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Understanding the Opportunities and Threats of COP-26

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Abstract

*The COP26 (The Conference of Parties) was a series of negotiations to fast-track the provisions under the Paris Accord. The paper attempts to study the progress made until now through Nationally Determined Contributions (NDCs) and synthesis reports. Focusing on the third goal of COP26, the paper also highlights the actions taken by countries and leaders to mobilize funds for transition and adaptation, the responsibility of both developed and developing economies, and the role of private investors in climate action. It aims to examine environmental actions undertaken through the lens of game theory, using a 2*2 matrix model to determine Nash Equilibria of cooperation. The paper examines strategic decision-making affecting climate action through the lens of game theory. It tries to depict decision-making through the perspective of two types of economies, developed and developing economies. The paper focuses on observing such results over a short run as well as a long run period and tries to analyze the differences between both through the results. The game-theoretical perspective also helps to establish a relevant observation of the implications of India's current stance on retaining phasing down rather than phasing out coal.*

Keywords: *climate change, game theory, Nash equilibria, NDCs, COP26, Paris Agreement*

1.0 Introduction

Since the formation of the United Nations, a pressing need to address climate change didn't arise until 1988, when there was a drastic depletion of the ozone layer (the deepest hole ever recorded was 73 Dobson Units on September 30, 1994) along with global warming (World of Change, 2009). This is when the Intergovernmental Panel on Climate Change (IPCC) was established. The United Nations Framework Convention on Climate Change (UNFCCC) was signed with 158 countries to collectively work towards stabilizing atmospheric concentrations of greenhouse gasses and make stronger commitments.

The Conference of Parties (COP) was formed under UNFCCC in 1994 to address the issue of climate change. COP, therefore, is a convention of all signatory parties to come together and implement and review the actions taken under the same. The first COP in 1994 adopted the Berlin Mandate which set the stone for further action. Thereafter, in 1997, the Kyoto Protocol paved the way for work towards a reduction in emissions of CO₂ and greenhouse gasses from

industrialized countries by an average of 5% in the first commitment period between 2008-12 (EESI, n.d.).

1. **COP8, New Delhi-** emphasized cooperation by developed nations to achieve emission targets while balancing their development.
2. **COP13, Bali-** adopted the strategies of shared vision, mitigation, adaptation, technology and financing as its instruments against fighting climate change.
3. **COP16, Cancun-** a step forward towards implementing the strategy of financing by developed nations to the developing ones.
4. **COP21, Paris-** this treaty was a landmark towards climate change which, for the first time, held the treaty as legally binding upon all the member nations. It targeted keeping global temperatures below 2°C and preferably, 1.5°C. This ambition also created a framework for its implementation based on a 5-year cycle, with its performance reviewed through NDCs submitted to the UNFCCC secretariat (UNFCCC, n.d.).

Every country is required to prepare, communicate and maintain successive NDCs that it aims to achieve. The Paris Agreement urged every country to submit their climate crisis goals to undertake reductions in greenhouse gas emissions post-2020. The synthesis report prepared by the United Nations Climate Change Secretariat based on the NDCs was postponed to COP26 because of the COVID-19 pandemic, giving countries more time to prepare their NDCs (*NDC Synthesis Report* | UNFCCC, n.d.). Fiji's UN ambassador confirmed that only four leaders from Pacific island states will be able to attend the COP26 conference in person. High quarantine rules and border closures will see poorer nations sending smaller delegations.

2.0 Objectives

Through this model, the paper seeks to examine the challenges and strategies for cooperation toward climate change, for the two types of economies, i.e developed and developing economies.

3.0 Literature Review

Climate change became an alarm for collective action only in 1988, however research for the same started in the 1940s. This points toward several changing trends responsible for triggering climate change (Hegerl et al., 2018).

1. **Demographic growth-** Demographic trends influence the distribution of resources and their availability over a while. Consistent growth in the world population has led to a manifold increase in consumption and utilization but is not mirrored in the distribution of growth. Out of a yearly increase in population by 83 million, only one million reside in more developed regions (Climate Change Impacts and Emerging Population Trends, n.d.).
2. **Limited Resources-** Present models of growth focus on producing greater levels, accompanied by greater consumption. However, the concept of climate change rests upon the assumption that some important non-renewable resources will get exhausted with current levels of consumption and the rate of replenishment of the renewable ones being lesser than their usage.
3. **Unsustainable Usage-** In 2018, humans using natural resources were 1.7 times faster than their regenerative capacity. This points out the limitations of human beings as ‘perfectly rational’ (Richardson, n.d.).

