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The Themis Mechanism: A Proposal for Equitable Global Emission Reduction

The Paris Agreement is failing. Themis is a proposal for an international mechanism to reduce global greenhouse gas emissions in a fair and effective way. It addresses mitigation deficiencies in the Paris Agreement.

Themis is an ancient Greek goddess of justice, an organiser of the communal affairs of humans. She is often depicted with the scales of justice, but without a sword, because she represents common consent, not coercion. And she can see the future. All essential traits for tackling climate change.

The Themis Mechanism is built on four foundations:

1. Our atmosphere is a shared resource

Our atmosphere is the ultimate *commons*; regardless of their geographic origin, greenhouse gases contribute to determining the climate everywhere on earth. Since the global temperature grows with greenhouse gas concentration, any fixed temperature implies a maximum amount of greenhouse gas in the atmosphere. Therefore, the amount of greenhouse gases that can be emitted is a finite shared resource.

While fossil fuel users receive the full benefit from fuel consumption, the CO_2 cost is spread globally. This dilution effect makes continued use rational for individuals but collectively disastrous. The individual versus collective dilemma exists even if the cost exceeds the benefit for every single user. To prevent this, we must cooperate to guarantee climate results.

Fortunately, we know a lot about human cooperation. The political theorist Elinor Ostrom's *Governing the Commons* identifies necessary conditions for successful cooperation as: binding commitments, mutual trust, transparency, reciprocity and enforceable sanctions. The Paris Agreement shares none of these critical attributes.

2. Pricing greenhouse gas emissions

The root cause of climate change is the failure to account for the true cost of emissions. By treating the atmosphere as a free resource, we encourage over-exploitation. Themis internalises this *unpriced externality* by pricing greenhouse gas emissions.

While we routinely pay for resources, utilising the atmosphere's finite capacity to absorb greenhouse gases without exacerbating climate change remains an exception. This is a choice, not an inevitability, and we can opt to value this capacity differently.

Estimating the true cost of emissions is impractical. The cost of the changing climate is difficult to estimate, it may be different for separate regions, and it may depend crucially on the time horizon. To circumvent this hurdle, Themis uses voting to determine the price, detailed below.

3. Urgency

We have left effective action to the eleventh hour. Our climate collaboration cannot depend on long term promises for the future, such as Nationally Determined Contributions (NDCs) for 2030 or 2035, and NetZero by 2050. Verifying long term commitments logically necessitates

waiting to check their fulfilment. But we don't have time for that. For example the growth rate of CO_2 (not merely the concentration) in the atmosphere is higher now than when the Paris Agreement was adopted in 2015.

Instead, we need to focus on immediate emissions. Decarbonisation requires changes in infrastructure which take time. However, one should not confuse the timeline for the incentive mechanism with the one for implementation. Incentives must be immediate to enable societal change.

4. Equitability

Effective cooperation requires a fair guiding principle. Themis upholds *equity*: that our atmospheric resources should be shared equally between all humans. It's a moral and ethical judgement with wide potential acceptance.

This conception of equity differs from the corresponding Common But Differentiated Responsibilities (CBDR) principle of the United Nations Framework Convention on Climate Change (UNFCCC). Since greenhouse gas emissions are strongly correlated with wealth, the Themis definition of equity will tend to equalise economically, thereby helping with the goals of the Paris Agreement Green Climate Fund (GCF), but through a mechanism rather than voluntary donations.

Themis

Remark: for ease of exposition, the description of Themis is prefaced by three steps: first a description of national Carbon Fee and Dividend; secondly the replication of Fee and Dividend at the global level; and thirdly the insight that in practice the global level is agnostic to details of the implementation at the national level.

National Carbon Fee and Dividend

In a national Carbon Fee and Dividend system, government adds a fee to activities which cause release of greenhouse gases. At the end of the year, all the collected funds are paid out equally to the nation's citizens. This revenue neutral system will create economic pressures for all citizen to lower emissions. People who contribute smaller than average emissions will be net beneficiaries, as their dividend will exceed the sum of the fees they paid. Conversely, people who create larger than average emissions will be net contributors. The system is progressive as more wealthy people tend to create more emissions. It is fair, as everyone pays the collective for their use of a finite, valuable resource.

