Formulation of Pricing Strategies

Basic carbon asset pricing approaches

- **Market pricing:** following a market lead price (CDM market);
- **Auctioning:** discover willingness to pay or accept (RE contracts);
- **Cost pricing:** financial analytics (concessional finance);
- **Opportunity cost pricing:** macroeconomic analytics (Adjusted ERCs/ ITMOs).

Emission reduction credits (ERC)/ Mitigation outcome (MO) pricing – cost pricing

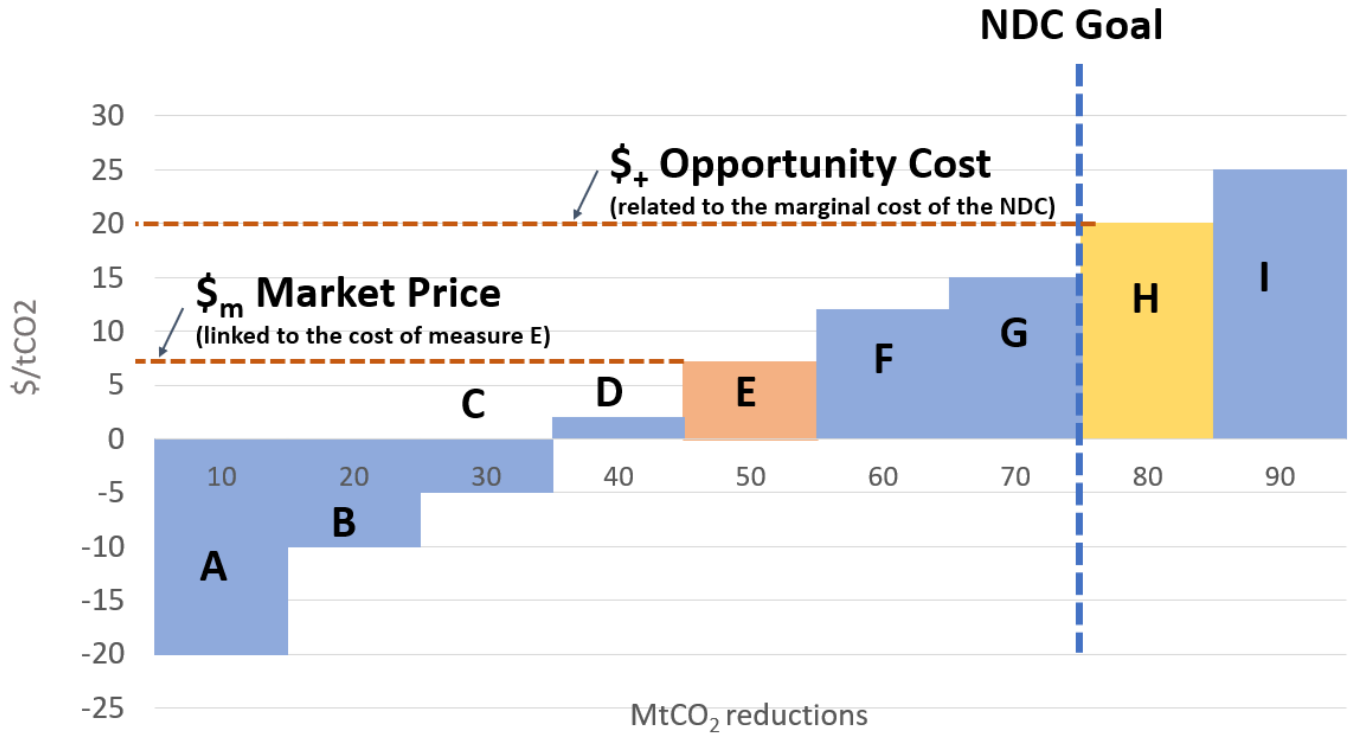
- **ERCs/MOs:**
  Stay in host countries, applied toward host country NDC compliance;

- **Payment for ERCs/MOs:**
  - Concessional climate finance (RBCF);
  - Private climate donations.

- **Minimum payment principle:**
  - Minimum payment to enable program implementation;
  - Financial analysis to determine cost gap;
  - Breakdown of cost gap to ERC/MO unit.

Adjusted ERC/ ITMO pricing – opportunity cost pricing

- **ITMOs:**
  - Transferred out of host country;
  - No longer available for host country NDC compliance: corresponding adjustments;
  - Host country has opportunity cost of transferring Adjusted ERCs/ITMOs.



Additional Slides

From costing to pricing

RBCF transaction (unit payments (pay), “price”):

- pay(MO) = c(MO), principle of concessional public finance (PCPF);
- pay(ITMO) = c(ITMO), if ITMO is canceled for net mitigation (PCPF).

Carbon market transactions:

- p(ITMO) = c(ITMO) + R, (R: rent factor), ITMO used for buyers’ compliance;
- R negotiated between buyer and seller (depends on buyer value, and parties’ bargaining strengths):
- c(ITMO) <= p(ITMO) <= buyer value
- For European sovereigns: EUA price signal.

GCAM model to estimate marginal costs of NDCs

21st Meeting of the Climate Market Club

Modeling Paris climate pledges improve chances of limiting global warming to well below 2°C

May 23, 2022

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Pacific Northwest NATIONAL LABORATORY

Joint Global Change Research Institute

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Paris Agreement

- The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016.
- Global target: to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.
- **Nationally Determined Contributions (NDCs):** countries communicate actions they will take to reduce their GHG emissions in order to reach the goals of the Paris Agreement. NDCs could be
    1) **Absolute emission limit in 2030** (e.g., Argentina "A maximum emissions limit target of 359 MtCO2e net GHG emissions")
    2) **% reductions relative to BAU or a reference year** (e.g., US, 50-52% reduction in all GHGs below 2005)
    3) **Emission intensity (CO_2/GDP) reduction targets** (e.g., China, lower carbon dioxide emissions per unit of GDP by 60% to 65% from the 2005 level)
    4) **Action-based target** (% of clean electricity, etc.)
- The Paris Agreement works on a 5-year cycle of increasingly ambitious climate action carried out by countries.

Source: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

Paris Agreement

In 2015, Fawcett *et al.* estimated the implications of the original 2015 NDCs for long-term global mean temperature change, from a risk management perspective.