“**The Theory of Population**” by Thomas Robert Malthus substantiates the above-mentioned reason for demographic growth as a key concern in the allocation of resources in the long run. The theory points out the possibility of adverse situations due to insufficient resources and consistent rising levels of population. The first possibility is polarization between developed and developing nations in resources causing global inequality. The second possibility is a natural reduction in population due to insufficient resources falling short to sustain the growing population. The third is longer sustenance due to a slow increase in wealth and population under effective policy measures. All three possibilities were made under the assumption of technology being constant. However, the theory was disregarded when it fell short in explaining the population growth and its survival caused by the technology of the green revolution (Marquette, 1997).

Garret Hardin’s “**The Tragedy of Commons**” once again tried to reiterate the theory of population control. He deemed population control as a necessary step to sustain human survival and even went on to criticize the universal declaration of human rights for giving families the irrevocable right of freedom to breed. The theory illustrates the rational choice theory to explain

a man's decision making which is only based on maximizing profit, consciously or unconsciously, which may undermine the greater good. He points out the greedy nature of man as an argument for the need for a population control policy. Both theories still hold relevance as addressing the issue of a key economic problem that connects to climate change, i.e limited resources (Kharkongor & Kanwar, 2018).

Further research published by MIT, "**Limits to Growth**" in 1972 reported the possibility of resources getting extinguished if present levels continue to rise. A game theoretical analysis by Parkash Chander in his book "**Game Theory and Climate Change**", also concludes with similar results of long-term benefits of climate action exceeding the total costs. It also offers a solution to the dilemma of unequal outcomes of climate action between different nations by the approach of side payments. Distributing the surplus benefits derived from climate action equally so that each country is better off (Chander, 2018).

4.0 Research Methodology

This paper has been written based on secondary data collection and behavioural outcomes based on a determined set of assumptions. Most of the secondary data is sourced from the UN database. Moreover, the data for game theory is taken from a given set of assumptions to set up a relevant model for understanding. Thus, the data presented is taken through the lens of the present period under the research, through some established set of assumptions.

5.0 Macro Level Analysis

In 2020, all countries were supposed to submit their revised NDCs so that the UNFCCC could further prepare a synthesis report. As the components of the NDCs weren't highlighted by the COPs after Paris, the Ad-hoc Working Group on the Paris Agreement worked on it to clarify the scope and features. After this, Article 4.2 of the Paris Agreement made it mandatory for parties to include a mitigation contribution in their NDCs (Mehrotra & Benjamin, 2022) such as

1. To represent a progression from previous NDCs.
2. To represent the highest possible ambition and include economy-wide emissions reduction targets.
3. To be accounted for to promote environmental integrity, and transparency, and

4. To ensure accuracy, completeness, comparability and consistency, and avoid double counting (Pauw & Klein, 2020).

NDCs may contain components related to

1. **Mitigation-** There is a direct relationship between global average temperatures and the concentration of greenhouse gases in the atmosphere. For this, CO₂ emissions and the concentration of CO₂ need to be reduced by increasing sinks (eg. increasing forest area) Mitigation refers to efforts to reduce emissions and improve sinks. Many NDCs have specified their targets in broadly two ways; GHG greenhouse gasses (GHGs) and Non-GHG targets. The former specifies a numerical target that the country aims to achieve. For eg- reducing emissions to 730 million tons of carbon dioxide equivalent (MtCO₂e) annually by 2030 (Environment and Climate Change Canada, 2022). The latter refers to technology goals, in non-numerical terms. A viable solution is a mix of both, as adopted by many countries.
2. **Adaptation-** The impact of climate change, the identification of vulnerable sections, priority adaptive measures, and the formulation of time-bound adaptation targets vary from country to country. To come to a global consensus, United Nations Environment Programme (UNEP) assists countries all over the world in their efforts to create National Adaptation Plans (NAPs). It aims to identify medium and long-term adaptation needs based on the most recent climate knowledge. It also produces plans to address major climate change vulnerabilities after they have been identified. The two broad purposes of NAPs are to
 - a. Build adaptive capability and resilience to reduce vulnerability to the effects of climate change.
 - b. Adaptation should be incorporated into new and existing policies and programmes, particularly development initiatives.
3. **Financial Support-** According to UNFCCC, Climate Finance refers to local, national or transnational financing—drawn from public, private and alternative sources of financing. It seeks to support mitigation and adaptation actions that will address climate change *Introduction to Climate Finance | UNFCCC, n.d.*

