

Compliance with international commitments: Evidence from the Paris Agreement

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Paris Agreement

- COP 21 of United Nations Framework Convention on Climate Change (UNFCCC)
- Signed in 2016 by 196 parties
- Hybrid system to climate governance
 - Cooperative top-down elements → temperature targets, adaptation goal, finance etc.
 - **Non-cooperative bottom-up elements → in their Nationally Determined Contributions (NDCs) countries decided voluntarily which targets they set internationally**

Motivation

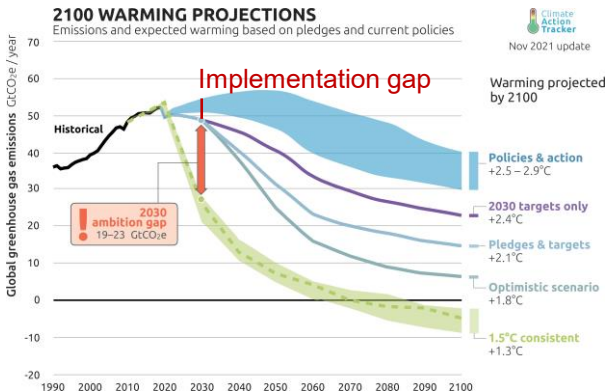


Figure 1: Implementation gap, published in [Climate Action Tracker \[2021\]](#)

Background

- We are measuring a form of free-riding
- Trade-offs: effectiveness trilemma [\[Dimitrov et al., 2019, Tørstad, 2020\]](#)
 - Broad participation ✓
 - Ambition
 - Ambitious global targets, eg. 1.5°C target, finance etc. ✓
 - First free-riding: translating global targets to targets in NDCs (ambition gap)
 - **Compliance**
 - Second free-riding: do countries implement their NDCs nationally (implementation gap)?

Motivation

Examining compliance

- 1. Are NDCs translated into national legislation?**
2. Do the outcomes (e.g. GHG emissions) adhere to the NDCs?
 - No legal obligation
 - Insufficient laws or policies: lacking ambition or lacking implementation

Contribution

Contribute to the literature on international environmental agreements

1. Create a compliance index for the Paris agreement
2. Understand determinants of compliance with the Paris agreement

Approach

Measure compliance with NDCs using text analysis tools and AI

1. Compare the country's targets with their national legislation/policies
2. Output:
 - Compliance index ranging from 0 to 1
 - differentiate by category and by type
 - Year of compliance

Approach

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	Mitigation		Adaptation	
	Strict	Broad	Strict	Broad
China	0.33	0.84	0.22	0.64

Data sources

1. The NDC data from the NDC explorer by the German Development Institute [\[Pauw et al., 2022\]](#)
 - Analyse and compare countries' (Intended) Nationally Determined Contributions.
 - 70 subcategories of targets related to mitigation, adaptation, finance and support, planning and process.
 - Mitigation examples: renewable energy, transport...
 - Adaptation examples: vulnerable sectors, climate risks...
 - Finance and support examples: conditionality of mitigation finance, technology needs...
 - Planning process examples: stakeholder consultation, training...
 - Provides a general description of the commitments and the commitment level (if applicable)

Data sources

2. Policies and laws from the FAOlex database [\[FAO, 2024\]](#)

- Database of national legislation, policies and bilateral agreements on food, agriculture and natural resources management
- Contains legal and policy documents drawn from more than 200 countries
- Provides the document as well as a summary and key information (e.g. language, type of document, related documents)
- Period starting 2016

Data collection process

1. Collect the exact targets from the NDCs

- guided by the data from the NDC explorer by categorization
[\[Pauw et al., 2022\]](#)
- read the NDC and extract the targets
 - ex: EU sets a renewable energy target of at least 20% of energy generation.

2. Policies and laws from the FAOlex database [\[FAO, 2024\]](#)

- keep only documents starting 2016 (or later depending on countries' NDC submission dates)
- prepare data for text analysis
 - split by paragraphs
 - language check (when relevant)

3. Filter the paragraphs by target-based keywords (NDC-specific)

→ ex: *solar, wind, photovoltaic, PV*

Data collection process

4. Use ChatGPT to identify compliant paragraphs [\[Rathje et al., 2024\]](#)

Example from GPT4:

"I am going to give you text excerpts on the environmental policies or regulations or laws of the European Union. I want you to check if any of the paragraphs explicitly mentions at least 20% energy generation from renewable sources.

Answer with 0, if it does not mention renewable energy at all.

Answer with 1, if it mentions renewable energy but not in the context of climate change mitigation.

Answer with 2, if it explicitly mentions at least 20% of energy generated from renewable energy sources and provide an explanation for your answer.