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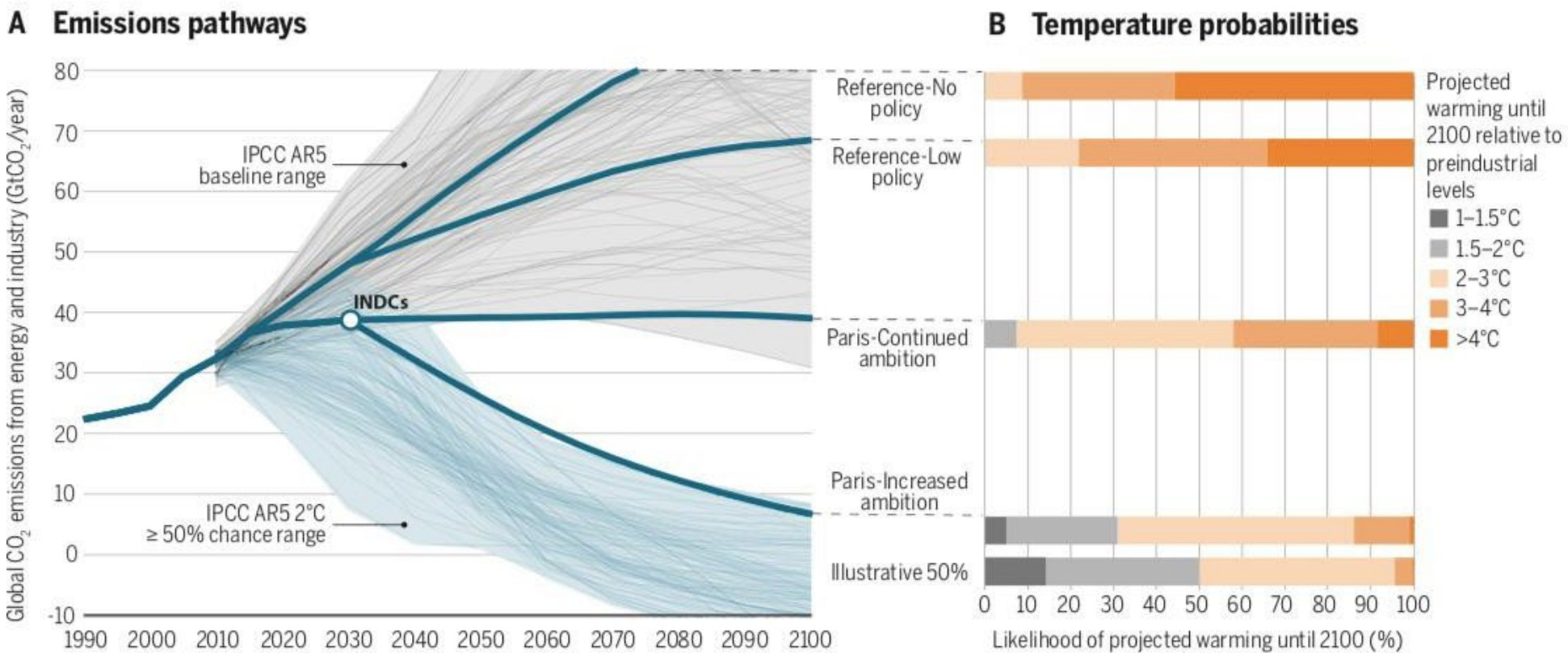
POLICY FORUM | CLIMATE POLICY

Can Paris pledges avert severe climate change?

ALLEN A. FAWCETT, GOKUL C. IYER, LEON E. CLARKE, JAMES A. EDMONDS, NATHAN E. HULTMAN, HAEWON C. MCJEON, JOERI ROGELJ, REED SCHULER, JAMEEL ALSALAM, [...] WENJING SHI +6 authors Authors Info & Affiliations

SCIENCE · 4 Dec 2015 · Vol 350, Issue 6265 · pp. 1168-1169 · DOI: 10.1126/science.aad5761



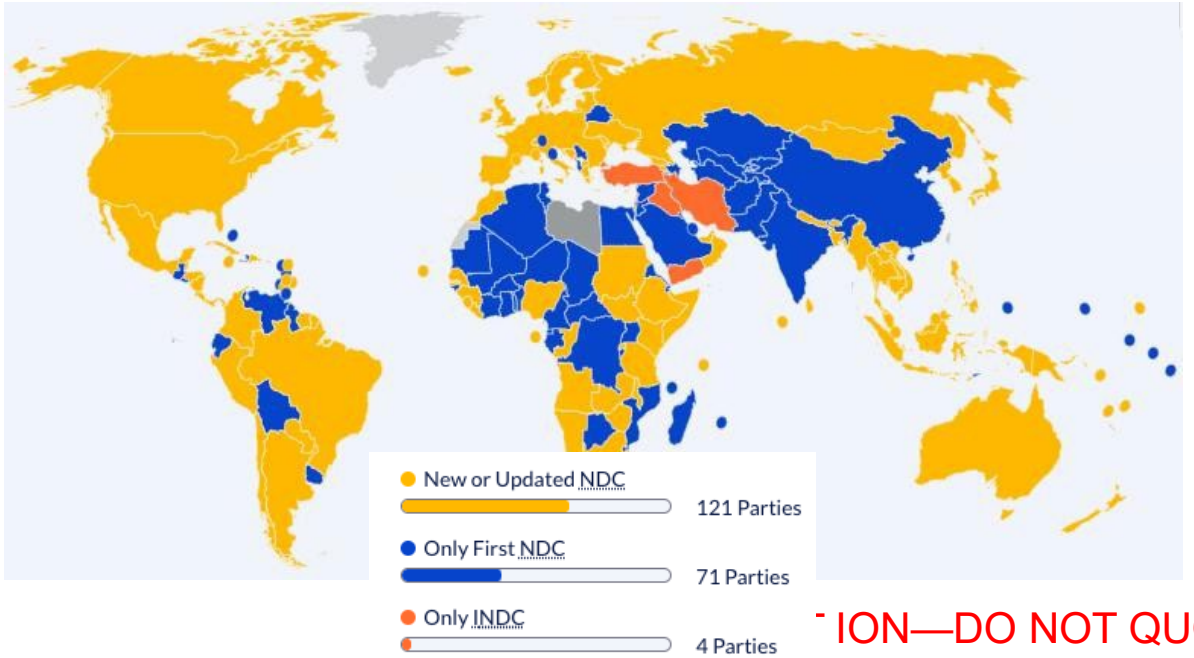
Fawcett *et al.*, Can Paris pledges avert severe climate change? *Science* **350**, 1168-1169 (2015).