To be specific, assume the fee for emissions is fixed at p, for emitting one tonne of CO_2e. The country in question emits an average of e tonnes of of CO_2e per person per year. At the end of the year, every citizen will receive an identical dividend of $d = e \times p$, the total of which will exactly equal the sum of the fees.

Variants of Carbon Fee and Dividend exist in Switzerland and some Canadian provinces. But it is far from widespread. There are two reason why not. Firstly, the variants implemented only provide partial dividends, and are therefore viewed as unpopular taxes. Secondly, the systems are only applied locally or nationally. This means that the climate impact will be small, because any nation on its own, has only a small influence on the climate. To be effective, Carbon Fee and Dividend has to be implemented across borders.

Global Carbon Fee and Dividend

The easiest and most straight forward way to extend Fee and Dividend to the global scale is to apply the same principles at the higher level: where nations play the role of citizens. All motivation and desirable properties remain the same. The only difference is that there is no global government to manage the fees. Instead, this must be done by mutual agreement.

Here is how it works: the price of emission is p per tonne of CO_2e, identical in every nation. The fee is collected by national governments, identically to the national systems. The average global emission in e tonnes per person per year. At the end of the year, every government payes an identical dividend of $d = e \times p$ to every citizen, precisely as in the national scheme.

Because the average emission per person is different for different countries, the total fee collected by each nation won't necessarily equal the sum of the dividends. Larger than the global average emitters will build a surplus. At the end of the year, these countries pass their surplus to the nations with less than the global average emissions. The larger than average emitters are paying the smaller than average emitters for using more of the common, valuable resource. The total sum of all surpluses will equal all deficits, overall the system is revenue neural.

Global Carbon Fee and Dividend in practice

The global Carbon Fee and Dividend system has been motivated by national systems, variants of which are already implemented. But in fact there is no reason why individual nations must implement Fee and Dividend at all. In practice every country is free to follow any implementation they wish, and which fits their cultural and economic circumstances. As long as they honour the transactions at the global level. For some above average emitters, national Carbon Fee and Dividend may indeed be a reasonable way to implement the scheme. But many less wealthy, below average emitters, may not implement a fee at all, as their low emissions will make them net beneficiaries.

What is necessary to implement the system? The only data needed is the number of citizens and the total annual CO_2e emissions for each nation. These measures are already widely reported, eg using UNFCCC emission accounting standards.

The Themis Mechanism

After this motivational detour, we are ready to describe the practical mechanism, which implements our objectives.

Themis is built entirely on immediate annual commitments. Adherence is verifiable by partners, enabling the building of mutual trust. The mechanism is governed by a single number, p, the price of emitting one ton of carbon dioxide equivalent, or CO_2e. The annual cycle is based on four steps:

1. Each year, all nations are invited to join at a predefined emissions price, p.
2. At year-end, each member reports emissions and pays p per ton of CO_2e.
3. Proceeds are redistributed immediately among members, in proportion to population.
4. Members vote openly on next year's price; the median vote determines p.

Prior to launch, all nations are invited to vote for the initial price, p.

A consequence of the mechanism is that only *per capita* emissions are relevant, reflecting equitability. Nations with above average member per capita emissions will be net contributors; all others will be net beneficiaries. All members (not just large emitters) immediately experience

