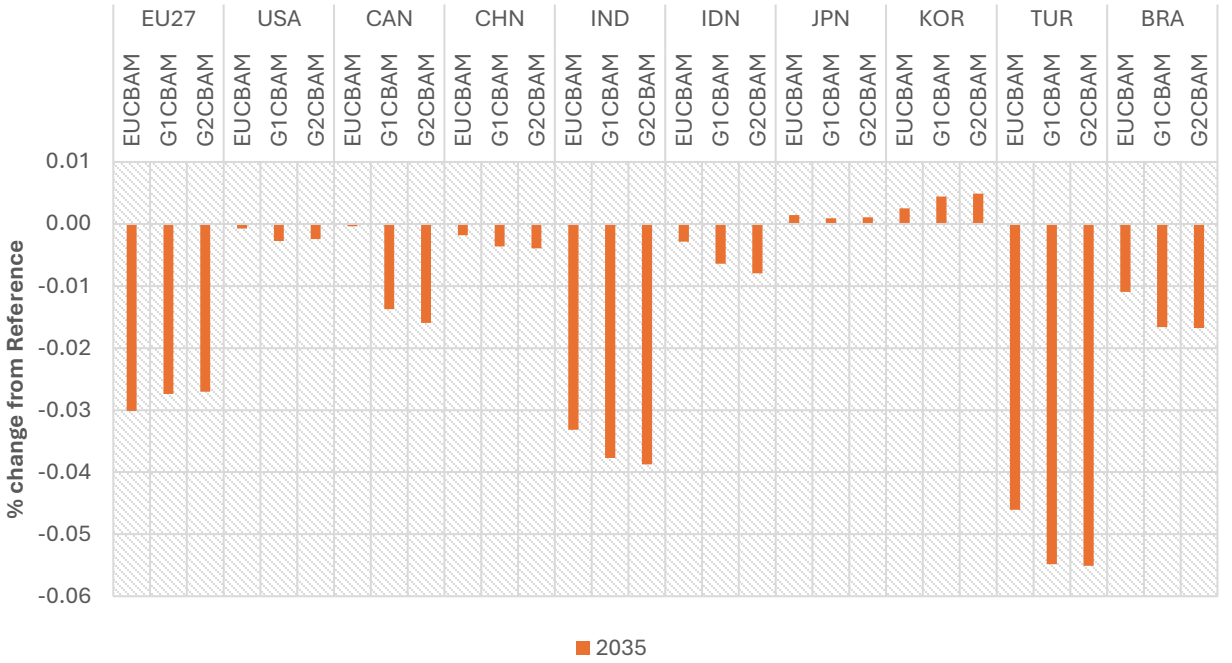


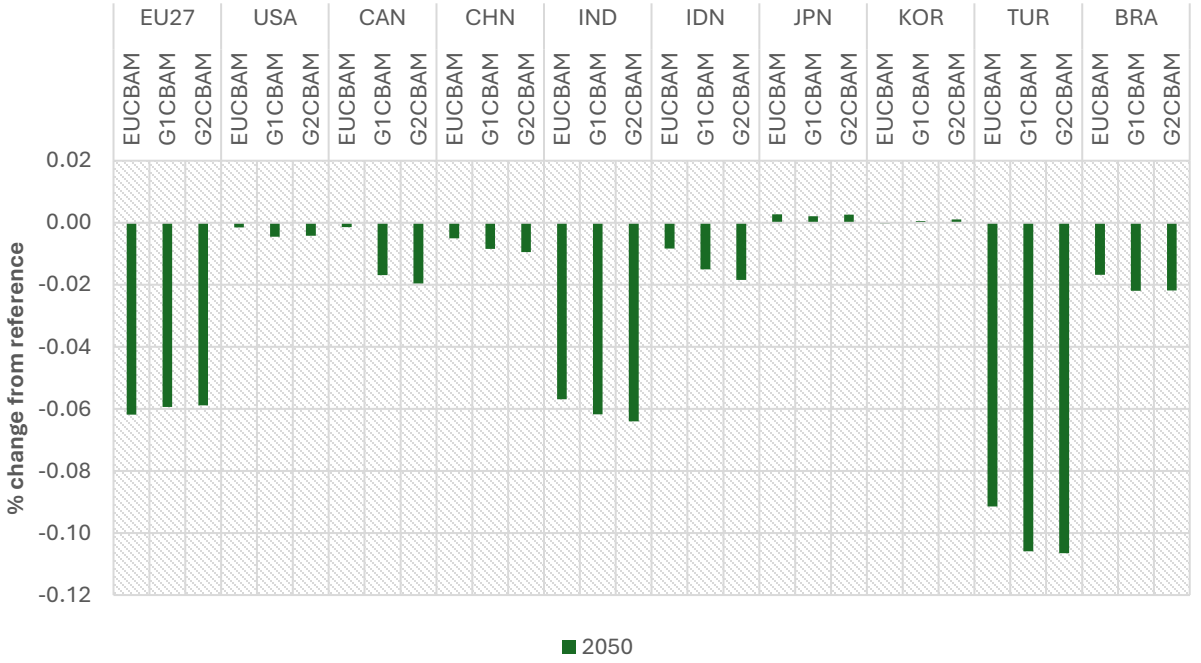


GDP impacts

- Small global and country-level GDP impacts
- Turkey, EU and India with highest GDP losses among countries examined

- Trade (imports/exports) is affected the most in relative terms, driving GDP impacts in the EU27, Japan and S. Korea
- Changes in consumption are also key
    - induced economic effect of lower incomes,
    - Increased prices of composite goods both for countries imposing CBAM and for countries that import their goods
- Imports fall in most countries





Exports impacts

		2030	2050	Cumulative
EUCBAM	China	0.00%	0.02%	0.01%
	India	-0.26%	-0.32%	-0.31%
	Indonesia	-0.01%	0.00%	0.00%
	Japan	0.02%	0.07%	0.05%
	Korea, Rep.	0.02%	0.03%	0.02%
	Australia	0.00%	0.00%	0.00%
	Turkey	-0.11%	-0.37%	-0.26%
	United States	0.01%	0.03%	0.02%
	Canada	0.02%	0.05%	0.04%
	Brazil	-0.02%	-0.04%	-0.04%
	United Kingdom	0.04%	0.11%	0.08%
	EU27	-0.38%	-0.89%	-0.66%

		2030	2050	Cumulative
CBAMG1	China	0.00%	-0.01%	-0.01%
	India	-0.26%	-0.37%	-0.36%
	Indonesia	-0.01%	-0.06%	-0.06%
	Japan	0.02%	0.02%	0.01%
	Korea, Rep.	0.02%	0.04%	0.03%
	Australia	0.00%	-0.22%	-0.16%
	Turkey	-0.11%	-0.44%	-0.31%
	United States	0.01%	-0.05%	-0.04%
	Canada	0.02%	-0.05%	-0.04%
	Brazil	-0.02%	-0.07%	-0.06%
	United Kingdom	0.04%	-0.03%	-0.02%
	EU27	-0.38%	-0.86%	-0.63%

		2030	2050	Cumulative
CBAMG2	China	0.00%	-0.02%	-0.02%
	India	-0.26%	-0.46%	-0.42%
	Indonesia	-0.01%	-0.10%	-0.08%
	Japan	0.02%	0.03%	0.01%
	Korea, Rep.	0.02%	0.04%	0.04%
	Australia	0.00%	-0.22%	-0.15%
	Turkey	-0.11%	-0.44%	-0.31%
	United States	0.01%	-0.05%	-0.04%
	Canada	0.02%	-0.08%	-0.06%
	Brazil	-0.02%	-0.07%	-0.06%
	United Kingdom	0.04%	-0.03%	-0.01%
	EU27	-0.38%	-0.86%	-0.63%