6.0 Long-Term Financing

A financial mechanism entrusted to certain entities was established in the Paris Agreement to assist the financial provision for developing parties. Some operating entities are The Global Environment Facility (GEF) and the Green Climate Fund (GCF). At the same time, a Standing Committee on Finance (SCF) was also established to assist the COP in exercising all financial functions. All policies, programme priorities, and eligibility criteria for funding are decided by the finance mechanism (Climate Finance in the Negotiations | UNFCCC, n.d.). The long-term finance process aims to advance the mobilisation and scaling up of climate funding from a wide range of sources, including public and private, bilateral and multilateral, and nontraditional sources. We look at finance broadly divided into public and private finance.

1. **Public Financing-** Eleven public finance priorities have been identified, including the quantity and predictability of climate finance, the role of Multilateral Development Banks, Public Development Banks and Development Finance Institutions, delivery through Multilateral Climate Funds, mobilizing private climate finance, wider fiscal challenges, the allocation of finance – in particular grants – to the poorest and most vulnerable, access to climate finance, finance for adaptation and resilience, finance for nature and nature-based solutions, the coherence of approaches to climate impacts, and the gender-responsiveness of climate finance (COP26 Presidency, 2021).
2. **Private Financing-** The goal of private finance aligns with these priorities: to ensure that every professional financial decision takes climate change into account. For the financial sector to allocate capital to manage risks and grasp opportunities throughout the transition to net zero, the correct framework is required (Carney, 2020). To accomplish this, the COP26 Business Finance Hub will collaborate with the private sector and other stakeholders to develop:
 - a. **Reporting-** Establishing a standard framework based on the Task Force for Climate-related Financial Disclosures recommendations will increase the quantity, quality, and comparability of climate-related disclosures.
 - b. **Risk management-** Ensuring that the financial industry can assess and manage financial risks associated with climate change.

- c. **Returns** - Assisting investors in identifying opportunities in the transition to net zero and reporting on how their portfolios are prepared (ibid).

There are many reasons why climate finance is needed. Here are some reasons that are prioritized-

1. **Adaptation and Resilience-** Developing countries are more vulnerable to natural disasters than higher-income groups. The global development community has identified a host of solutions to help these countries cope with these shocks in terms of forecasting, monitoring, infrastructure, asset and livelihood replacement programs (UNEP, 2021).
2. **Low-Carbon Energy Transition-** In aligning with the COP mitigation goals, a smooth transition to a renewable and less costly means of energy production is the need of the hour. In terms of consumption, 759 million people still do not have access to electricity (SDG 7.1 - Access to Energy, n.d.). As the cost of solar and onshore wind energy decreases as off-grid technologies develop, there is a chance to provide low-income populations with affordable and clean energy services. According to a World Bank report, the number of people using decentralized, renewable energy solutions has more than doubled in the last decade, from 5 million to 11 million. These also promote the expansion of micro, small, and medium enterprises (MSME) in terms of livelihoods and economic growth leading to a productivity boost and job development.
3. **Safeguarding nature-** Livelihoods of more than 2.6 billion people depend on agriculture and related ecosystems. Smallholder intensification strategies including intercropping, agroecological pest management, and crop diversification can boost yields while lowering land demand. This could result in net revenues of over \$300 billion for smallholders while lowering carbon emissions by up to 1.4 gigatons by 2050 (Baur & Pasricha, 2021).

The stake of both developed and developing countries in their respective financial inputs:

During the COP15 in 2009, it was decided that developed countries would mobilize \$100 billion to developing nations by 2020, to cope with adaptation and mitigation. Since a lot of countries reneged on their promises, this goal was revamped in the Paris Agreement and

was extended up to 2025. There are four methods through which money is transferred - Bilaterally, multilaterally, export credits, and private investments mobilized by public finance. The OECD which tracks climate finance reported that only \$79.6 billion had been mobilized until 2019. Moreover, since the major partners in OECD are developed countries, developing countries feel that the body is not neutral enough (COP26 Outcomes: Finance for Climate Adaptation | UNFCCC, n.d.).