Please be very precise.

Always respond with the number first and then the explanation. Here is the paragraph:"

Data collection process

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Answer with 2, if it explicitly mentions at least 20% of energy generated from renewable energy sources and provide an explanation for your answer.

Please be very precise.

Always respond with the number first and then the explanation. Here is the paragraph:"

- Loops over the paragraphs extracted from each document
- Evaluates the text
- Codes it with 0, 1, or 2 and gives explanation

Data collection process

5. Manual verification

- AI accuracy: language, targets
- Year of compliance
- Translation accuracy (in relevant cases)

6. Computation of compliance by category and per NDC target

Data collection process

- Dataset covers 54 countries (27 countries and the EU-27)
 - 77% GHG emissions
 - Top fossil fuel producers and consumers
- Compliance index per category and type
 - Split by mitigation and adaptation targets (and sub-categories)
 - Assessed through:
 - Strict compliance: target is in national law/policy
 - Broad compliance: target is in national strategy
- First NDC and updated
- Year of compliance

Preliminary results

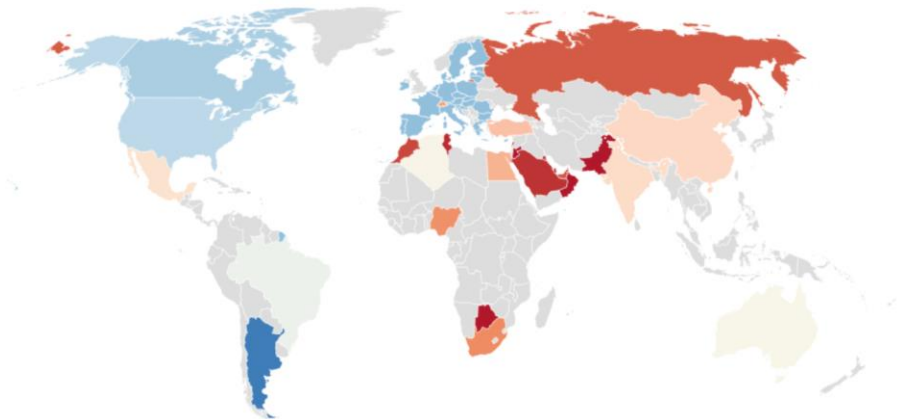
	Strict	Broad	Mitigation - Strict	Mitigation - Broad	Adaptation - Strict	Adaptation - Broad
Argentina	0.94	0.96	1	1	0.93	0.93
Algeria	0.49	0.86	0.28	0.72	0.56	1
Australia	0.5	0.9	0.62	1	-	-
Bahrain	0	0.15	0	0	0	0.3
Botswana	0	0.78	0	0.83	0	0.78
Brazil	0.55	0.68	0.4	0.46	0.83	1
Canada	0.73	0.9	0.63	0.82	1	1
China	0.33	0.84	0.22	0.64	0.52	1
Egypt	0.25	0.37	0.25	0.5	0.29	0.29
European Union	0.77	0.95	0.83	0.94	-	-
India	0.34	0.62	0.29	0.43	0.47	0.6
Jordan	0	0.74	0	0.74	0	0.69
Kuwait	0	0.57	0	0.08	0	1
Lebanon	0.06	0.5	0.1	0.4	0.04	0.65
Mexico	0.38	0.88	0.11	0.89	0.45	1
Morocco	0.06	0.45	0	0.41	0	0.6
Nigeria	0.18	0.81	0.29	0.78	0.1	0.94
Oman	0	0.19	0	0.58	0	0
Pakistan	0	0.66	0	0.55	0	0.84
Qatar	0	0.06	0	0.2	0	0
Russia	0.09	0.47	0.12	0.5	0.07	0.5
Saudi Arabia	0.03	0.13	0	0	0.04	0.21
South Africa	0.17	0.94	0.18	0.91	0.23	1
Switzerland	0.22	0.74	0.18	0.91	0.5	0.83
Tunisia	0.02	0.53	0.06	0.31	0	0.68
Turkey	0.28	0.6	0.21	0.56	-	-
United Arab Emirates	0.08	0.62	0.05	0.51	0.2	0.8
USA	0.7	1	0.62	1	-	-
Average	0.26	0.64	0.23	0.6	0.26	0.69