Bilateral Exports of products s.t. CBAM | EUCBAM scenario

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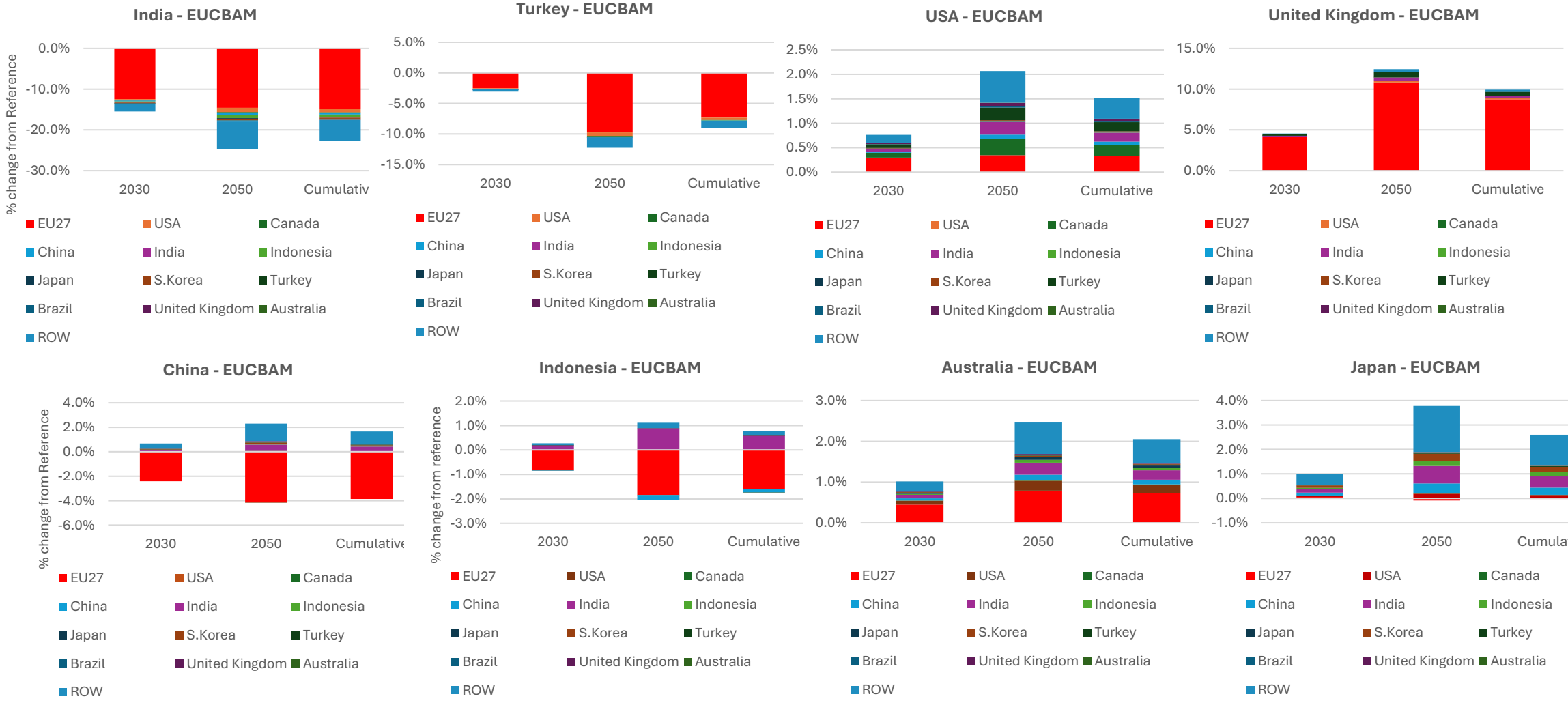
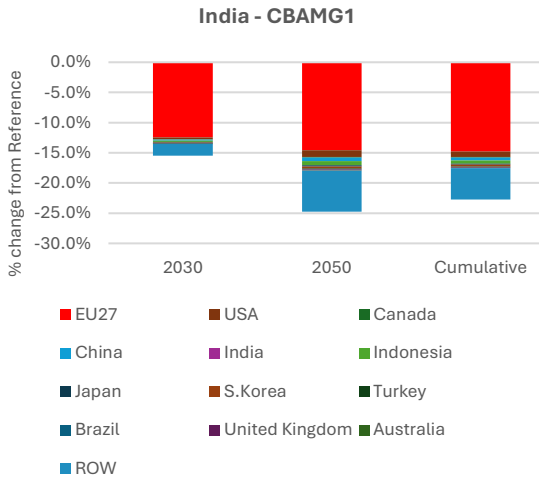
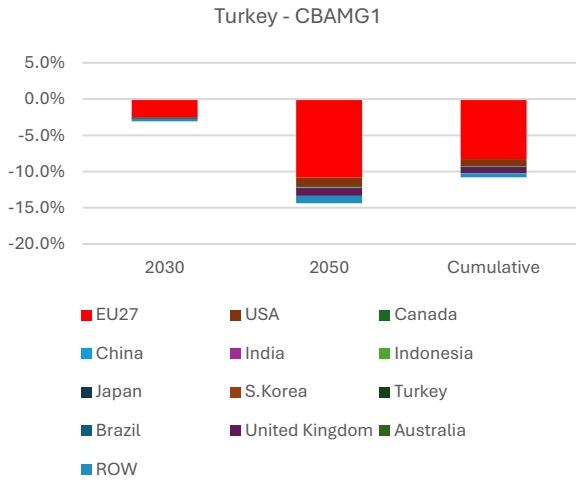
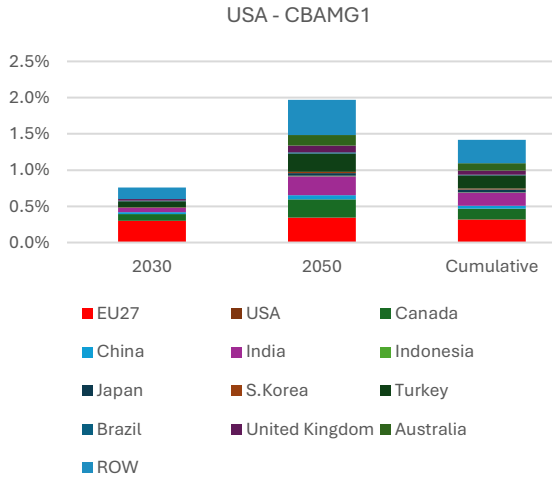
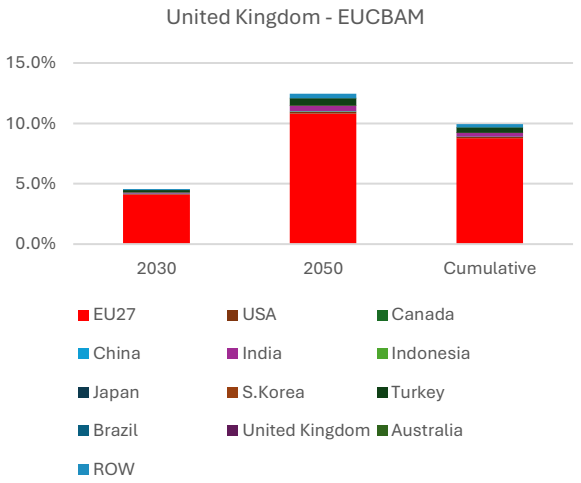


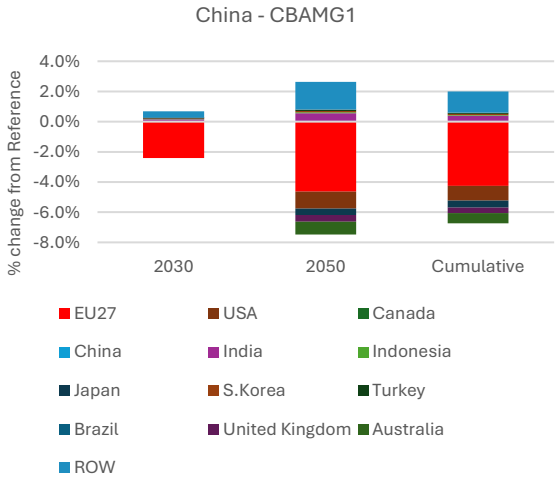
Bilateral Exports of products s.t. CBAM | CBAMG1 scenario

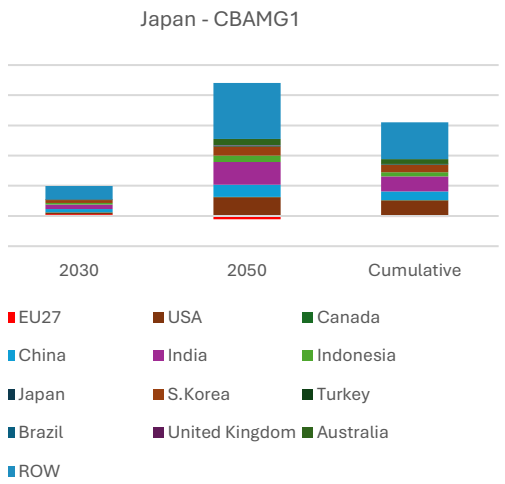


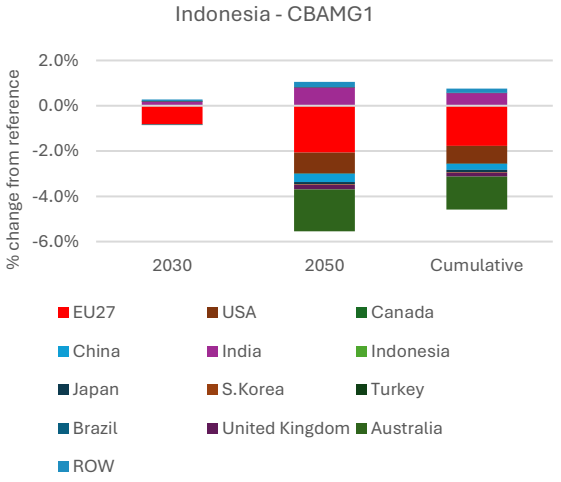


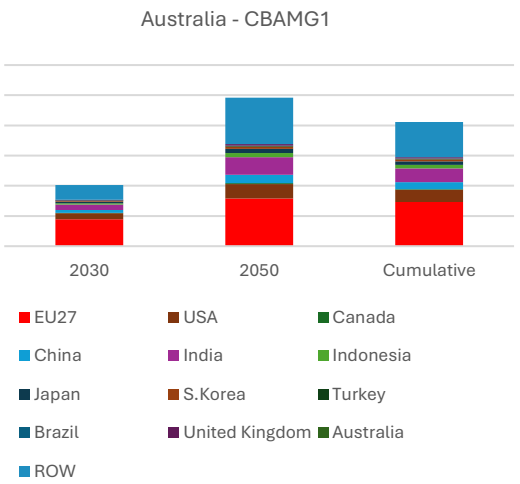




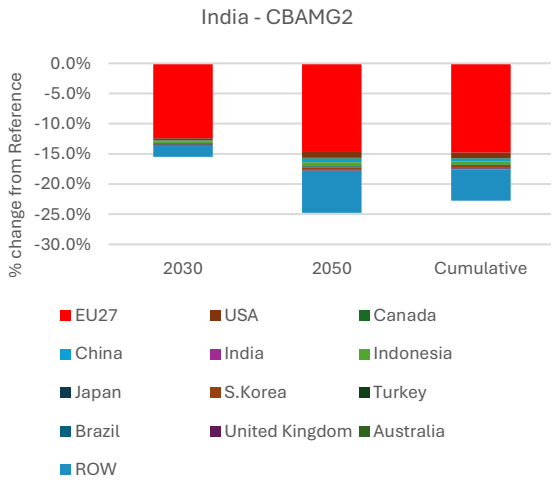


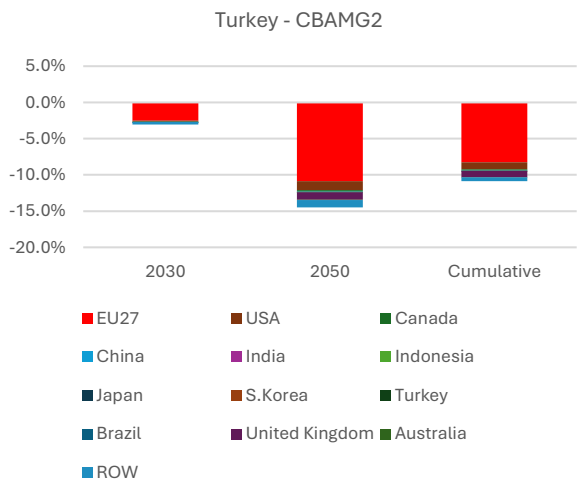


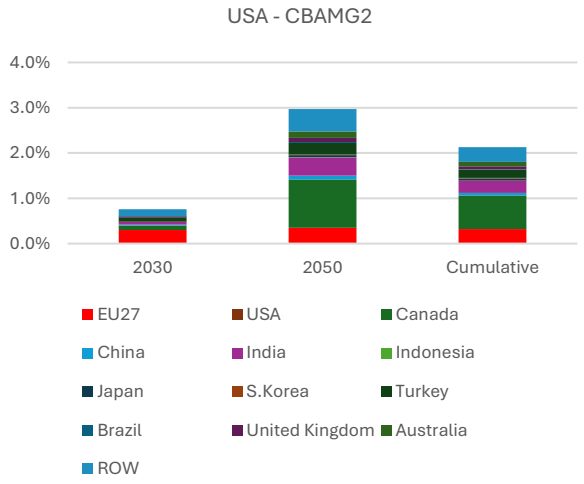


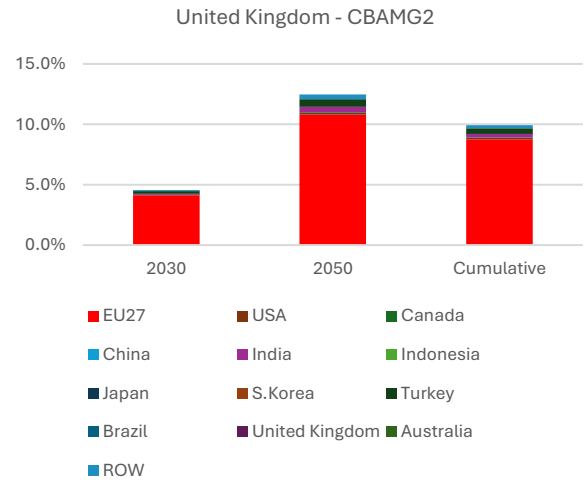


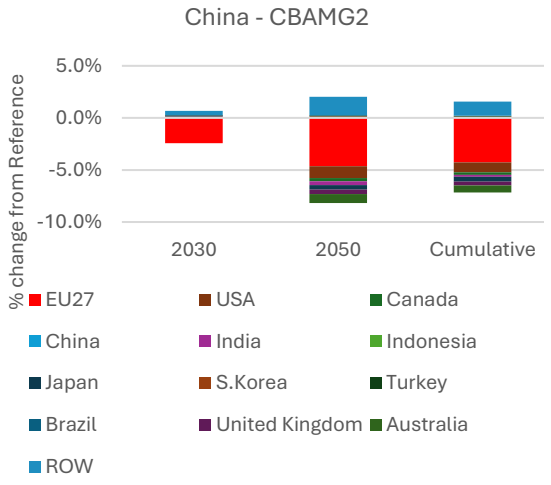
Bilateral Exports of products s.t. CBAM | CBAMG2 scenario