NDC status and progress since 2015

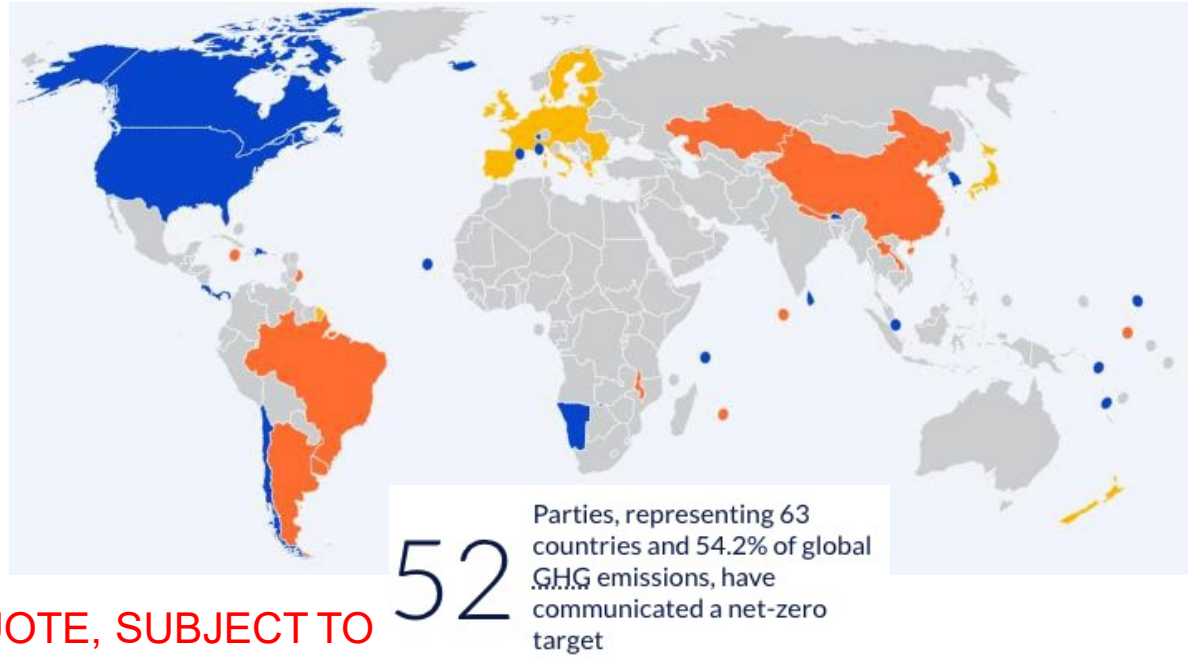
Source:
https://www.climatewatchdata.org/

1. In preparation for the 26th Conference of Parties (COP-26) in Glasgow, countries are expected to submit updated NDCs by November 2021.
2. Countries have also communicated net-zero pledges.
3. Since 2015, countries have implemented a variety of emission reduction policies.
4. Since 2015, emerging low-carbon technologies have progressed over the last few years, including rapidly declining renewable energy costs, the expansion of electric mobility, as well as novel CO_2 removal technologies