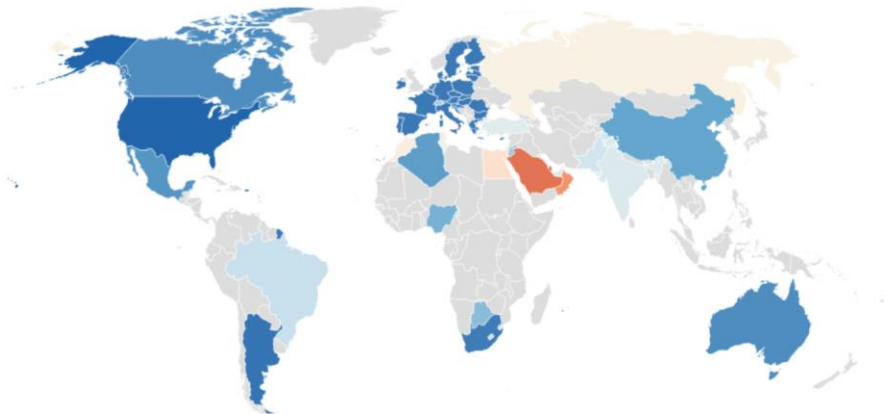
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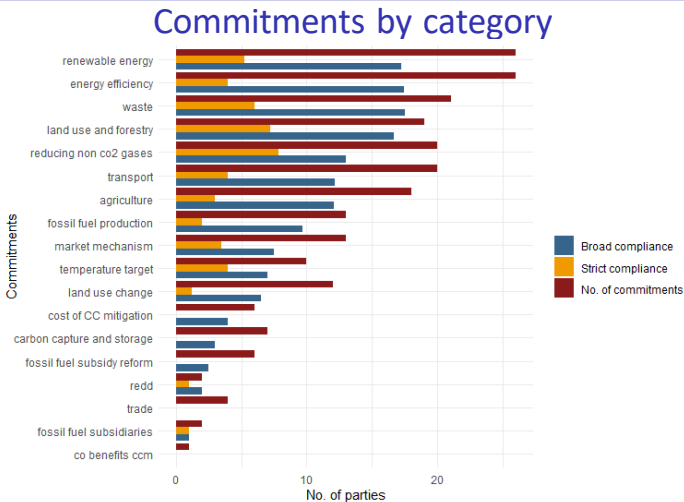
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Strict compliance by country

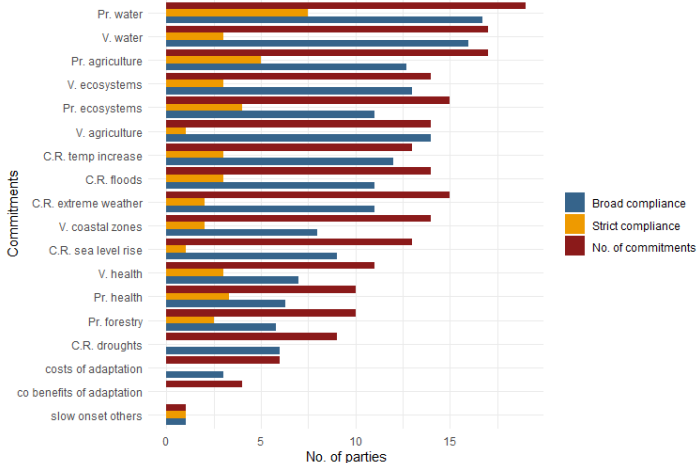






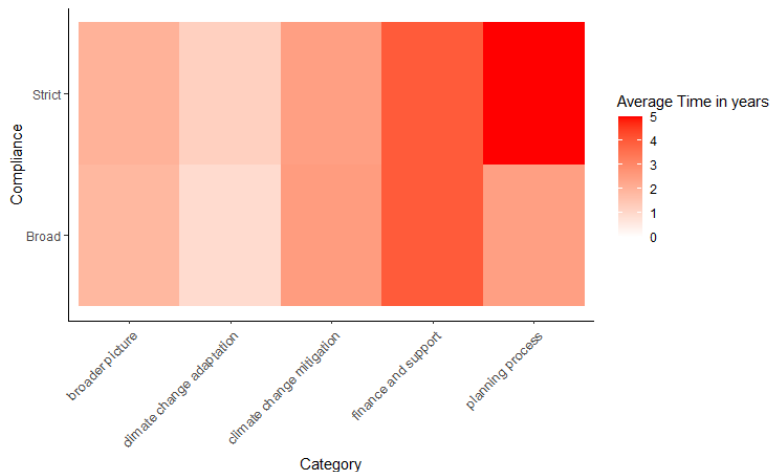
Number of climate mitigation commitments, strict compliance, and broad compliance

Commitments per category



Number of climate adaptation commitments, strict compliance, and broad compliance