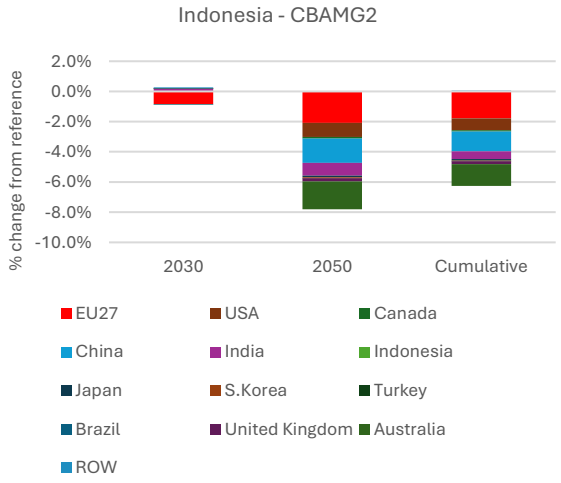


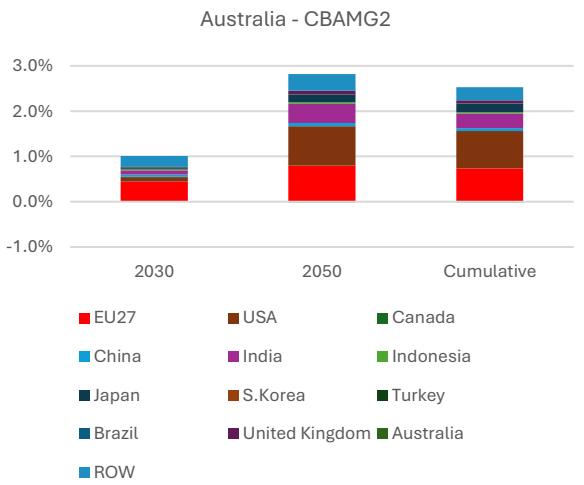


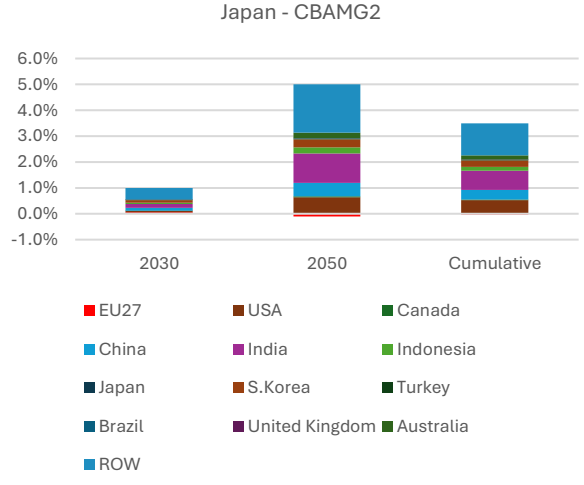




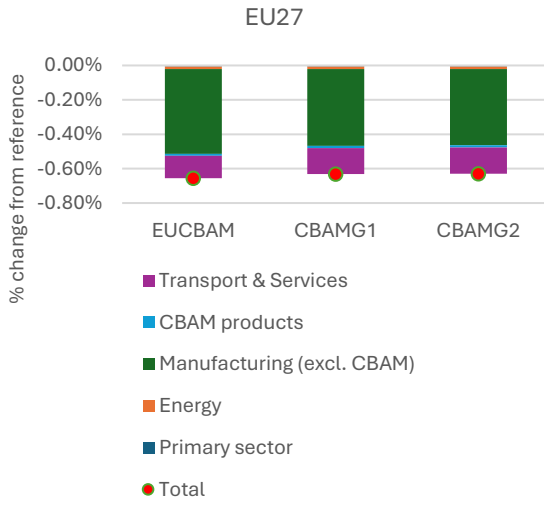


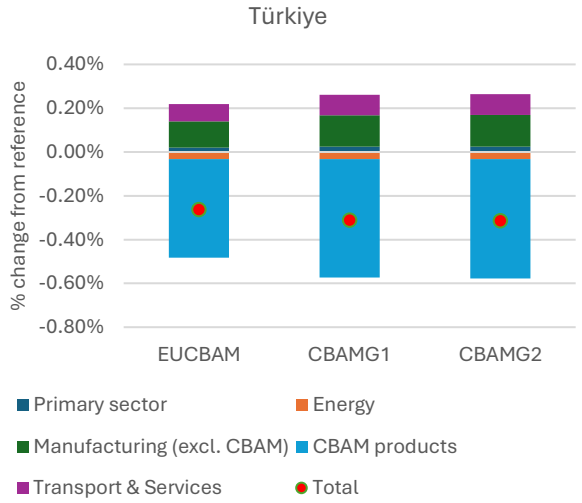


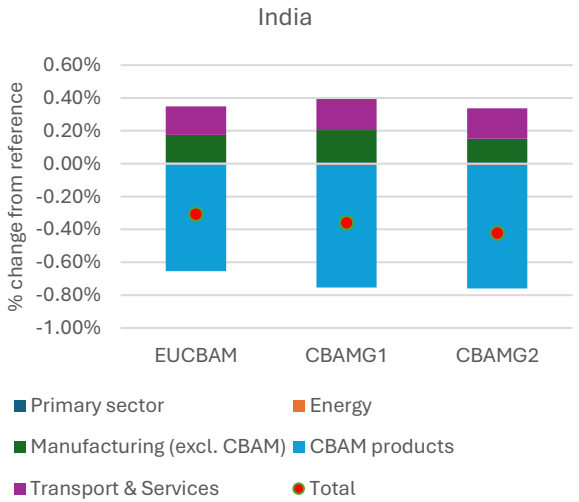


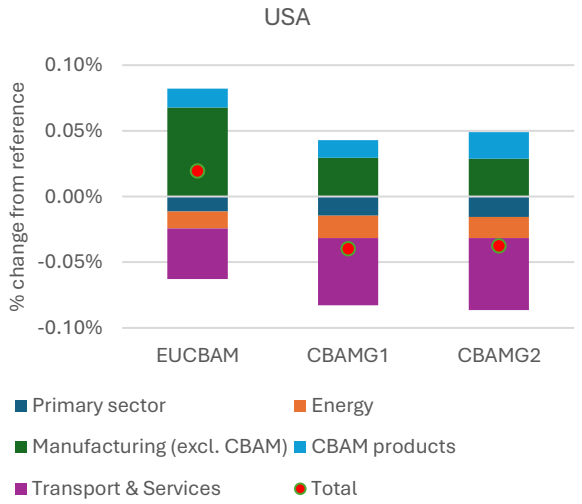


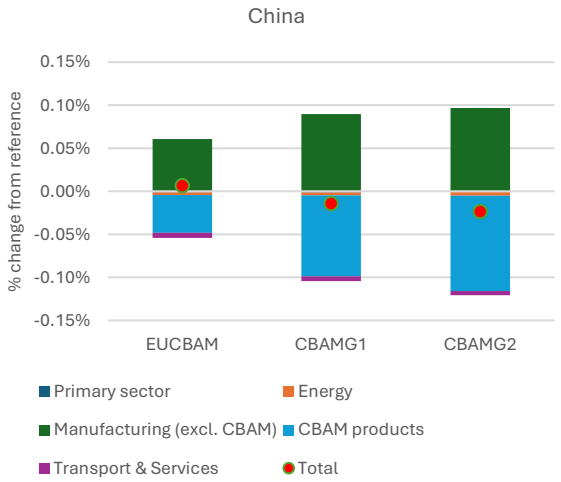
Sectoral Exports

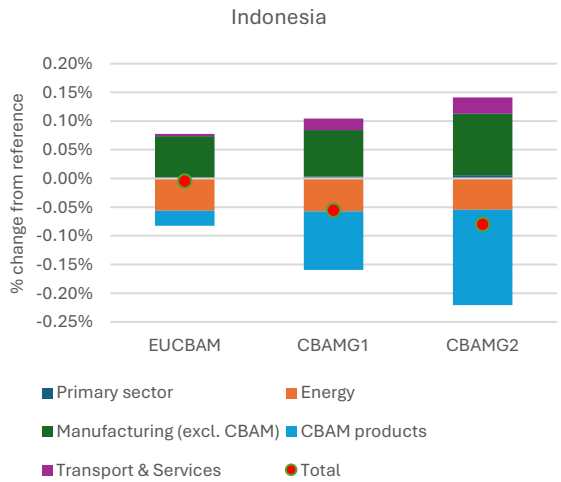


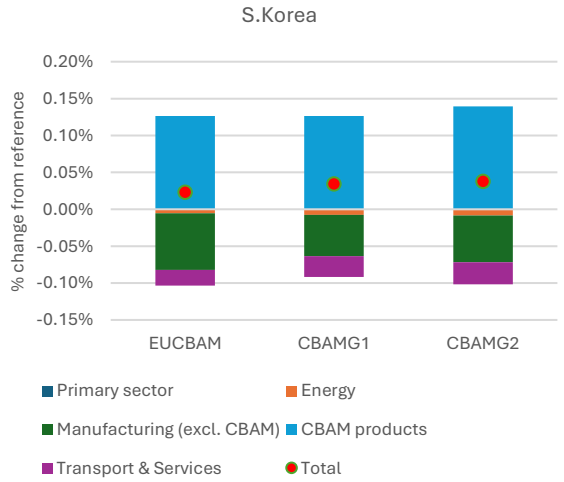


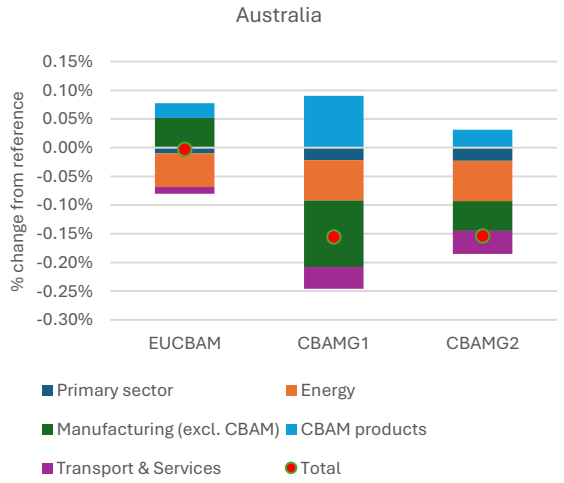




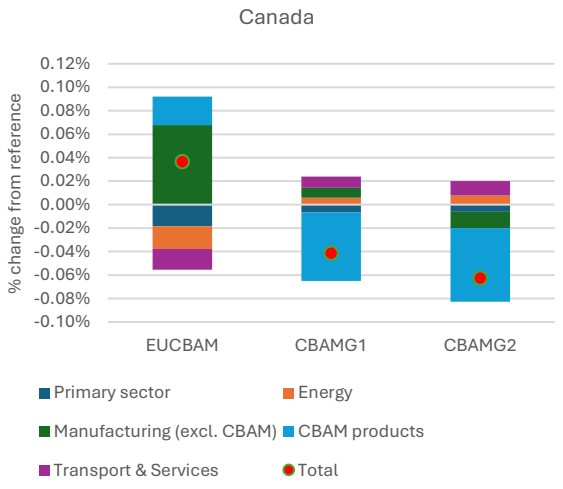


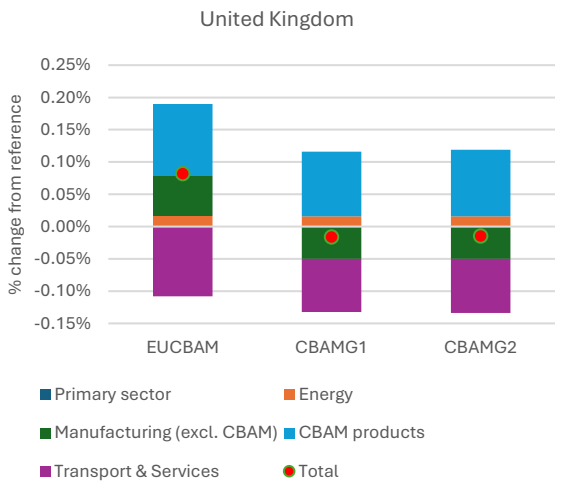


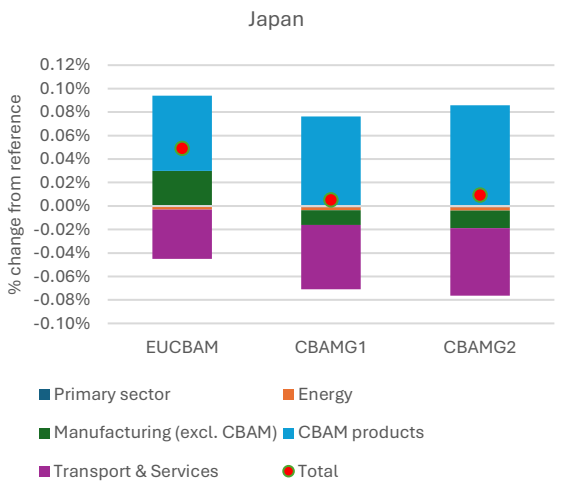


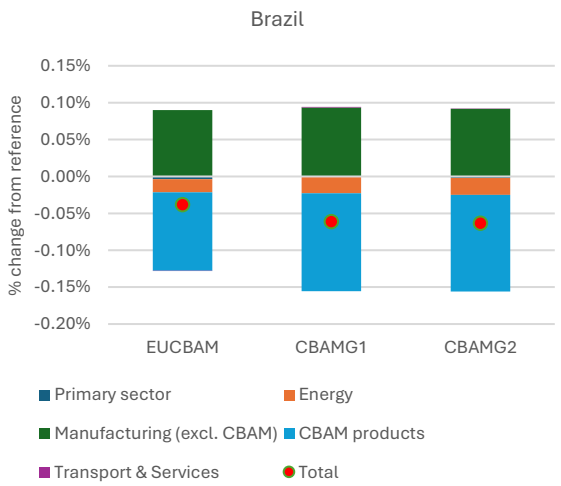


Sectoral Exports









Thank you for your attention!

Expanding carbon pricing boundaries and the EU CBAM: insights into China and India

Paola Rocchi, Edoardo Campo Lobato, Alice Di Bella, Valentina Bosetti

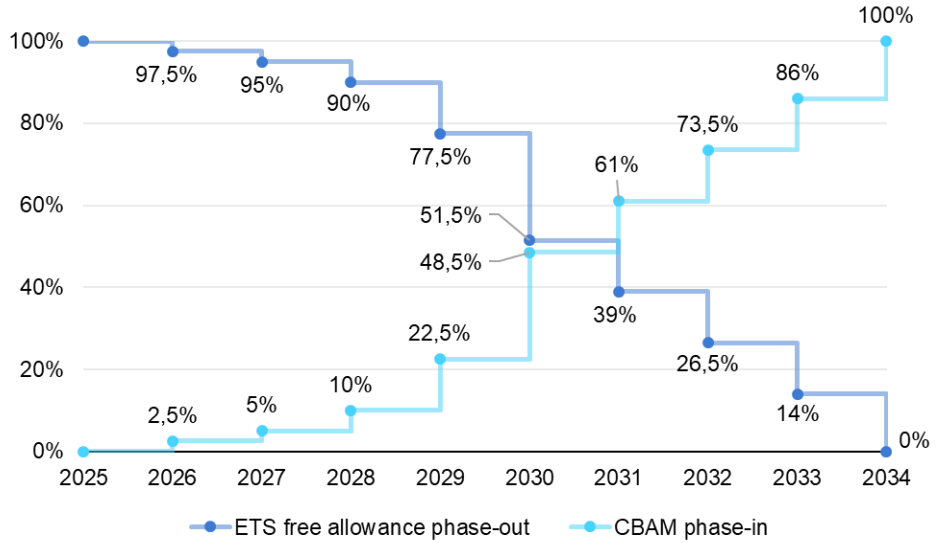
Paola Rocchi*RFF-CMCC EIEE

4th ELEVATE International Stakeholder Workshop, 6 Mar 2025

Framework: CBAM (EP&C, 2023) and reactions

CBAM

- Dual nature
  - Trade policy on imported commodities
  - Environmental nature
    - Based on carbon content
    - Exemption when similar domestic carbon pricing system
    - Aimed at avoiding carbon leakage
- Complement to ETS revision: gradually from 2025, simultaneously to the phasing out of the ETS free allowances



