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Leave it in the Ground Initiative

Fossil Fuel Phaseout Systems Analysis

A contribution to the Santa Marta Process

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SEPTEMBER 2026

The Santa Marta Process is a multilateral government initiative which arose to explicitly advance and coordinate transitions beyond fossil fuels. Complementary to the UNFCCC process, its members form a "coalition of the doing", a new piece of the puzzle of the fossil endgame.

The transition beyond fossil fuels constitutes a formidable challenge: transforming a highly complex system with many interlinked actors around the globe, profoundly reshaping societies.

For the First International Conference on Transitioning Away from Fossil Fuels in Santa Marta, Colombia in April 2026, we developed the current model of the global fossil fuel phaseout, in order to inform answers to the strategic question of where efforts to facilitate and accelerate the transition beyond fossil fuels might create the biggest systemic impact.

Vester's Sensitivity Model is an easy to use tool, which helps understand complex systems, identify critical parts of the system for transformation and to provide insights into how to build strategies that create the desired changes at the system level. The model does not offer predictions, it rather maps the system's leverage points, and possible future dynamics. In it, each variable can influence others (active variable) or be influenced by others (reactive variable), leading to a unique systems map.

In our model of the Fossil Endgame, whose map is represented below, variables have been mapped into five clusters: physics, politics, economics, technology, and culture. This associated with fossil fuels are shown in red, those associated with the transition are shown in green. Blue variables can go either way.

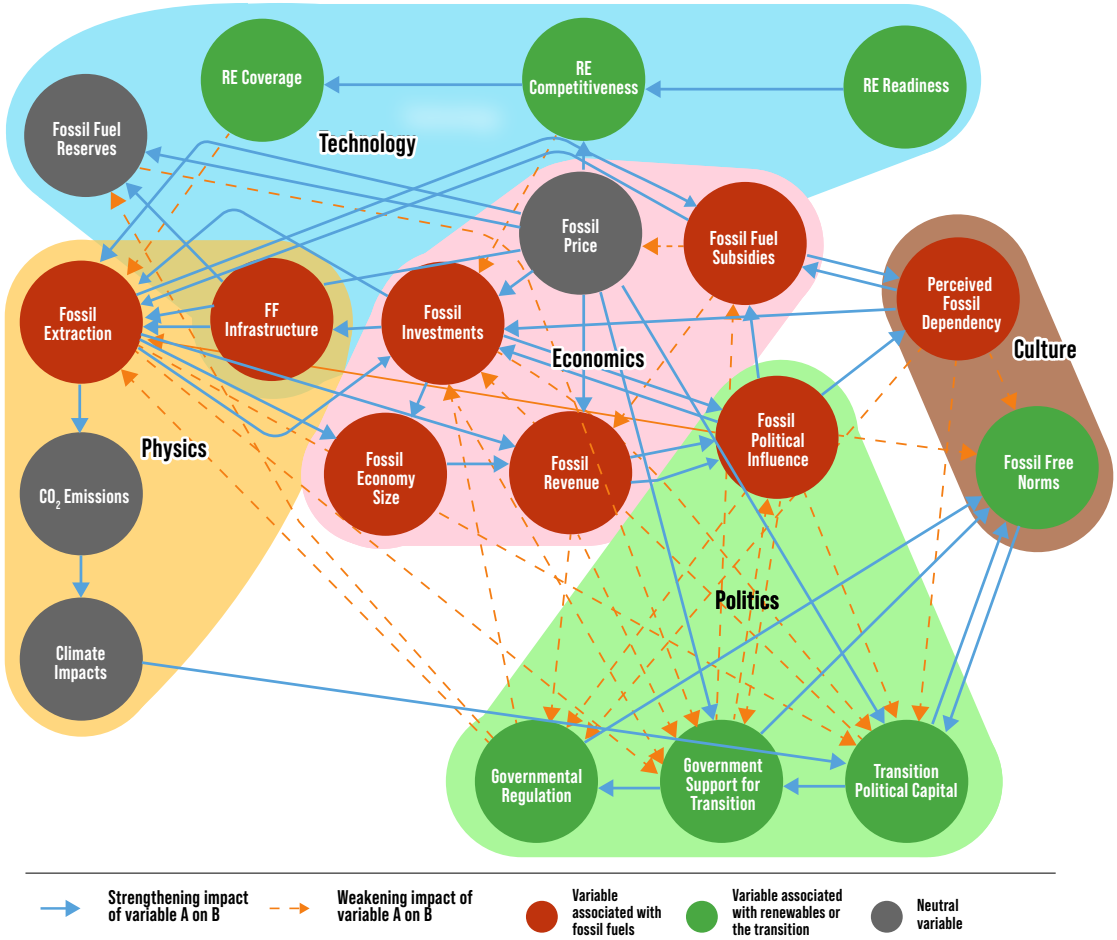


Fig 1. The variables of the fossil fuel phaseout system organized by spheres.