Updated NDCs



Net-zero pledges



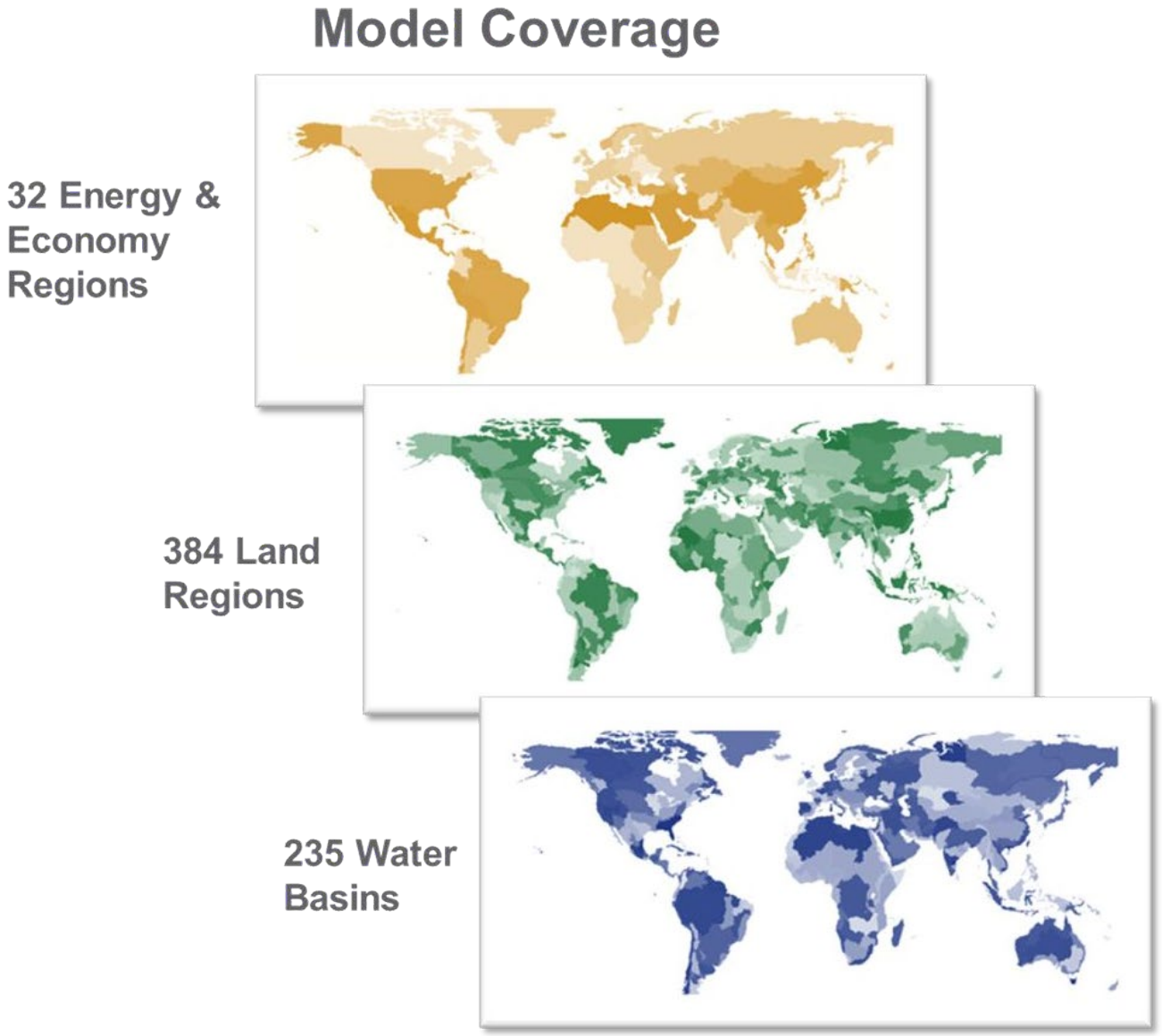
Research questions

1. How do the updated pledges collectively deliver with respect to the Paris Agreement's long-term objectives of limiting temperature change to well below 2°C and reducing the risks of adverse effects of climate change?

2. How much of the probabilistic temperature outcomes can be attributed to the updated understanding of climate science on the one hand versus updated emissions trajectories – driven by the updated pledges and other recent policy, societal, and technological developments – on the other?

3. What are the implications of meeting NDC and net-zero pledges (e.g. energy system transition, carbo prices, etc.)?

Global Change Analysis Model (GCAM)



- Dynamic-recursive (NOT optimization).
- Simultaneously resolves **energy**, **water**, **land**, and **economic** markets, and **climate systems** **it solves in a single unified code**.
- **Five-year time steps** but can run on one-year time steps.
- Time horizon is 2100.
- **Open source community model** (https://github.com/JGCRI/gcam-core/releases). source code, data, and documentation are publicly available.
- Tracks emissions of greenhouse gases, aerosols and short-lived species.
- Used in all IPCC assessment reports.

Detailed modeling approach

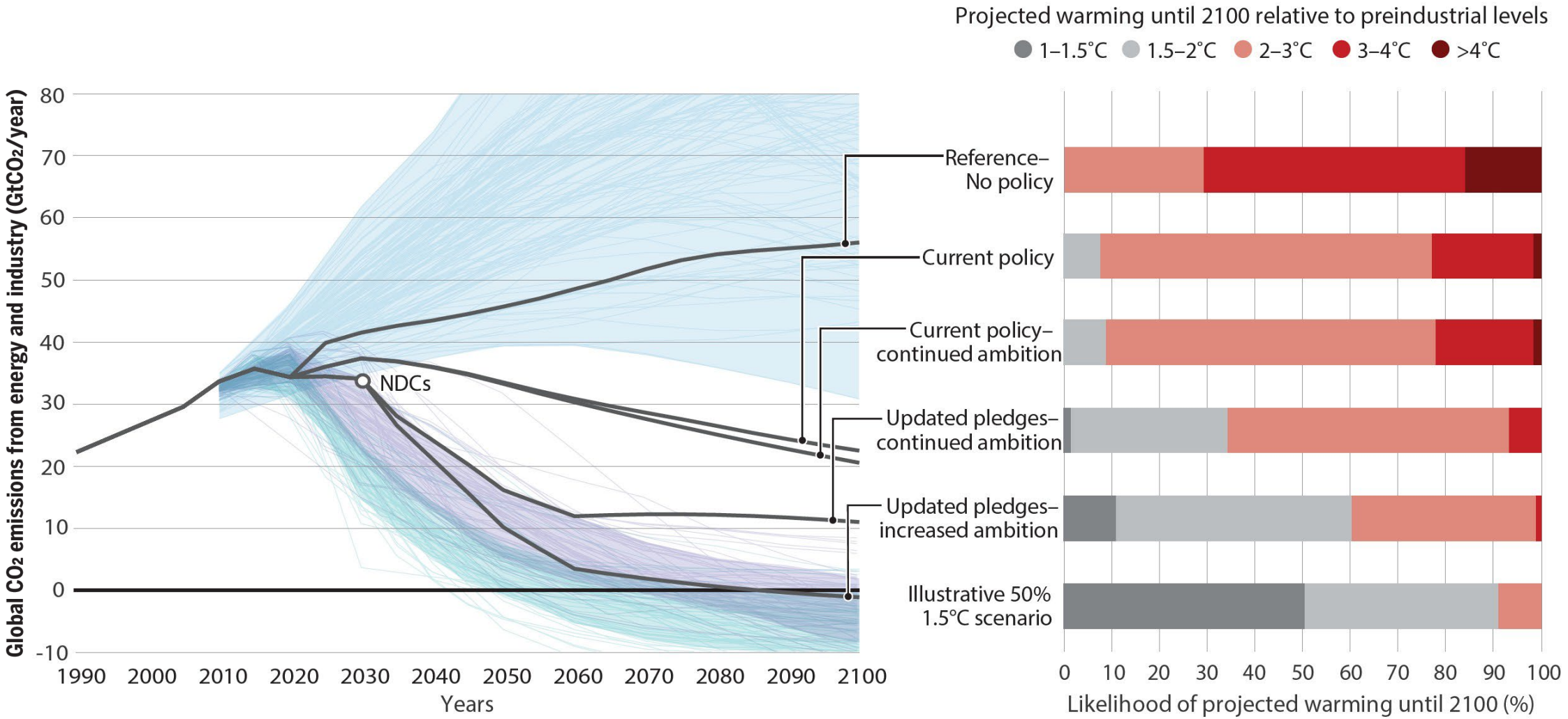
1. GCAM including up-to-date assumptions about technology costs, post-covid socioeconomic development, as well as non-CO_2 GHG mitigation options.
2. Emission trajectory data for current policy, NDC, LTS, and net-zero pledges will be compiled into a consistent global dataset.
3. Probabilistic temperature change will be evaluated in two reduced-from climate models: MAGICC 6 and the latest MAGICC 7