Reactions

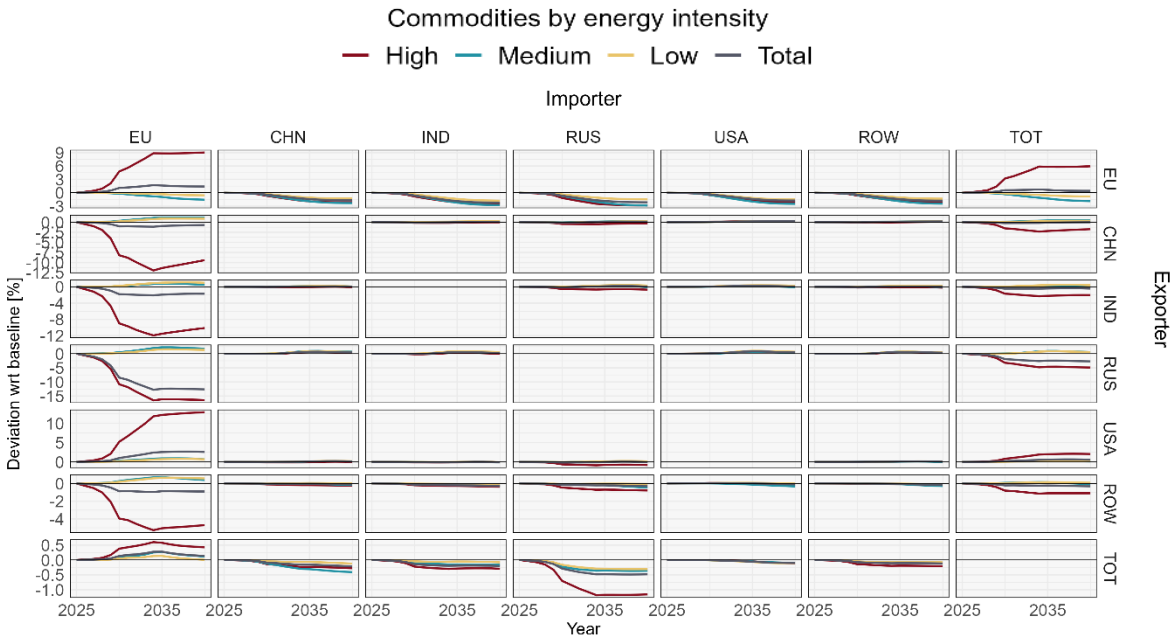
- Academic and institutional debate (Böhringer et al., 2022; Kolev, 2021 ; Vidovic et al., 2023; Marcu et al., 2024; Delbeke et al., 2021; Clora et al., 2023; Sun et al., 2023)
- Reactions in the political sphere (IETA, 2024; ICAP, 2024): pushing forward progresses in carbon prices

Aim and main results

1. Environmental and macroeconomic impact with the specific scope and time frame

- CBAM meets its primary objective to induce a global decrease in CO_2, small increase in Eastern Europe
- Negligible macroeconomic implication, more pronounced for CBAM sectors
- Partial substitution of imports

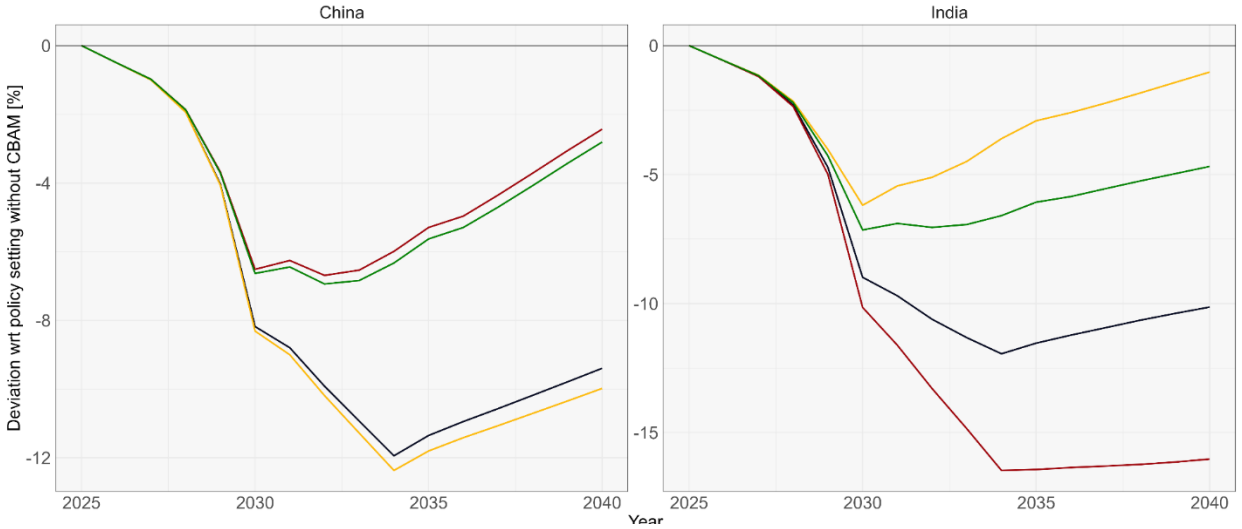
BILATERAL TRADE FLOWS VARIATION OF MANUFACTURING COMMODITIES



2. In the international context of domestic mitigation measures, focus on China and India

LEGEND	SCENARIO NAME	BENCHMARK SCENARIO	ANALYSED SCENARIO
	No national ambition	EU ETS (baseline)	Benchmark + CBAM
	Chinese carbon policy	EU and Chinese ETS	Benchmark + CBAM
	Indian carbon policy	EU and Indian ETS	Benchmark + CBAM
	Chinese and Indian policy	EU, Chinese and Indian ETS	Benchmark + CBAM

BILATERAL TRADE FLOWS VARIATION OF ENERGY-INTENSIVE COMMODITIES



- CBAM impact on international trade is mitigated
- CBAM strategically connects countries' mitigation policies

Thank you! Any question?