7.0 India and Its Stance

In 2021, India was badly hit by the second wave of the COVID-19 pandemic. The stimulus package launched by the government covered roughly \$3 billion in battery development and solar PV. However, India also continues to support coal with new loans to several thermal power projects, putting the green recovery at risk (Kumar, 2021). According to Climate Action Tracker (CAT) research, emissions will rise less in 2030 than in pre-COVID-19 forecasts due to the economic impact of the pandemic. Even though the utilization rate of coal power plants is declining, India continues to grow its coal capacity. A recent decision to boost domestic coal production has opened coal mining to private investors, posing a risk of fossil fuel lock-in and environmental damage.

Prime Minister Narendra Modi announced India's net zero targets to be reached by 2070 at the Glasgow session of COP26, meaning CO₂ and other GHGs are eliminated from the atmosphere. The CAT has evaluated India's net zero targets as information is incomplete. The Indian government has not disclosed any additional information on the scope, target architecture, or openness as of November 12, 2021. For example, it's unclear if India's goal applies to all greenhouse gas (GHG) emissions or just CO₂. As of November 12, 2021, India had not yet submitted a long-term strategy to the UNFCCC. While coal subsidies have stayed essentially unchanged since 2017, they are still roughly 35% greater than renewable energy subsidies (Kulkarni, 2022).

India has failed to submit updated 2030 targets to the UNFCCC (in its NDC). India's climate targets and policies are rated as "highly inadequate" by the CAT (Hindustan Times, 2019). In comparison to a predicted domestic emissions trajectory, India's present ambitions and policies will cause emissions to continue to climb, resulting in 4°C or more of warming. For India's rating

to improve, it must boost its unconditional NDC objective to considerably slow down the rate of emissions growth.

India INDCs:

1. Reduce the intensity of its GDP's emissions, by 2030, from 2005 levels, by 33-35%. By 2020, there will be a 75% increase in ambition.
2. By 2030, non-fossil fuels will account for 40% of installed electric generating capacity. A 33% increase above non-fossil fuel capacity in 2015.
3. Additional forest and tree cover to create a carbon sink of 2.5-3 billion tonnes of CO₂ equivalent (an increase of about 680-817 million tonnes of carbon stock).
4. Improve climate change adaptation through increasing investments in development programmes in climate-vulnerable sectors, such as agriculture, water resources, etc.
5. In light of the resources required and the resource gap, mobilize domestic and new & additional money from developed nations to conduct the aforesaid mitigation and adaptation initiatives (Government of India Ministry of Environment, Forest and Climate Change, 2018).

8.0 Game Theory: A Microeconomic Perspective

Game theory is a model of understanding how strategic decisions are made by rational players in response to a situation or multiple sets of situations. In such a model, all players are assumed to be rational in choosing a particular action or strategy. This decision can be based on certain factors taken into consideration. It is also assumed that every player makes a strategic choice to maximize some kind of payoff that the player is expected to receive. This paper analyzes the 2*2 matrix model where two players have a choice to decide between two possible actions.

With this respect, two concepts are necessary to understand-

1. **Dominant Strategy-** A dominant strategy is the one in which a player (x) finds the best strategy regardless of the other player's (z) actions. If a player has a dominant strategy, then the player will not deviate from that action and acts as the best response for the player.

2. **Nash Equilibrium-** It is a decision-making theory which tries to find the best consequence of a situation when both players make the best possible response and do not deviate from their position. This paper operates on the following principles under game theory (Tadelis, 2013).

8.1 Game 1: To Use Sustainable Alternatives Or Exploit The Existing Stock Of Non-Renewables In The Short Run.

Background- After realizing the climate emergency, every economy is faced with two options of utilizing resources to attain the objective of development. The two alternatives thus available are to either switch towards a sustainable alternative source or to continue utilizing an existing set of non-renewable sources. The objective is to analyze the strategies of two players, in this case, countries concerning climate change.

Model- This is a 2*2 matrix model.