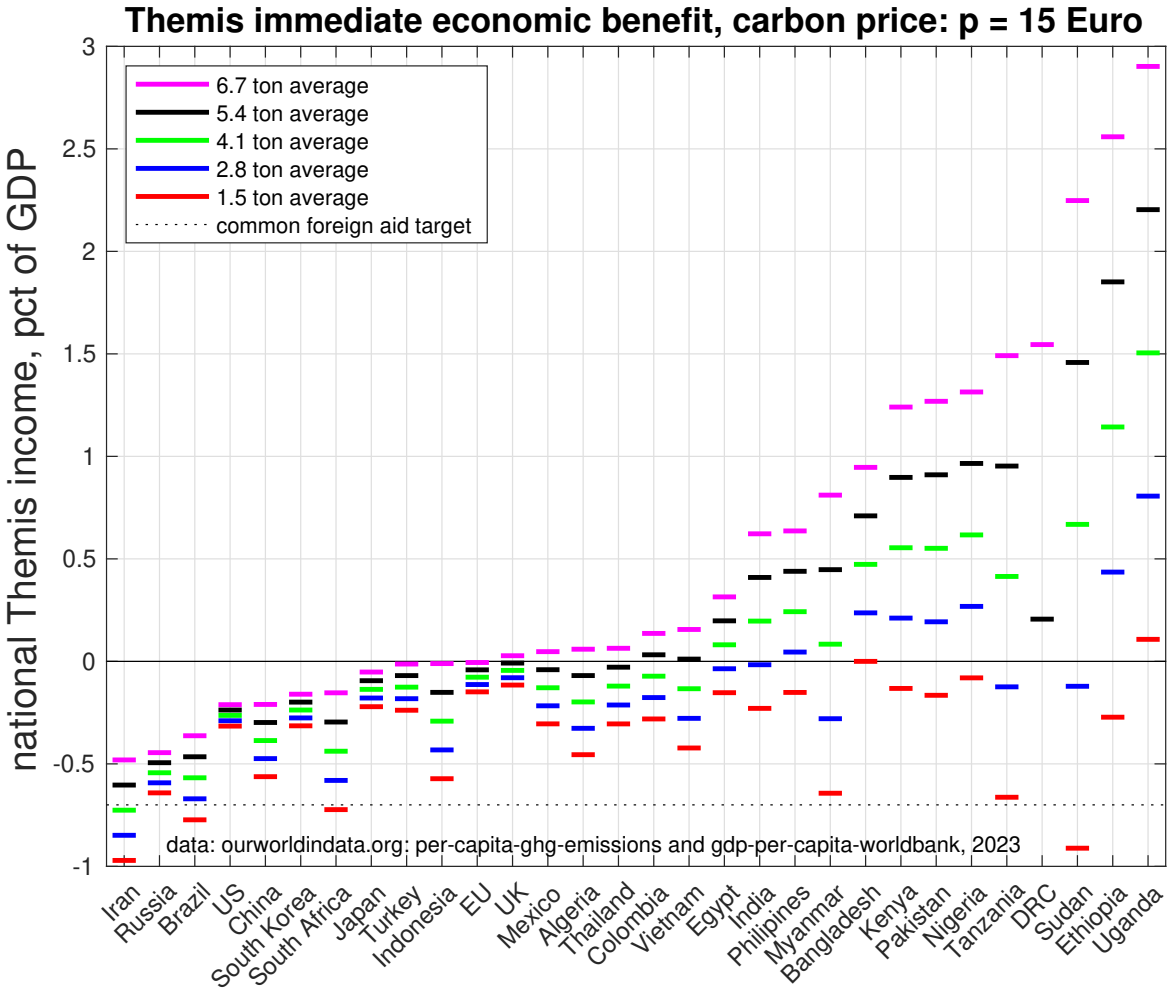

Figure 1: The net income generated from Themis membership for different nations and regions; negative income denotes net contributor. A CO_2e price of p = 15€ is assumed. The income depends on which countries are members; the colour key specifies the average *member* emissions. Universal membership would give 6.7 ton average. Membership is not explicitly depicted. For comparison, the common target of 0.7% of GDP for foreign aid for wealthy nations is shown. The data for DRC have been cut off.

economic pressures to reduce emissions. The Themis Mechanism is deliberately as simple as possible. It is designed for efficiency, eliminating complex negotiations that would delay urgent action. Themis can coexist with and mutually benefit other initiatives, including the Paris Agreement and the EU Emissions Trading System (ETS).