For more details or comments: paola.rocchi@cmcc.it

Environmental and economic impacts of EU CBAM and SBCE on the competitiveness of the main Brazilian commodities on the international market

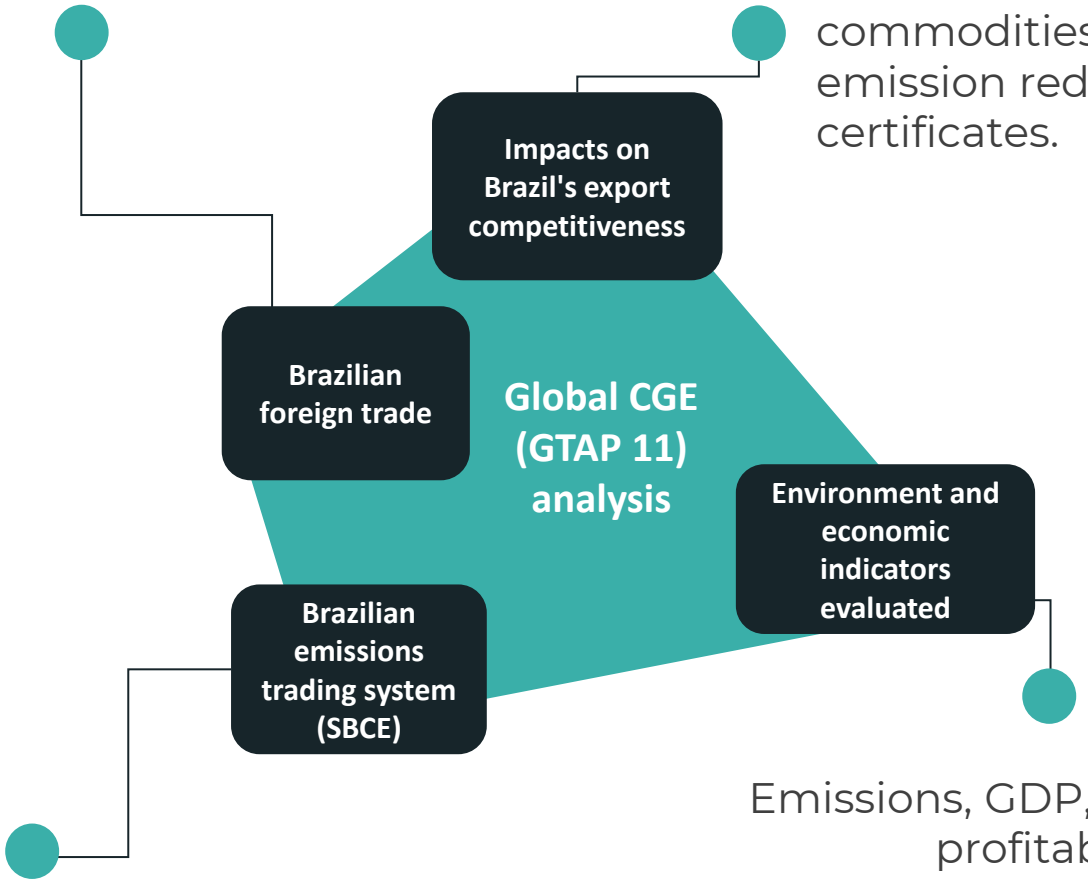
Roberto Schaeffer and Régis Rathmann

OBJECTIVE AND SCOPE

1. To measure the impacts of CBAM and the Brazilian carbon pricing policy on the country's emissions and GDP
2. To assess the extent to which the profitability of Brazil's commodity sectors is affected by policies to respond to the impacts of carbon pricing in terms of reducing the energy intensity of commodity transportation routes to the EU

Main exports goods are crude oil, soybeans and iron ore → China, EU countries, and USA.

CBAM requires importers of selected energy-intensive commodities to purchase emission reduction certificates.



Emissions, GDP, and export's profitability

Does the SBCE impact the competitiveness of Brazilian commodities?

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METHODOLOGICAL PROCEDURE

PAEG model has been updated with the GTAP 11 database:

- PAEG (General Equilibrium Analysis Project) is an applied general equilibrium tool capable of representing a global macroeconomic multi-sectoral multi-regional model built on GTAP 11 database and designed to analyze interactions across countries and sectors.

1. The PAEG model has been updated with the GTAP 11 database, in which Brazil is a representative region
2. Scenario assumptions: I) population growth and labor productivity variables from the SSP2 database are assumed to be exogenous in the baseline; ii) EU ETS allowances are auctioned in their entirety in the electricity sector, while in the industrial sectors the free allocation of allowances is phased out according to the scheme presented in the ETS review
3. 3 different policies were modeled. Initially, the adoption of CBAM in the iron and steel, aluminum, fertilizer, cement, soybean and crude oil sectors was considered. Pricing was modeled for the same sectors under the SBCE[1], assuming a carbon price of 40 euros per tonne of CO_2.

Carbon pricing policies implemented by scenario

Scenarios	Policies implemented
Baseline	Full EU ETS
CBAM	Full EU ETS and EU CBAM (sectors covered: iron and steel, aluminum, fertilizers, cement, crude oil, and soybeans)
Brazilian SBCE + CBAM	Full EU ETS, CBAM and Brazilian SBCE on energy-intensive industries (the SBCE will be gradual and divided into five main phases, covering industrial facilities that emit more than 25,000 tCO_2eq per year). A carbon price up to 40 EUR per tonne of CO_2 is assumed (Rocchi et al., 2024)

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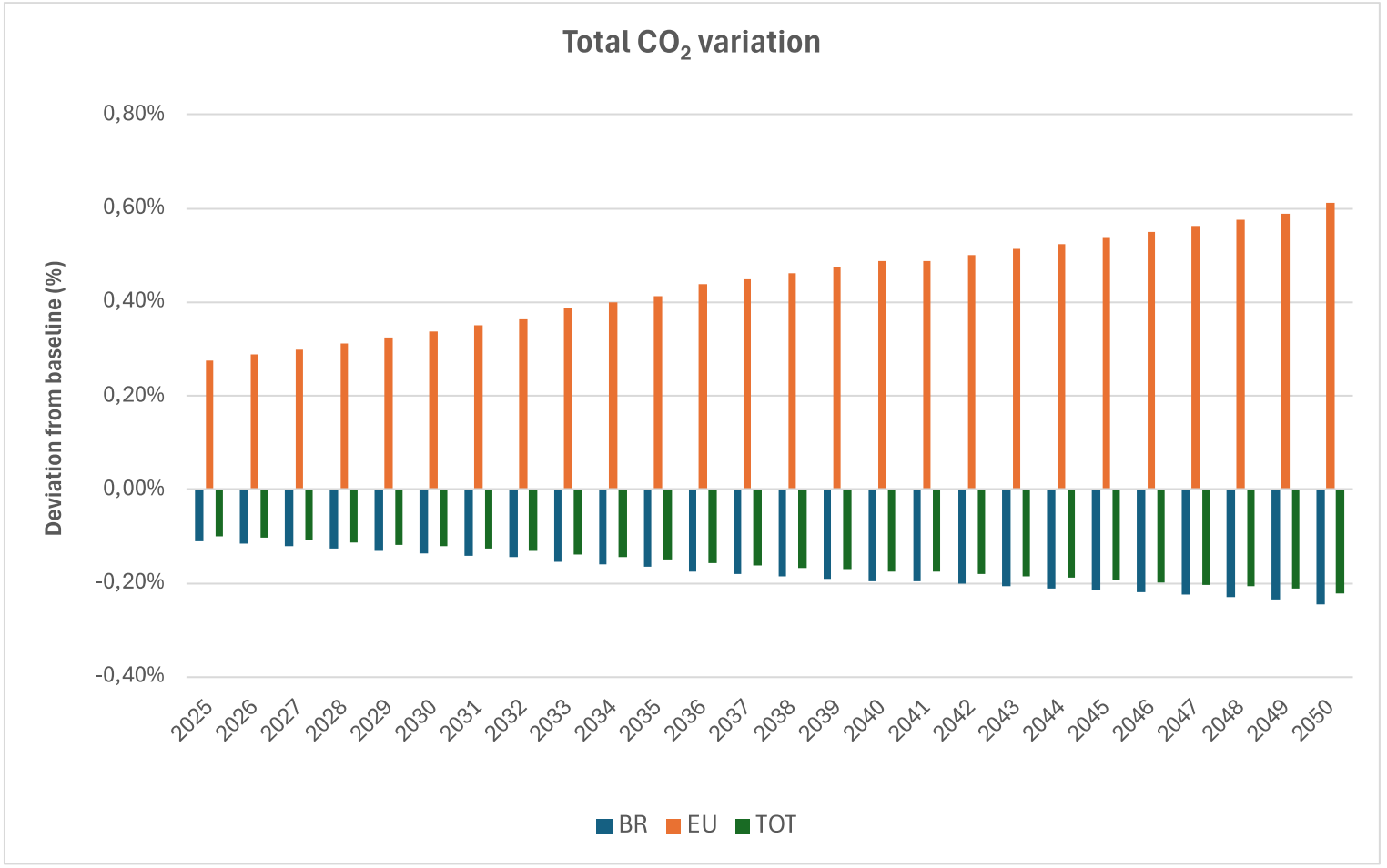
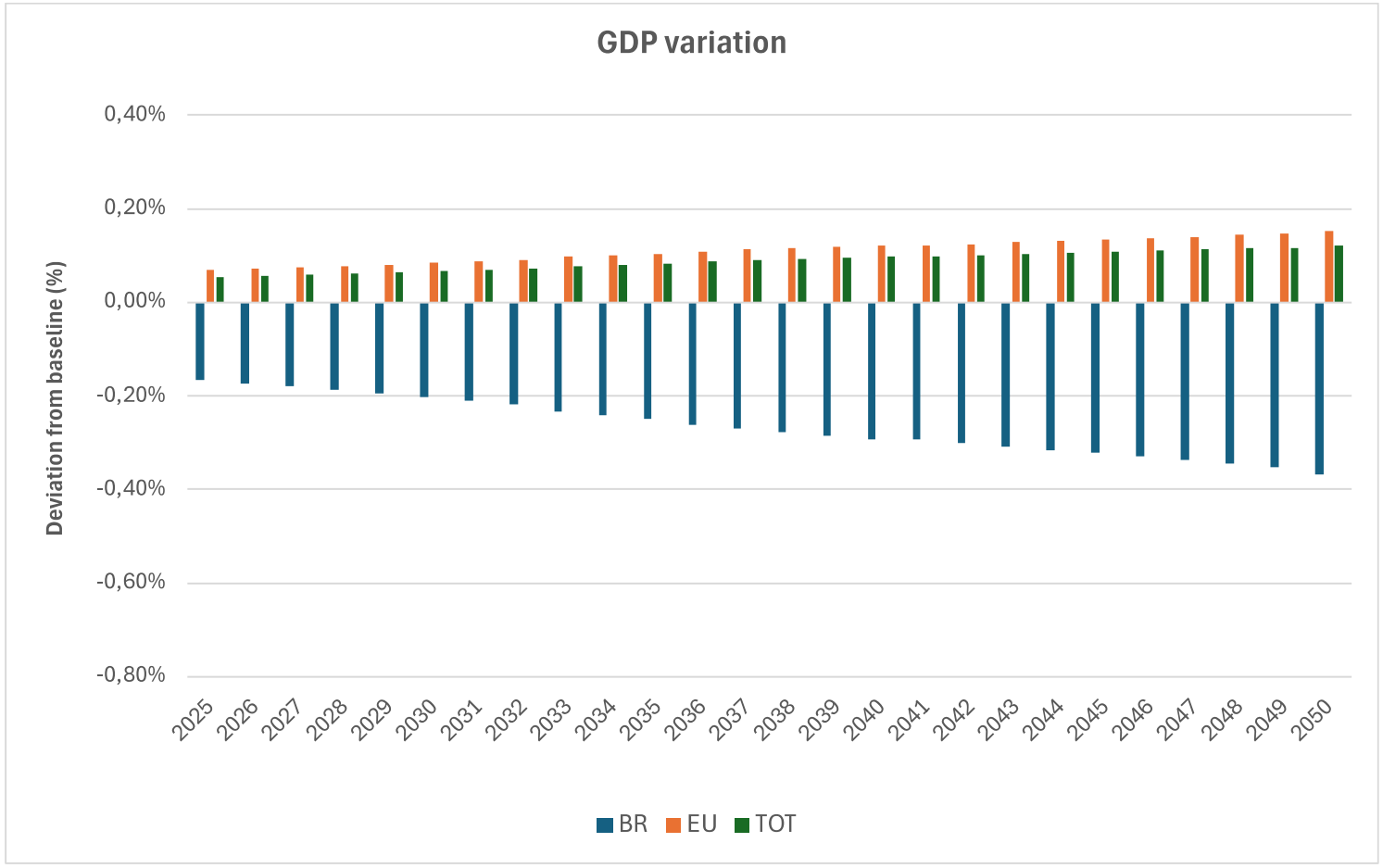
CO_2 Impacts