Scenario	Near-term (through 2030)	Long-term (through 2100)
Reference-No Policy	GCAM reference + COVID-19 impact	
Current Policies	• CAT "Current Policy" scenarios, averaged across "post-COVID high and post-COVID low" • CAT constraints applied to gross GHG	• Current Policies decarbonization rate[1] • Post-2030 only constraints ffi • For regions without current policies in CAT data, assume their reference emission trajectories
Current Policies-Continued Ambition	• Same as above	• Current Policies decarbonization rate/ 2% minimum carbon emission intensity reduction • Post-2030 only constraints ffi • For regions without current policies in CAT data, assume their reference emission trajectories
Updated Pledges-Continued Ambition	• Updated NDCs (including the latest Earth-day announcement) • NDCs only applied to binding regions	• Updated NDC decarbonization rate/2% minimum carbon emission intensity reduction • LTS • Rest pre-2030 NDC non-binding regions also applied 2% minimum carbon emission intensity reduction • Direct Air Capture are available
Updated Pledges-Increased Ambition	• Same as above	• Updated NDC decarbonization rate/5% minimum carbon emission intensity reduction • LTS • Net-zero pledges • Rest pre-2030 non-binding regions also applied 5% minimum carbon emission intensity reduction • Direct Air Capture are available

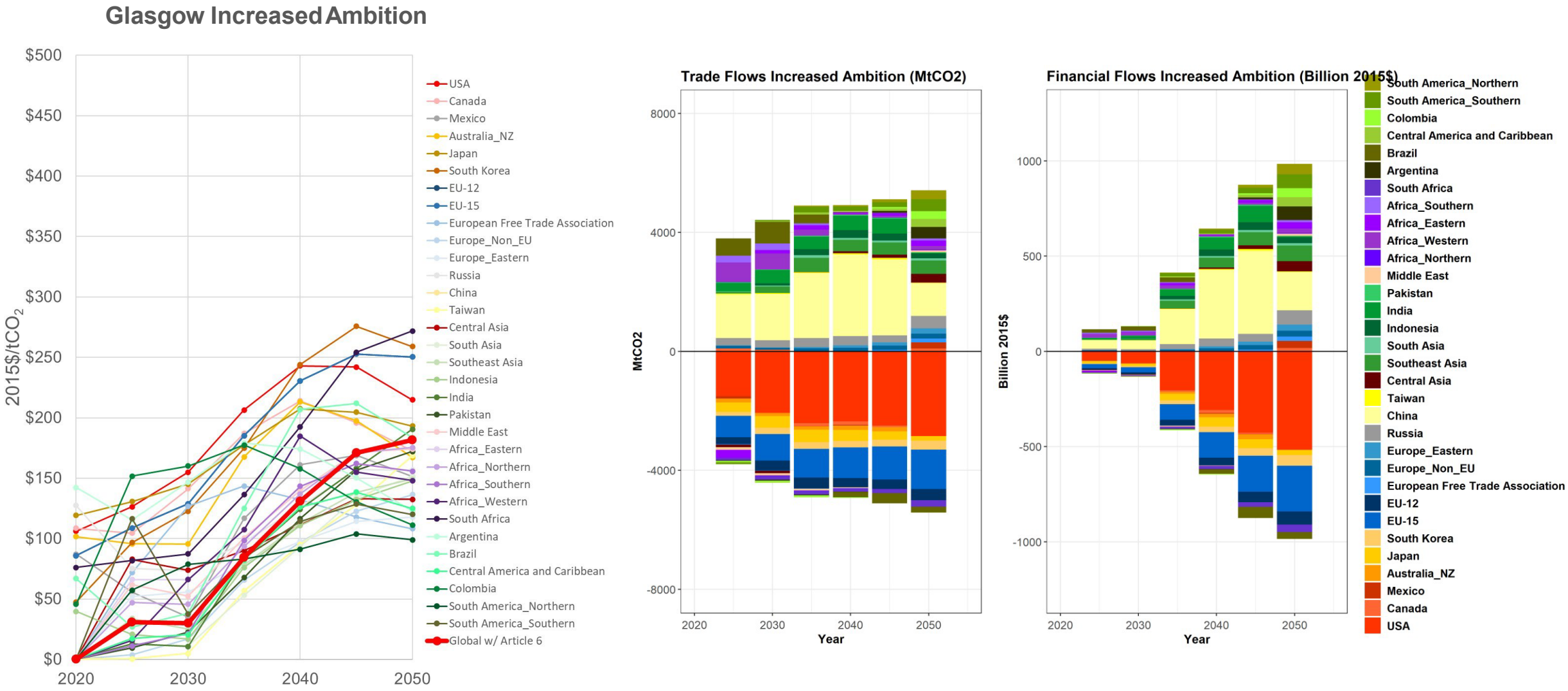
Paris to Glasgow: Temperature Probabilities

Science
AAAS

By Yang Ou[1], Gokul Iyer[1], Leon Clarke[2], Jae Edmonds[1], Allen A. Fawcett[4], Nathan Hultman[2,3], James R. McFarland[4], Matthew Binsted[1], Ryna Cui[2], Claire Fyson[5], Andreas Geiges[5], Sofia Gonzales-Zuñiga[6], Matthew J. Gidden[5,7], Niklas Höhne[8,9], Louise Jeffery[6], Takeshi Kuramochi[8,10], Jared Lewis[11,12,13], Malte Meinshausen[11,12,13], Zebedee Nicholls[11,12,13], Pralit Patel[1], Shaun Ragnauth[4], Joeri Rogelj[2,14], Stephanie Waldhoff[1], Sha Yu[1], Haewon McJeon[1]



Implications of A Global Carbon Market



DRAFT PRESENTATION—DO NOT QUOTE, SUBJECT TO CHANGE

Carbon Prices in Selected GCAM Regions

GCAM Regions/Countries		Carbon price to achieve 2030 NDCs ($/tCO$_2$, using 2015 exchange rate)
Africa	East Africa	67
	North Africa	46
	West Africa	31
	Southern Africa	21
America	USA	155
	Northern South America	78
	Southern South America	36
	Central America and Caribbean	20
Asia	Japan	145
	South Korea	123
	Central Asia	74
	Southeast Asia	25
	South Asia	11
Europe	EU	129
	European Free Trade Association	127
	Eastern Europe	56
	Non-EU	17
Middle East	Middle East	50

Summary

1. Updates to Paris climate pledges improve chances of limiting global warming to well below 2°C

2. However, the degree to which the updated pledges improve long-term temperature outcomes compared to the 2015 NDCs depends on the level of ambition beyond 2030.