↘ Key insights

As a general observation about the system at hand, a large number of variables are active and reactive at the same time. This means the system is internally very strongly interconnected -and therefore difficult to disrupt. Winning strategies to accelerate the transition should involve coordinated efforts which play on different variables, while recognizing some of the fundamental features of the system described below.

Key variable: Extraction of Fossil Fuels

Fossil Extraction is one of the most active variables, influencing many other variables, driving the system very strongly. Due to its position as the main interconnection between society and climate impacts, its state can be considered the litmus test of anything that is done in society with the aim of mitigating climate change. Efforts to target extraction at the root (e.g. by defusing carbon bombs) will likely weaken the system structure and have very destabilising effects on the overall (fossil fuel) system - which is the intended effect.

Once fossil extraction happens, it leads to economic and political effects that have been described as fossil fuel lock-in or carbon entanglement. It is therefore easiest to intervene before fossil fuel extraction has happened.

All variables, from the fields of technology and economics to culture and politics, need to influence the key variable of fossil fuel extraction, if they are to have an impact on emissions and climate impacts. That is a very specific requirement. The key influencers here are Fossil Investments, the build-up of Fossil Fuel Infrastructure itself, and Governmental Regulation of Fossil Fuel Extraction. If cultural and political interventions have an impact on these, they stand a chance of leading to climate benefits. If not, they may not prove very effective.

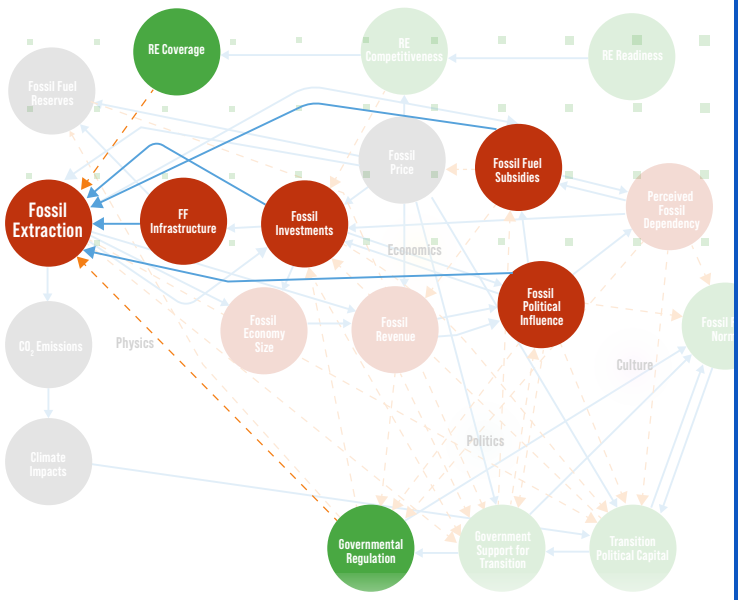


Fig. 2: Fossil Fuel Extraction is directly and strongly impacted by at least six variables in the system.

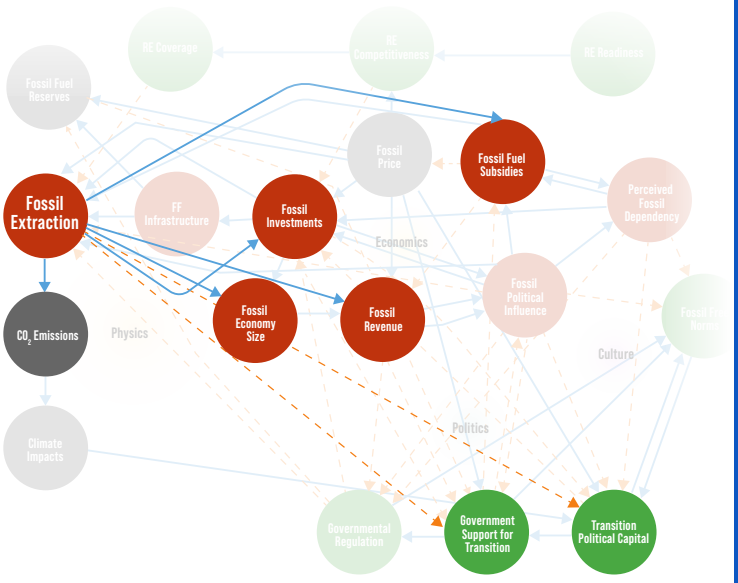


Fig. 3: Fossil Fuel Extraction exerts a strong impact onto the system by directly influencing seven variables strongly.