In terms of the impact on emissions of the introduction of CBAM in the EU, Brazil (BR) and in total terms in all economies (TOT), particularly on energy-intensive industries, modest effects in terms of CO_2 emissions were observed

CO_2 emissions variation in the CBAM scenario (Brazil, EU countries and Total)

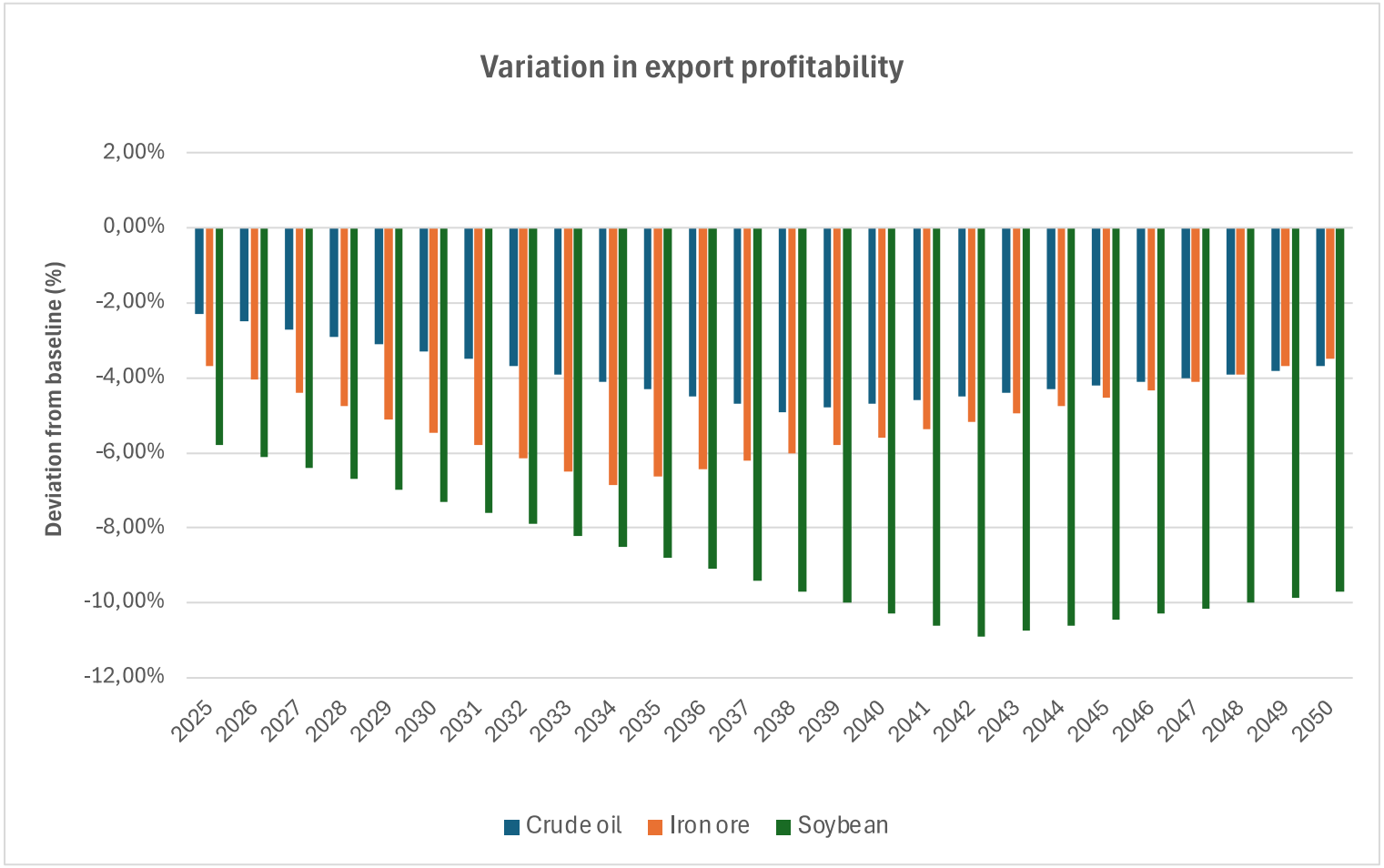
GDP Impacts



GDP variation in the CBAM scenario (Brazil, EU countries and Total)

GDP analysis revealed insignificant impacts for Brazil, the EU and the rest of the world economy. However, given the representativeness of the primary commodity sectors in shaping Brazil's GDP,

Exports profitability variation



Export profitability variation in the exports of crude oil, soybean and iron ore from Brazil

The main impacts of CBAM are on the profitability associated with exports of Brazil's main commodities: crude oil, soybeans and iron ore:

- Crude oil exports, Petrobras (Brazil's national oil company) showed a strong increase in its operating margin in 2024, which would allow it to deal with the small drop in profitability compared to that of the CBAM scenario. Furthermore, the European market is not the main destination for Brazil's exports

- Soybeans and iron ore

Conclusions

- A carbon pricing policy fulfills the role of mitigating emissions. However, the expected reduction is small, especially given the challenge associated with the effectiveness of the policy in terms of reducing emissions in sectors that are difficult to abate

- With regards to the impacts on GDP and export profitability, our results highlight that the current design of the CBAM policy has insignificant implications (impacts on GDP always less than 0.5%) for both EU and non-EU countries, becoming more relevant for the profitability of exports of the main Brazilian commodities

- CBAM and SBCE have a pronounced impact on the production and international trade of energy-intensive commodities that depend on international maritime transport. In this regard, sector-specific compensatory measures should be planned accordingly, such as border adjustments

- Our results indicate that the fear of loss of profitability associated with agricultural commodities exported from Brazil to the EU is valid

- However, the effect in terms of lost GDP is relatively small and the emissions mitigation potential may be significant

Thanks!!!

https://cenergialab.coppe.ufrj.br/

Discussion

- To what extent, and in what ways, have countries reacted to the EU CBAM?

- Which countries would you expect would also impose a CBAM in the upcoming years?