Assumptions- We assume the following conditions under the game:

- The game is between two players, player C and player B respectively representing two countries, i.e a developed economy like China and a developing economy like Bangladesh. Here, the countries which are taken are developed economies, whose GNI per capita is more than \$12,615 and developing economies, whose GNI per capita is less than \$12,615 (Prydz & Wadhwa, 2019).
- Both the players are facing externalities of climate change, here externalities are defined in the form of GHG emissions. Players operate with the feature of the tragedy of commons, i.e lesser resources available for others when resources are exploited. Here, resources include climate-vulnerable resources, i.e land, water resources and minerals.
- The cost of switching to a sustainable alternative is costlier in Bangladesh (player B) as compared to China (player C). Here sustainable alternatives include better technological equipment and the use of practices to utilize resources sustainably.
- The payoffs to both players are non-monetary.
- It is assumed that both countries cooperate when both opt to switch to sustainable alternatives.

Hence, we establish the following conditions for the model:

Players- Country C (China) and Country B (Bangladesh).

Strategies- to use a sustainable alternative, to exploit.

Payoffs- non-monetary in nature.

Country B → Country C ↓	Sustainable Alternative	Exploit
Sustainable alternative	-1, -2	-1, 1
Exploit	1, -1	0.5,0.5

Case 1- (Sustainable Alternative, Sustainable Alternative)

In this case, both countries opt for using sustainable alternatives. However, due to the initial increase in costs of switching, this has a negative outcome assuming the costs exceed the benefit in the short run. In this case, Country B bears more cost of switching to alternative sources due to the difference in financial and technological capacity.

Case 2- (Sustainable Alternative, Exploit)

In this case, Country C opts for a sustainable alternative in the short run, while Country B opts for exploiting existing resources. Assuming costs exceed benefits again, in this case, the outcome is negative for Country C and positive for Country B.

Case 3- (Exploit, Sustainable Alternative)

In this case, Country C opts for exploiting resources whereas country B opts for switching over to sustainable alternatives. This induces a positive benefit for exploiting resources for Country B and a negative outcome for costs exceeding benefit in the short run for Country B. Thus, the value assigned (1, -1).

Case 4- (Exploit, Exploit)

In this case, both countries opt for exploiting the existing stock of resources for production. In such a case, due to the operation of the tragedy of the commons, lesser resources will be available for others once utilized for production, hence both gain the value of (0.5, 0.5) by exploiting resources.

In the above form of the 2*2 matrix game, the following dominant strategies of both the players can be noted: For player C- Exploiting resources is the dominant strategy, irrespective of what player B chooses to do. Likewise, for player B- Exploiting resources is the dominant strategy, irrespective of what player C chooses to do.

Nash Equilibrium

Hence, the best possible strategy under which none of the players will have any incentive to change their decision will be the case where both countries decide to exploit their resources in the short run when costs exceed the benefits of using sustainable alternatives.

8.2 Game 2: To Use Sustainable Alternatives Or Exploit The Existing Stock Of Non-Renewables In The Long Run.

Background- After realizing the climate emergency, every economy is faced with two options of utilizing resources to attain the objective of development. The two alternatives thus available are to either switch towards a sustainable alternative source or to continue utilizing an existing set of non-renewable sources. The objective is to analyze the strategies of two players, in this case, countries concerning climate change.

Model- This is the 2*2 matrix model

Assumptions- We assume the following conditions under the game:

- The game is between two players, player C and player B respectively representing two countries China and Bangladesh. Here, the countries which are taken are developed economies, whose GNI per capita is more than \$12,615 and developing economies, whose GNI per capita is less than \$12,615 (WDI - Classifying Countries by Income, n.d.).
- Both the players are facing externalities of climate change, hence operating with the feature of the tragedy of commons, i.e lesser resources available for others when resources are exploited. Here resources include climate-vulnerable resources, i.e land, water resources and minerals.
- In the long run, it is assumed that the costs of switching to sustainable alternatives are lesser than their benefits, i.e benefits exceed the costs. Here sustainable alternatives

include better technological equipment and the use of practices to utilize resources sustainably.

- The payoffs to both the players are non-monetary in nature.
- It is assumed that both countries cooperate when both opt to switch to sustainable alternatives.