Ending fossil fuels by building renewables?

Renewables need to follow a sequence to have a substantial impact on the system: from (technological) Readiness to (economic) Competitiveness to (on-the-ground) Coverage. Only once RE Coverage has displaced fossil fuel demand, a negative impact on Fossil Fuel Extraction will manifest - something that then gets factored into operating and investment decisions.

Strong renewable energy impacts on the fossil fuel system are still rare and will be specific to the sector where they have come to dominate, not affecting the whole fossil fuel system. The overall system can stay resilient in the face of sectoral disruption by renewables if other market segments are growing and/or prices stay high enough to warrant continuing investment and extraction. The growth of the fossil fuel system (or in other words, economic growth) can simply counterbalance and "swallow" the effects of any decarbonization successes via renewables implementation.

Simply adding more renewables so far mostly gets absorbed into the existing economy, unless it specifically dismantles a pocket of fossil fuel dependency.

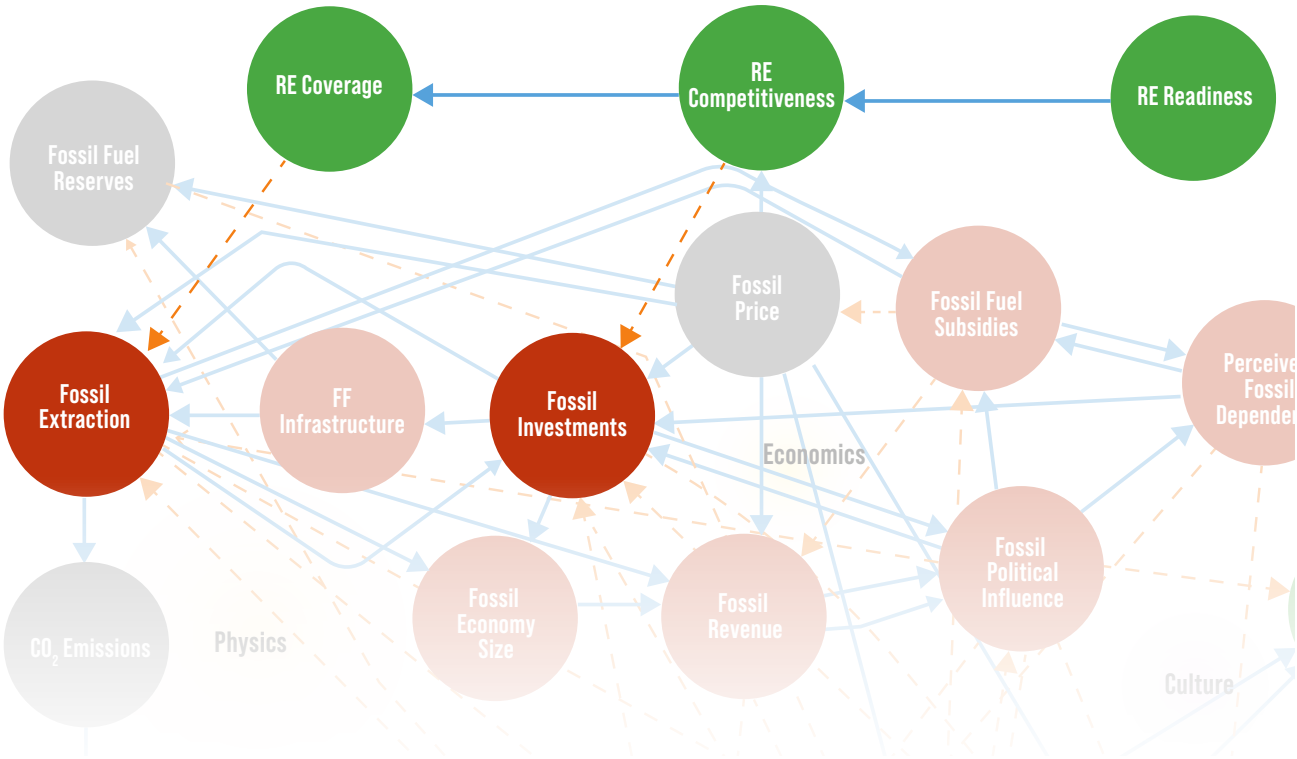


Fig. 4: Renewables need to become competitive and actually get deployed before they displace fossil fuels substantially.

Climate impacts or fossil free norms as a catalyst?

Climate impacts are a surprisingly weak driver compared with political and economic incentives.