3. Cooperative implementation of NDCs holds significant potential to reduce cost and enhance ambition.

Implication for the host country and implementation of the approach

Impact of Corresponding Adjustment for MOs transfer for host countries

- In pre-2020 carbon markets, the emission reduction purchase agreements were between the buyer and seller (project developer), there was limited role nor any share of most host government;
  - China, for instance, was an exception and collected substantial tax on low-cost mitigation activities coupled with a minimum price for CERs.

- In context of mitigation activities under Art 6 seeking transfer of mitigation outcomes outside, the role of the host government is enhanced:
  - Ensure current NDC commitments are met;
  - To perform corresponding adjustment (present);
  - Seek avenues for further mitigation to enhance ambition for (future) NDC update; and
  - Additionally, identify investment needs climate resilience among other activities (present and future).

- To perform these roles, the host government could charge a fee/ cess/ levy /tax to finance set of activities for the additional mitigation activities that have to be undertaken due to corresponding adjustment.

- For mitigation outcomes (MOs) with corresponding adjustment, there may be a need for a two-part payment with the market price (**$m**) being paid to the seller and an additional share (**$+**) to the host government.

One approach for applicable charge for Corresponding Adjustment

For transparency, clarity and simplicity, host country government may decide and specify the charge applicable for the 1st NDC period acknowledging the increasing cost of mitigation activities in blocks as follows:

Description	Payment to seller	Fee/ Charge/ Levy/ Tax for Corresponding Adjustment
For ERCs/MOs less than and up to [5] million tCO2e	Market price	[20] USD/tCO2e
For ERCs/MOs > [5] million tCO2e up to [10] million tCO2e	Market price	[30] USD/tCO2e
For ERCs/MOs > [10] million tCO2e up to [25] million tCO2e	Market price	[50] USD/tCO2e
-	-	-

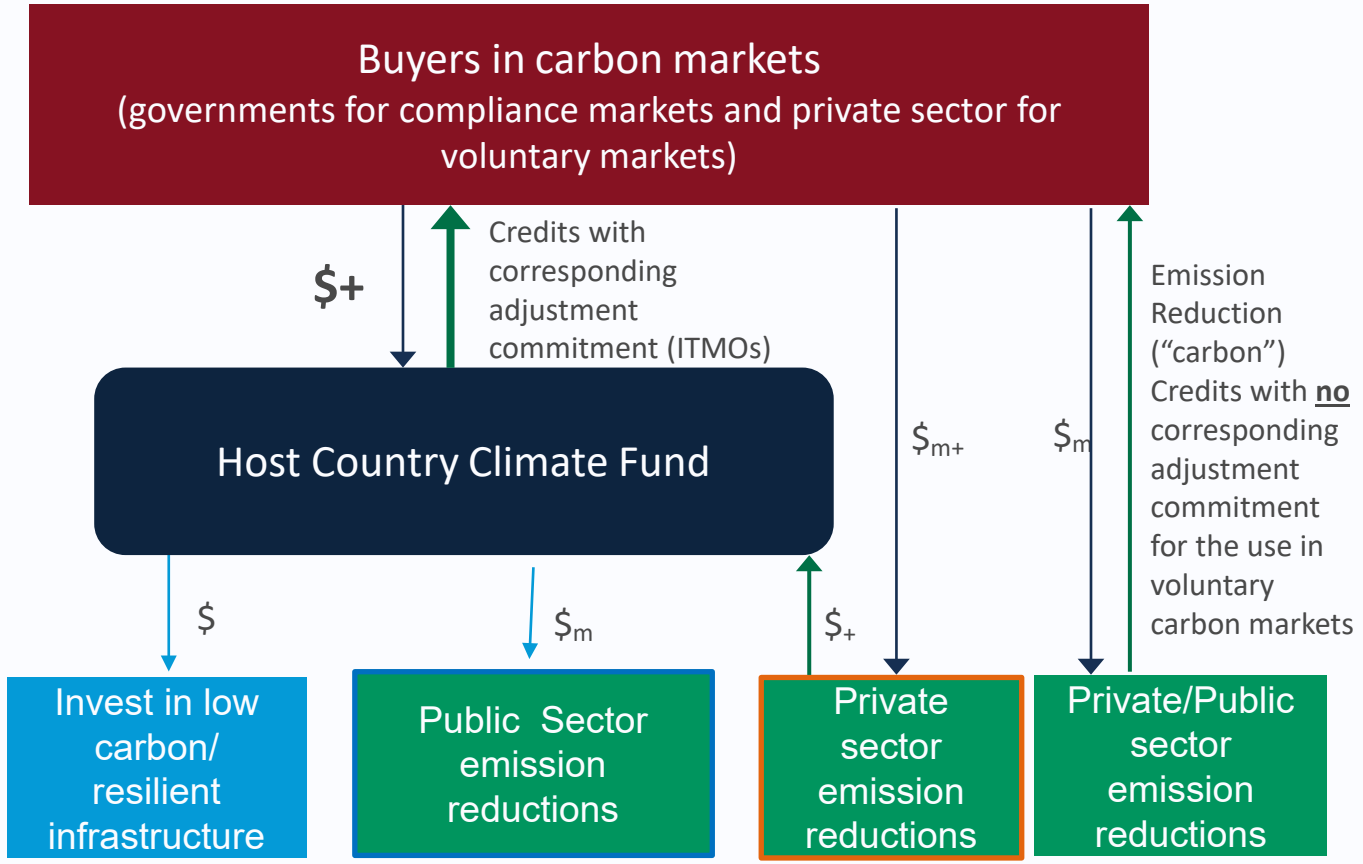
Exceptions may be provided; for instance, the host government may also decide not to apply any additional charge towards carrying out corresponding adjustment for activities defined in the positive list.