Quantitative Illustration

In Figure 1 the immediate economic gain from Themis membership is shown for the 30 most populous nations and regions. Membership isn't specifically specified in the figure, the average *member* emission (colour coded) is sufficient to determine the net payments. The lower average member levels imply that many of the large emitters are non-members. In the figure the price has been, somewhat arbitrarily, set to p = 15€, but the net income is proportional to the price, so you can easily rescale to any other price. More than half the emissions of DRC, Tanzania,

Ethiopia, Myanmar, Sudan, Brazil, Uganda and Kenya are caused by land use and forestry; Themis membership would incentivise conservation.

For comparison, a common target of 0.7% of GDP for foreign aid for wealthy countries has also been shown. Another common target is 2% of GDP for defence, used by some NATO members. The price of p = 15€ can be compared to the price of an emission allowance in the EU European Trading System (ETS) which was 75€ at the start of 2025 – but note, that the EU fee stays within the EU whereas (part of) the Themis payment would go to foreign nations.

Why would nations join?

The overwhelming reason to join would be that all countries benefit from diminished climate change enabled by the mechanism. Below average emitters also have an immediate economic incentive to join. Themis does not require universal participation to be effective; widespread adoption is sufficient. Members may in time seek to sanction free-riding non-members, but this is not part of Themis.

Currently, carbon footprints for wealthy nations are often underestimated because they import carbon intensive manufactured goods. What would happen under Themis membership? The price of the carbon intensive manufactured goods would increase, the importer would pay more, reflecting their climate load. There would be no pressure to move manufacturing between member nations, since the emissions price is identical everywhere.

The complex regulation in the Paris Agreement related to the international transfer of carbon credits (the so-called Article 6), would be eliminated under Themis. Nations could financially support developing countries to reduce emissions and share the resulting Themis payout, without any need for explicit rules in the mechanism.

Refinements

The basic structure is captured by the four point annual cycle, but in practice we need to be specific about a couple of details:

1. To enable reciprocity, decisions to join may be *conditional*. For example, the UK may join only on the condition that France and Germany join. Or on the condition that countries responsible for at least 50% of emissions join. Reciprocity is a key enabler of cooperation and helps ensure against imbalances.
2. In the case where a country has initially been outside the mechanism, and wishes to become a future member, they must pay their fees right back to the inaugural year. This is necessary to avoid an incentive for nations to postpone membership. Postponement is unacceptable because it further exacerbates the already troubling problem of differing historical emissions. This rule would make it more difficult to join later, increasing the pressure for prompt membership.

Price dynamics

The price, p, is likely to start modest and grow with time. Once a country has joined, it becomes in its interest for other, larger emitters to join too. How are members likely to vote? Below average emitters will favour higher prices, but not so high that large emitters quit. Similarly, above average emitters may favour a low price, but not so low as to undermine the emission pressure.

Even while the price is too low to massively reduce emissions, the mere existence of the mechanism and annual membership decision and open ballot price vote are welcome recurring opportunities for nations to show their hand.

Hurdles

Implementation may face some challenges: enforcement of emissions reporting may be difficult. Themis does not resolve differing historical emissions. Some nations may choose not to participate for economic or ideological reasons.

The short annual cycle and absence of a known future price within Themis has been criticised for creating unwanted uncertainty for treasuries and may make planning of energy systems difficult. These may be genuine concerns, but the rapid cycle is necessary since we have very little time left, and long term promises create mistrust which poisons cooperation. There is nothing to stop nations declaring their votes ahead of time or coordinating their price votes. Themis just doesn't require countries to do so.

The existence of hurdles should not themselves spoil Themis. The real question is not whether Themis is perfect, but whether it is better than its absence.

Next steps

The Themis Mechanism is an idea in early stages needing support to be implemented. What can you do to help make Themis a reality? Two things: First, you can help spread awareness of the fact that there are constructive ways to deal with climate change. It's our choice whether we implement them or not. Second, you can engage your leaders and decision makers: What price will they vote for? Under what conditions will they join?

While Themis is not a complete solution, it is a crucial step toward fair and effective global emissions reduction. Supporting Themis means taking immediate, verifiable action toward a fairer and more effective global climate strategy.