Part II: The Carbon Pricing Incidence Calculator

The data and method behind CPIC

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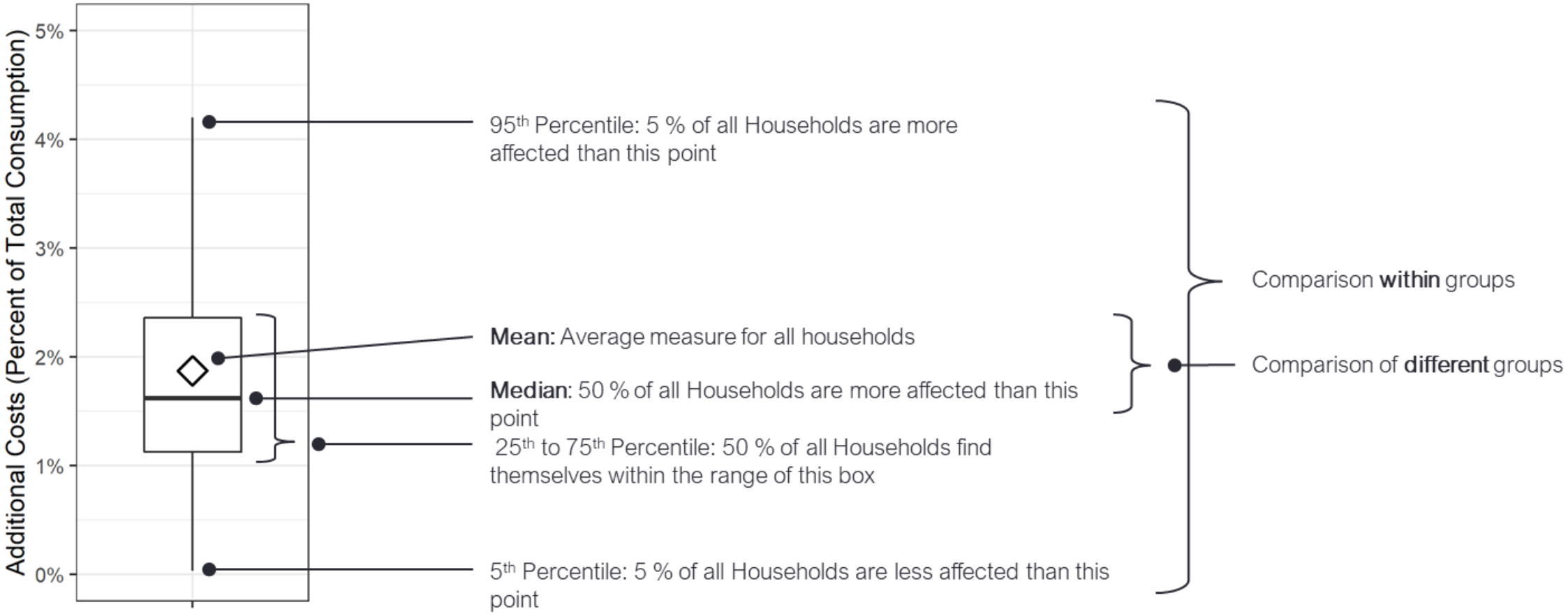
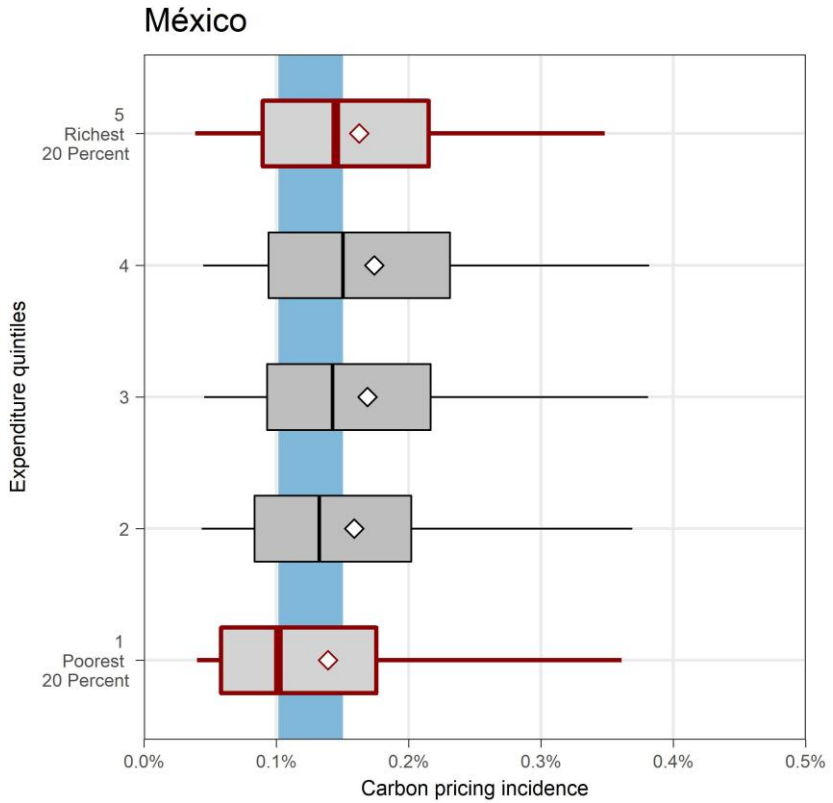
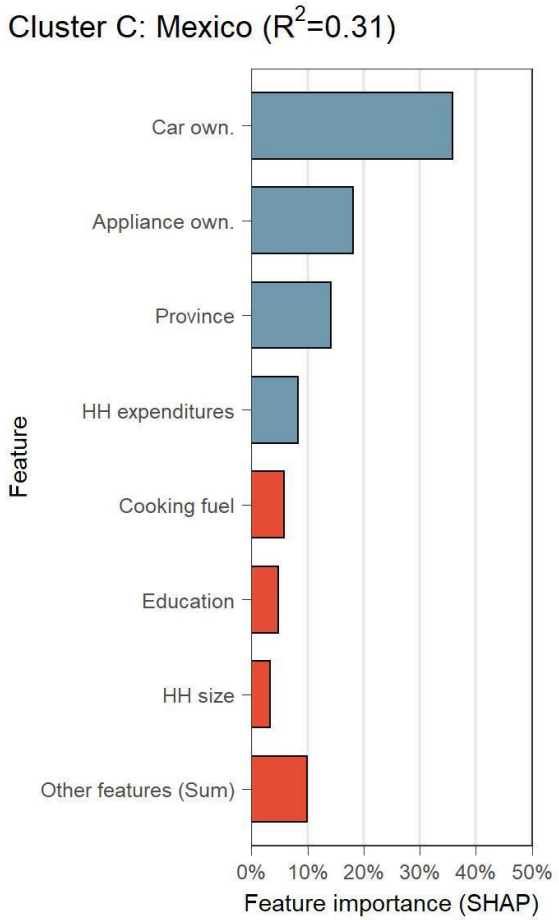
Interlude: Boxplots enable the comparison of distributions



Who is affected by carbon pricing depends on country specifics





- Large differences within poorer and richer households
- Factors beyond income matter

Source: Missbach & Steckel (2024)

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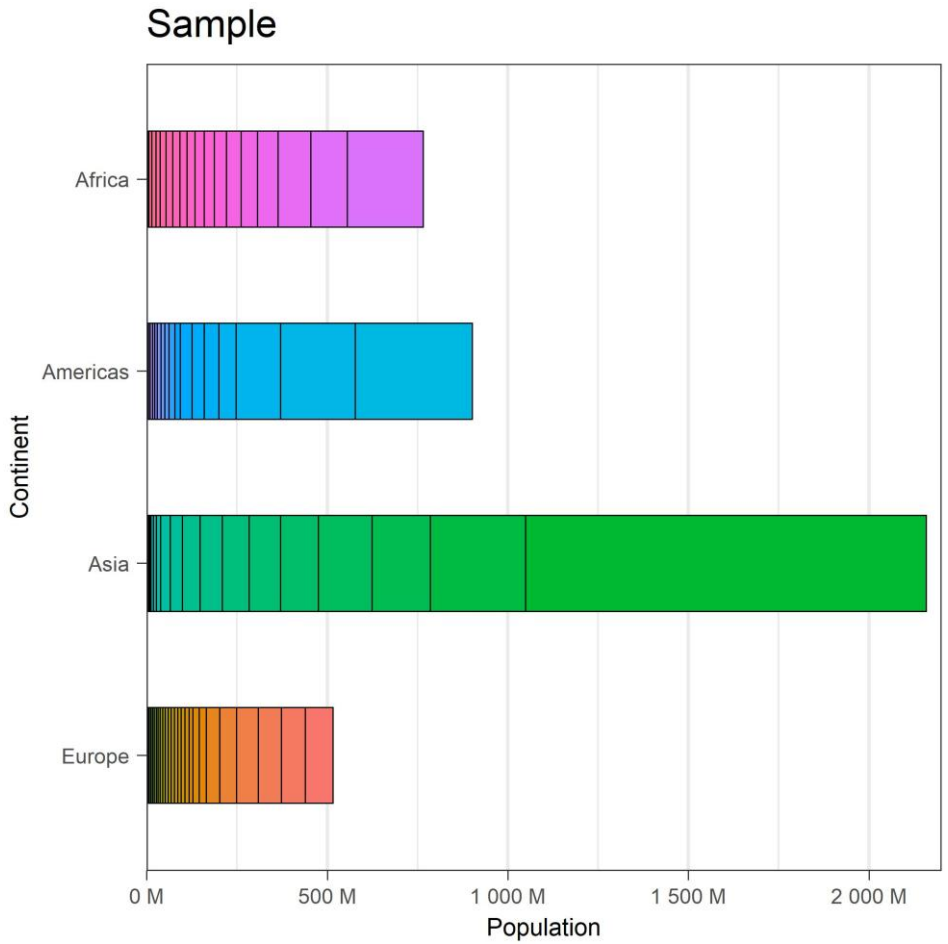
We compile a comprehensive dataset

- 1.56 million households in 88 countries (1)
- Countries account for
  - 65% of global population
  - 68% of global GDP and
  - 52% of global CO_2-emissions
- MRIO-data from GTAP represents year 2017 (2)



(1) Feindt et al. (2021), Steckel et al. (2021), Vogt-Schilb et al. (2019), Missbach et al. (2023), (2) Aguiar et al. (2023)

Source: Missbach & Steckel (2024)

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Modelling the distributional incidence

- We use household data on around 74,000 households from Mexico representative of the population*

Four household members, Jalisco, average income, no car, cooking with LPG,…
Total yearly expenditures: MXN 120,000

* from Encuesta Nacional de Ingresos y Gastos de los Hogares (2020)

Modelling the distributional incidence

- We use household data on around 74,000 households from Mexico representative of the population*
- Households report on consumption expenditures, differentiated by consumption items

Four household members, Jalisco, average income, no car, cooking with LPG,…				
Total yearly expenditures: MXN 120,000				
Services	Transport & Cooking	Vegetables	…	
MXN 3,200	MXN 5,000	MXN 2,500	…	

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- We use household data on around 74,000 households from Mexico representative of the population*
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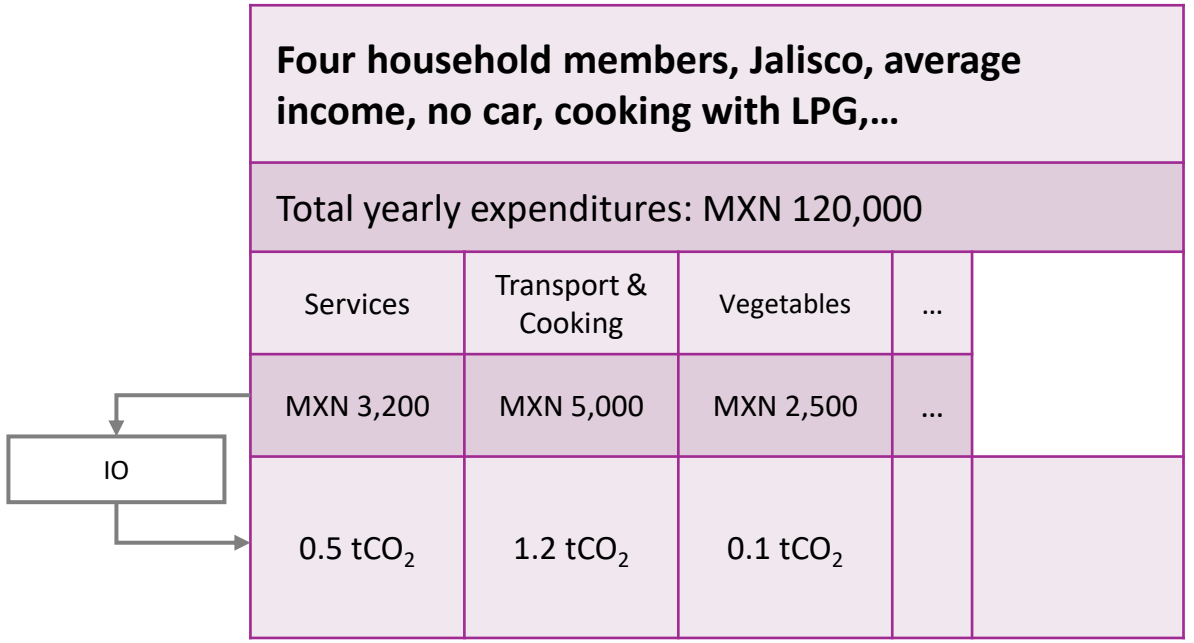
- We use an multiregional Input-Output model (GTAP) to derive sector-specific embedded CO_2-intensities