Host Country Climate Fund (HCCF) and the role in corresponding adjustment

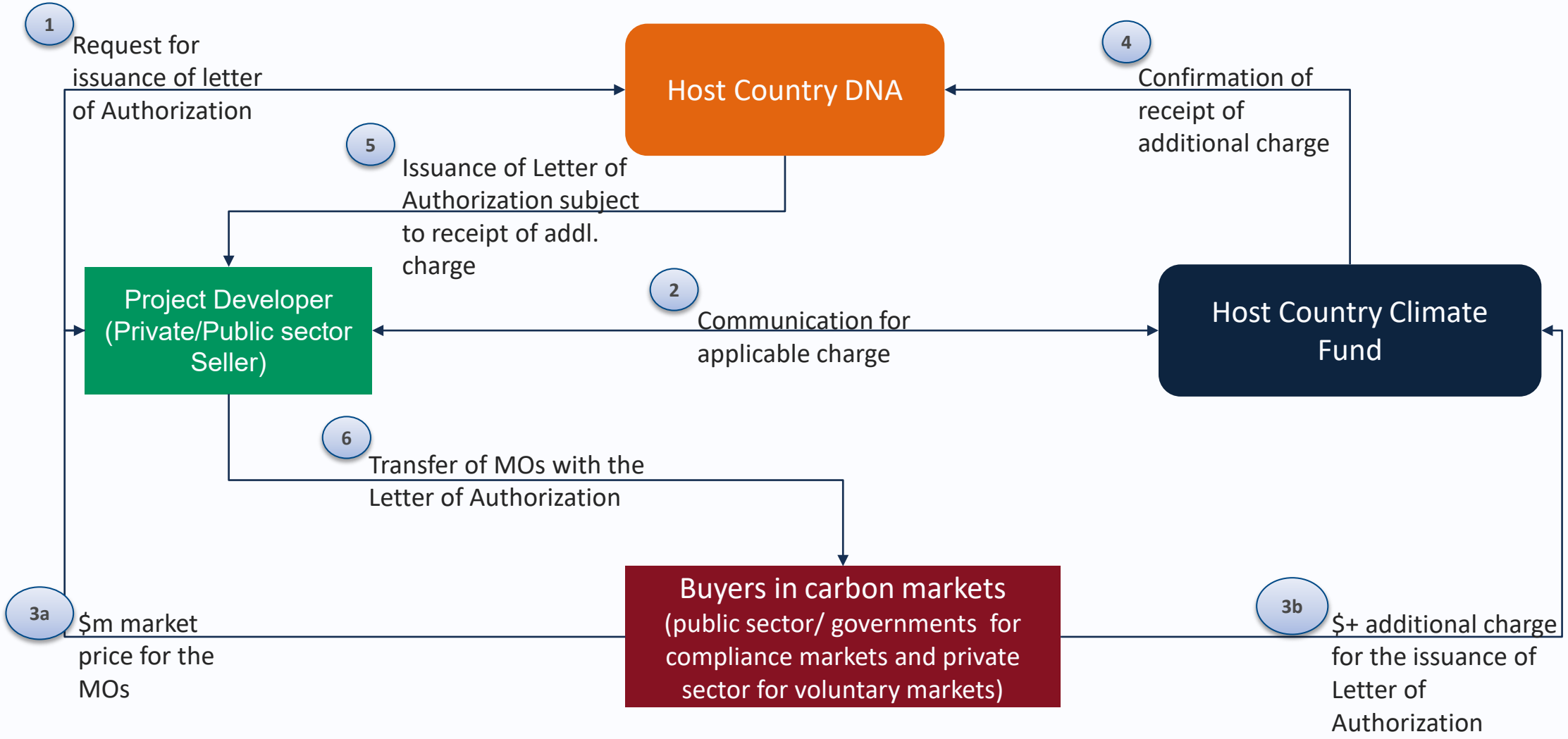
- The Host Country Climate Fund can:
  - Aggregate and sell emission reductions **Authorized** by host government to incentivize low carbon development; and
  - Invest part of the sale proceeds in raising NDC ambition and increasing climate resilience in the host country.
- Support host government in meeting its NDC commitments while meeting overall development goals;

- Facilitate the monetization of GHG reduction and authorized mitigation outcomes at a fair price reflecting the opportunity cost of the host country's additional NDCs target.

- Provide a signal towards pricing of carbon credits and authorized mitigation outcomes; and