Hence, we establish the following conditions for the model:

Players- Country C (China) and Country B (Bangladesh)

Strategies- to use a sustainable alternative, to exploit

Payoffs- non-monetary in nature

Country B → Country C ↓	Sustainable Alternative	Exploit
Sustainable alternative	2, 2	2,1
Exploit	1, 2	0.5,0.5

Case 1- (Sustainable Alternative, Sustainable Alternative)

In this case, both the countries opt for using sustainable alternatives. Due to benefits greater than costs, in the long run, both countries receive a positive outcome i.e (2,2).

Case 2- (Sustainable Alternative, Exploit)

In this case, Country C opts for a sustainable alternative in the long run, while Country B opts for exploiting existing resources. Assuming benefits exceed the costs, the outcome is positive for Country C but less than 2 for Country B, due to externalities posed by exploiting resources.

Case 3- (Exploit, Sustainable Alternative)

In this case, Country C opts for exploiting resources whereas country B opts for switching over to sustainable alternatives. This induces a positive benefit for exploiting resources for country B however lesser than 2 due to externalities posed by natural resources and a positive outcome for benefits exceeding costs in the long run for country B. Thus, the value assigned (1,2).

Case 4- (Exploit, Exploit)

In this case, both countries opt for exploiting the existing stock of resources for production. In such a case, due to the operation of the tragedy of the commons, lesser resources will be available for others once utilized for production, hence both gain the value of (0.5,0.5) by exploiting resources.

In the above form of the 2*2 matrix game, the following dominant strategies of both the players can be noted: For player C - Switching to a sustainable alternative is the dominant strategy, irrespective of what player B chooses to do. Likewise, for player B - Switching to a sustainable alternative is the dominant strategy, irrespective of what player C chooses to do.

Nash Equilibrium

Hence, the best possible strategy under which none of the players will have any incentive to change their decision will be the case where both countries decide to switch to sustainable alternatives in the long run when benefits exceed the costs of using sustainable alternatives.

8.3 Limitations

The assumption of both the players facing externalities of climate change and operating along the tragedy of commons, (i.e lesser resources available for others when resources are exploited). The numerical payoff is thus based on the set of assumptions.

9.0 Results

Through the following games, we observe the impact of climate initiatives from a game theoretical perspective. The Game Theoretical perspective allows an insight into the nature and course of strategic decision-making. The outcomes through decision-making affect the players thus involved through such interactions. Thus, it helps to understand the conflict and cooperation between countries at a global level.

In the short term, there is a negative impact on the efforts to mitigate climate action, when the costs exceed the benefits. Moreover, this outcome is an imbalance among developing nations, which already lack the capacity and technology to adapt to suitable change. In the short run, entities face the prisoner's dilemma in their decision between raising efforts and utilizing the

existing resources. The results also reiterate Garret Hardin's tragedy of commons theory, indicating an inclination of nations towards short-term self-interest which is exploiting resources in this case (Tadelis, 2013). This leads to the tragedy of changes caused by climate change for all in the long run. However, in the long run, we assume that benefits exceed the costs. In this case, both players made a strategic choice to switch to sustainable alternatives. Cooperation in such cases may be strengthened through constant and increased interactions between the entities, and through incentivising cooperation to reduce defection (Stewart, 2015). While international treaties and conventions have served the foremost objective, climate action policy needs various incentives to reduce defection.

10.0 Conclusion

As large-scale expenditures are necessary to considerably cut emissions, climate finance is required for mitigation. Climate finance is also critical for adaptation, as large financial resources from both developed and developing countries are required to adjust to the negative effects of climate change and mitigate its consequences. This becomes a mechanism for side payments to distribute resources for a better off outcome for each of the nations. The results of the game-theoretic model for the short-run highlight the possibility of developing economies still not being able to phase out coal due to its current short-term requirements and higher costs. A developing economy such as India faces a similar challenge and must phase out ageing, high-capacity power plants with lower efficiency and higher emissions, as well as stop adding new coal capacity, to stay on a 1.5°C emissions path.

Price support in the form of feed-in tariffs, and shifting subsidies from fossil to non-fossil sources might be key drivers of increased renewable energy adoption. Setting an aggressive conditional aim to reduce the predicted emissions rise with foreign assistance, better communication and transparency can also help achieve longer-term objectives of climate change. As negotiations begin ahead of the UN climate summit Cop 27 in November, Egypt's leadership will place a focus on finance and mitigation and will press countries to adopt more aggressive emissions reduction targets for 2030.

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