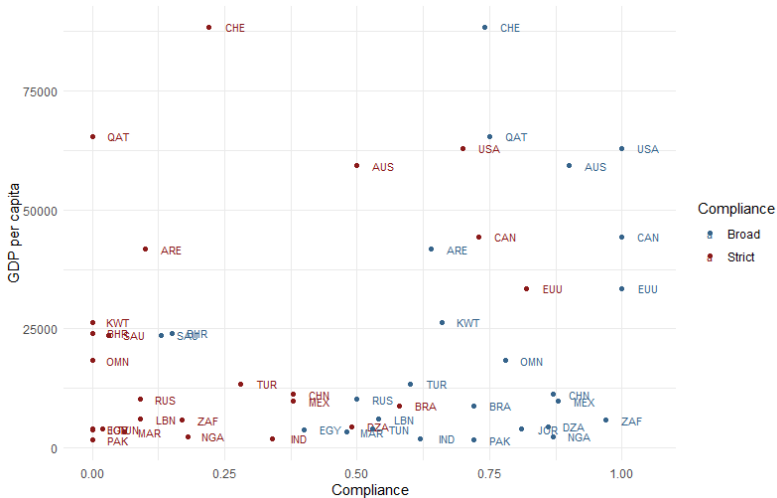
Compliance by category



Heat map on time to comply by commitment category and compliance type

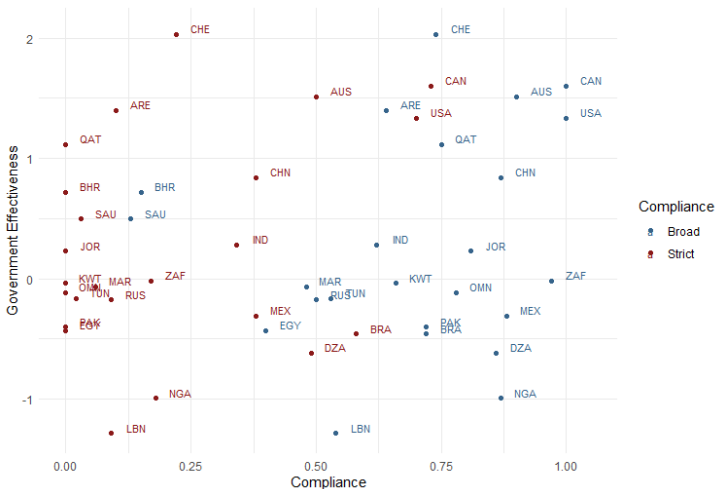
- Strict compliance takes longer than broad compliance
- Mitigation takes longer than adaptation

Compliance rates and per capita income levels



Real GDP per capita and compliance

Compliance rates and government effectiveness



Government effectiveness and compliance

Empirical analysis

- Dependent variable: compliance rate per country/year (0 → 1)
 - Strict & Broad
 - Mitigation & Adaptation
- Explanatory variables
 - Economic and Energy
 - GDP/capita, Industry (% GDP), Energy intensity
 - Oil/gas exports, Natural resources rents (% GDP), Fossil fuels as main energy source
 - Environmental
 - ND-GAIN (vulnerability + readiness)
 - GHG emissions per capita
 - Institutional
 - Government effectiveness

Empirical Analysis

- Fractional Logit (country and year FE)

	Strict	Broad
GDP/capita (constant 2015 \$)	0.0003*** (0.0001)	0.0001 (0.0001)
Industry (% GDP)	0.001 (0.046)	-0.144*** (0.044)
Energy intensity (MJ/PPP.GDP)	0.136 (0.397)	0.197 (0.380)
Gas exports	-6.805** (3.304)	5.961* (3.014)
Fossil fuel consumption (% of total)	-0.047 (0.060)	0.104* (0.060)
Natural resources rents (% GDP)	-0.093** (0.038)	0.049 (0.040)
ND gain	-0.077 (0.080)	-0.363*** (0.094)
GHG / capita	-169.988 (134.768)	-273.087** (128.701)
Gov. Effectiveness	0.472 (0.590)	1.145* (0.668)
Observations	142	142
country FE	yes	yes
year FE	yes	yes

Note:

*p < 0.1; **p < 0.05; ***p < 0.01

Regression Results: strict and broad

Summary

- Strict compliance takes longer than broad compliance
- Adherence to adaptation targets is higher than to mitigation targets
- Compliance with mitigation targets takes on average longer time
- Strict compliance is positively associated with income levels and negatively associated with the economy's dependence on fossil fuels
- Broad compliance is negatively associated with the share of industry in the economy and the overall environmental indicators

Next steps

- Disentangle drivers of compliance with mitigation and adaptation targets: cover a measure of ambitiousness of NDCs
- Analyze varying mitigation outcomes across countries

Thank you for your attention!

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