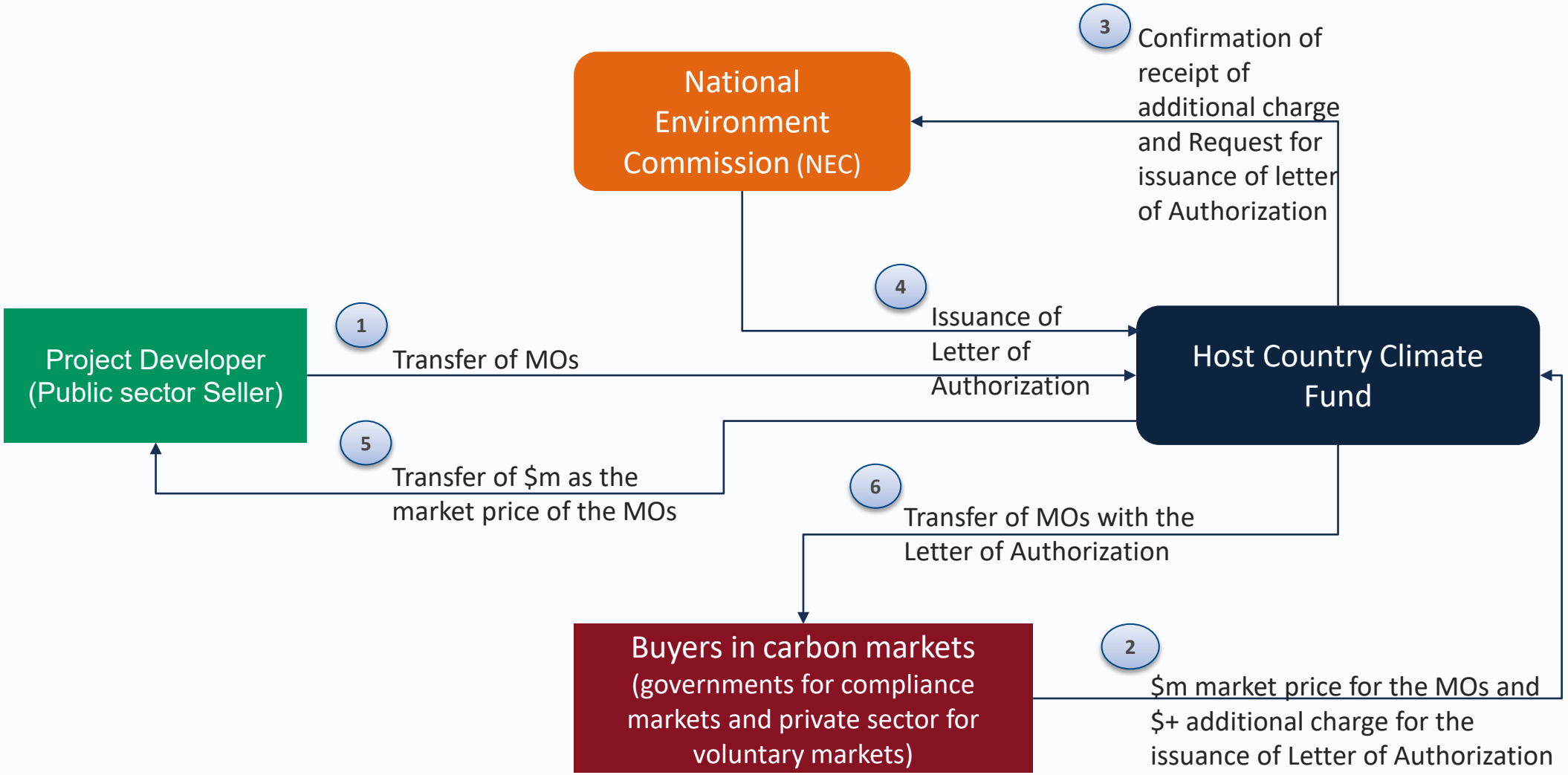


Process flow: Letter of Authorization



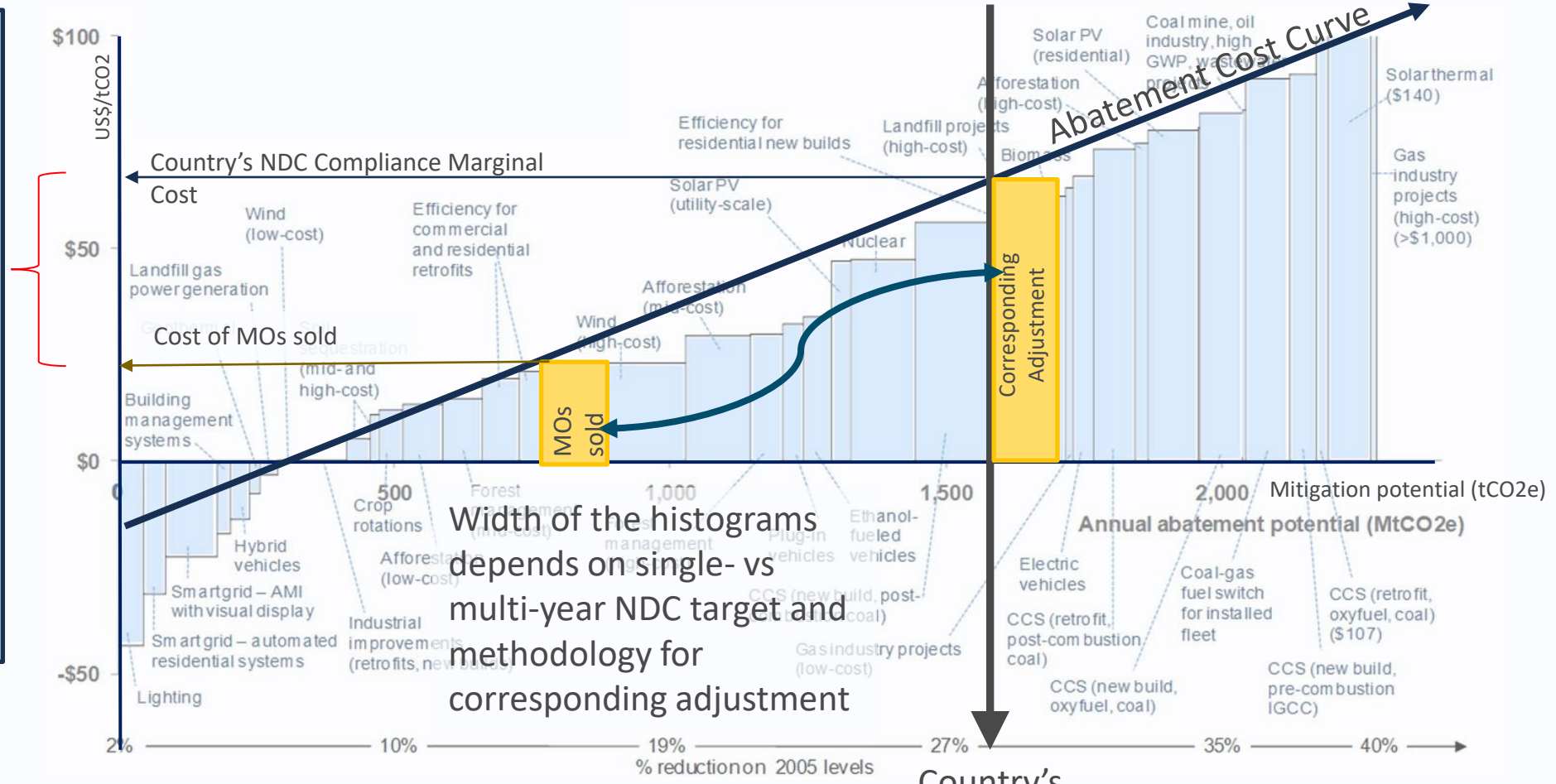
Process flow: Letter of Authorization

BCF as aggregator for public sector entities



Impact of MOs transfer for host countries:
Increase of NDC goal, increased cost of compliance and pricing implication

Opportunity cost – the difference between market price and abatement cost – between the project developer and the government. The share of the government can be seen as an insurance provision towards raising NDC ambition and increasing climate resilience.



Case of CA under the Single Year Target

Q&A Discussion