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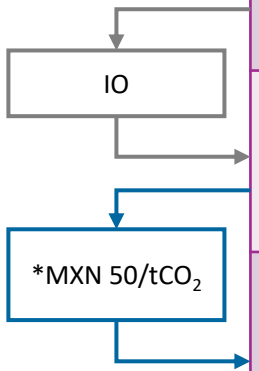
- Next, we derive sectoral price increases resulting from a carbon price of MXN 50/tCO_2



Four household members, Jalisco, average income, no car, cooking with LPG,…				
Total yearly expenditures: MXN 120,000				
Services	Transport & Cooking	Vegetables	…	
MXN 3,200	MXN 5,000	MXN 2,500	…	
0.5 tCO_2	1.2 tCO_2	0.1 tCO_2		
MXN 367.5	MXN 882	MXN 73.5	∑	**MEX 250**

* from Encuesta Nacional de Ingresos y Gastos de los Hogares (2020)

Modelling the distributional incidence

- We use household data on around 74,000 households from Mexico representative of the population*
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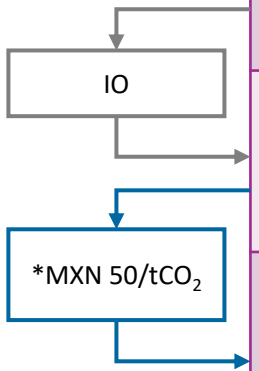
- Next, we derive sectoral price increases resulting from a carbon price of MXN 50/tCO_2
- We compute the total additional overnight costs



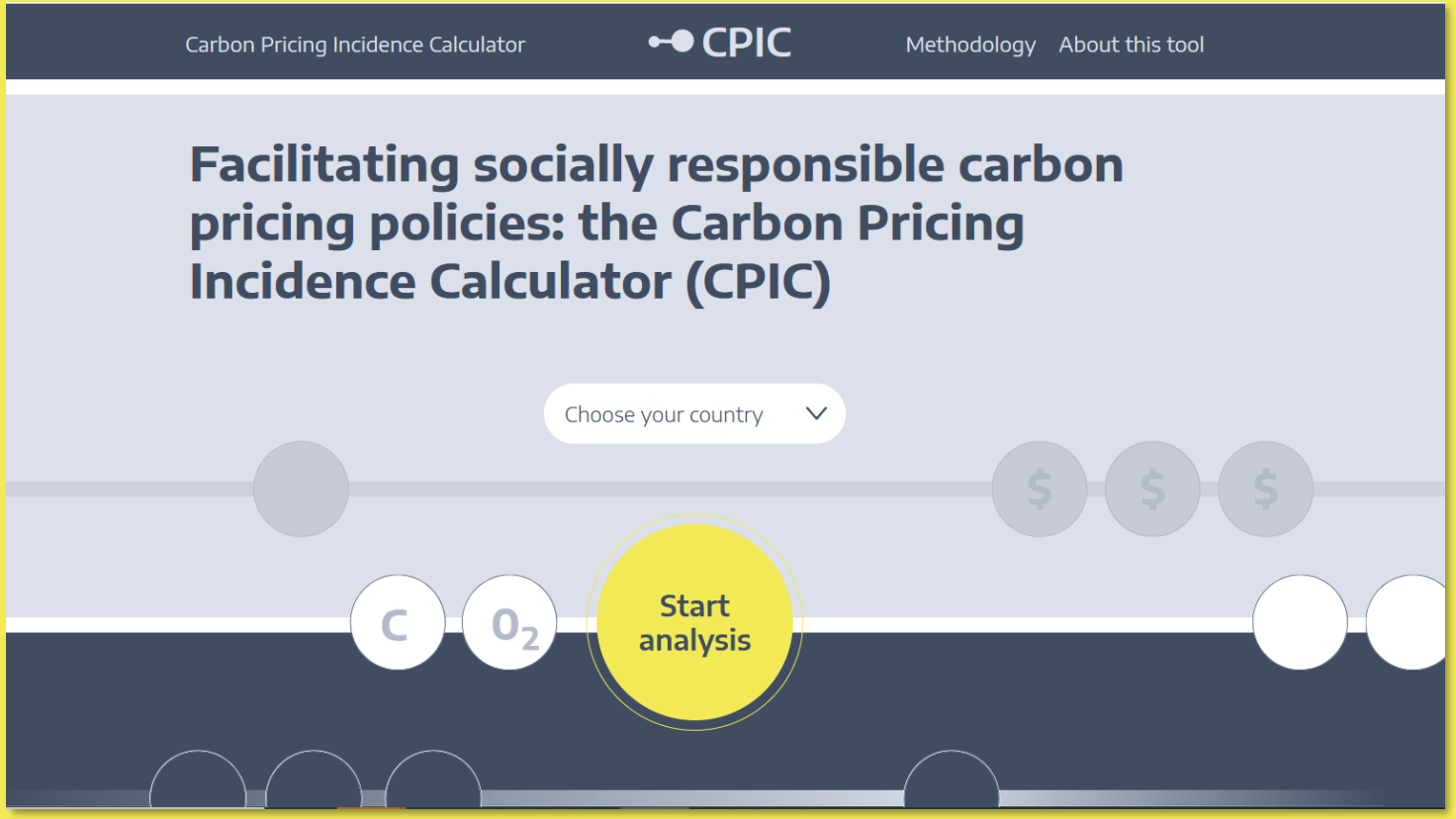
Four household members, Jalisco, average income, no car, cooking with LPG,…				
Total yearly expenditures: MXN 120,000				
Services	Transport & Cooking	Vegetables	…	
MXN 3,200	MXN 5,000	MXN 2,500	…	
0.5 tCO_2	1.2 tCO_2	0.1 tCO_2		
MXN 367.5	MXN 882	MXN 73.5	∑	**MEX 250**
Share of total expenditures				**0.21%**

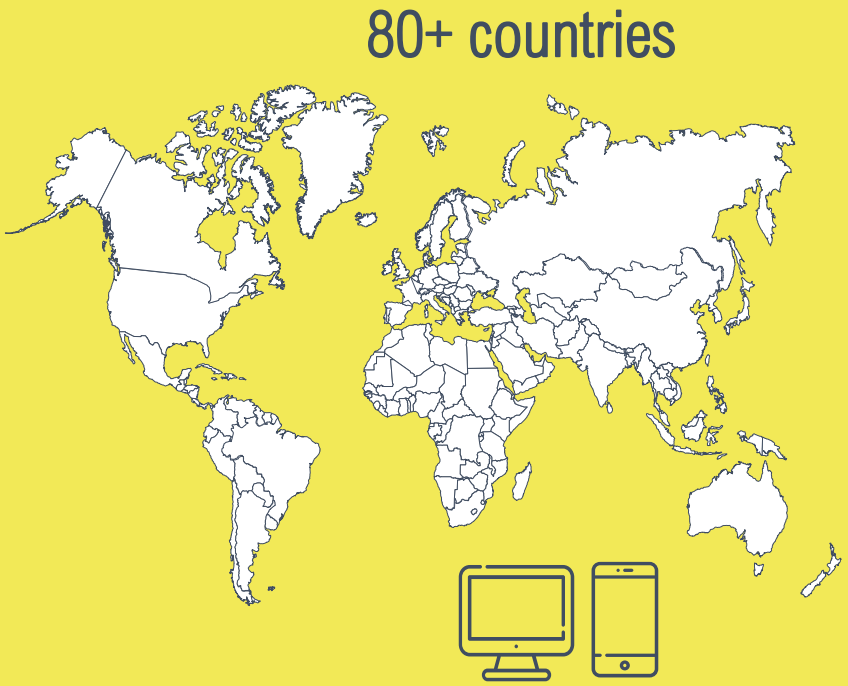
* from Encuesta Nacional de Ingresos y Gastos de los Hogares (2020)

Limitations

- No supply-side responses, i.e. strong assumption on industries and technologies
- No demand-side responses, i.e. strong assumption about consumer behavior
- First-order ‘over-night’ effects
- Analyses prone to data peculiarities
- Descriptive analyses → no attribution of carbon pricing incidence to particular household characteristics
- Limited consideration of existing and recently established policies

The Carbon Pricing Incidence Calculator (CPIC)





We simulate different carbon pricing policies and compensation options

Carbon pricing policies	Coverage
National carbon price	Nationally released CO_2-emissions
Global carbon price	Internationally released CO_2-emissions (e.g. CBAM)
National carbon price in the electricity sector	Nationally released CO_2-emissions in the electricity sector
National carbon price on liquid fuels	Nationally released CO_2-emissions from liquid fuel combustion (e.g. for transport)

Compensation options	Intended use of revenues
Equal per capita transfer (lump sum)	
Equal per household transfer (lump sum)	
Electricity price subsidy	Compensation proportional to pre-tax electricity expenditures
Exempting electricity from carbon pricing	Differentiated carbon price in electricity sector
Reducing consumption taxes (e.g. VAT)	Compensation proportional to pre-tax total household expenditures

TOOL TOUR

Find CPIC at: www.cpic-global.net

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Part III: Do the maths!

Interactive exercise using CPIC

Interactive exercise

Please note down a few observations to share afterwards.

1. Open the tool at www.cpic-global.net and choose **a country** from the drop down menu
2. Take a few minutes to explore the different population characteristics available, then revert back to **„5 income groups“** and display results as **boxplots** *(menu on the right)*
3. Next, go to **Carbon Price** and play around with the slide bar and the different pricing options
4. Change the settings to a **national carbon price of USD 50** and display **results as averages** before going to the ***Compensation*** tab.
5. Now, select a compensation measure and play around with the slide bar to decide how much of revenues raised should be distributed back to the population.
6. After setting **50%** and **Equal per capita transfer (lump sum)**, switch back to the *Population* tab.
7. Finally, compare the impact on households divided by **a) Urban/Rural** and **b) one other characteristic** of your choice.

Reflection

Questions, comments, remarks?

THANK YOU

Find the Carbon Pricing Incidence Calculator at cpic-global.net

Prof. Dr. Jan Christoph Steckel

jan.steckel@pik-potsdam.de

POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH

PIK

MCC

Research Department 5
Climate Economics and Policy -
MCC Berlin

Leibniz Association

IV ELEVATE INTERNATIONAL STAKEHOLDER WORKSHOP

Forging a Net-Zero Future: Unlocking technological and economic innovations to bridge the implementation gap

Report back from Break out Rooms

Zoi Vrontisi, ELEVATE researcher (E3M)

Jan Steckel, ELEVATE researcher (MCC/PIK)

ELEVATE
supporting international climate policy

Funded by
the European Union

Discussion

What role do market-based and financial instruments play on the pathway to net-zero?

Discussants:

Calli Obern, Former International Relations Specialist, Department of Energy (US)

Demetrio Florentino de Toledo Filho, Senior Decarbonization Analyst, Ministry of Development, Industry and trade (Brazil)

Jacob Werksman, Principal Advisor, DG CLIMA (EU)

Moderator: Detlef van Vuuren, senior researcher and ELEVATE research lead (PBL)

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Forging a Net-Zero Future: Unlocking technological and economic innovations to bridge the implementation gap

Thank you so much for joining us!

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