Cultural elements like perceived fossil dependency and fossil free norms are more reactive than active, suggesting that interventions targeting that sphere may not directly produce strong systemic results.

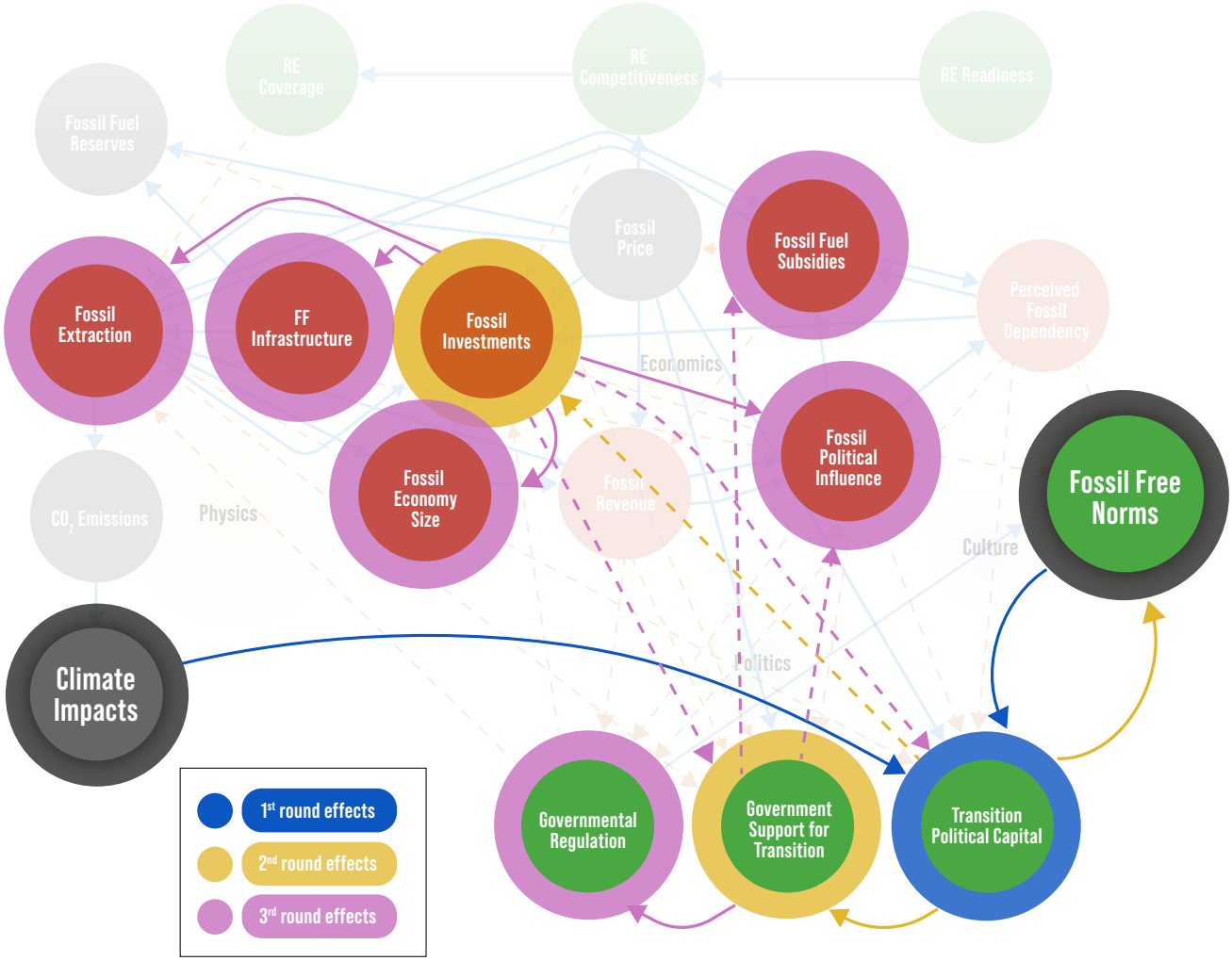


Fig. 5: Climate Impacts and Fossil Free Norms can influence the system, but it takes several steps.

Fossil fuel prices and investments

Fossil fuel prices are more active than reactive, and high prices are a condition which ultimately favours the transition, as they increase the competitiveness of renewable energy. Each price shock leads to long-term gains for renewables and creates a permanent dent in the fossil system, while bearing high costs for people's short-term wellbeing.

Fossil investments are a strongly "critical" variable in the system (meaning that they receive strong impacts from the state of the system, while simultaneously strongly influencing the system itself). Effective systemic change is likely going to have to target or indirectly move investments noticeably.

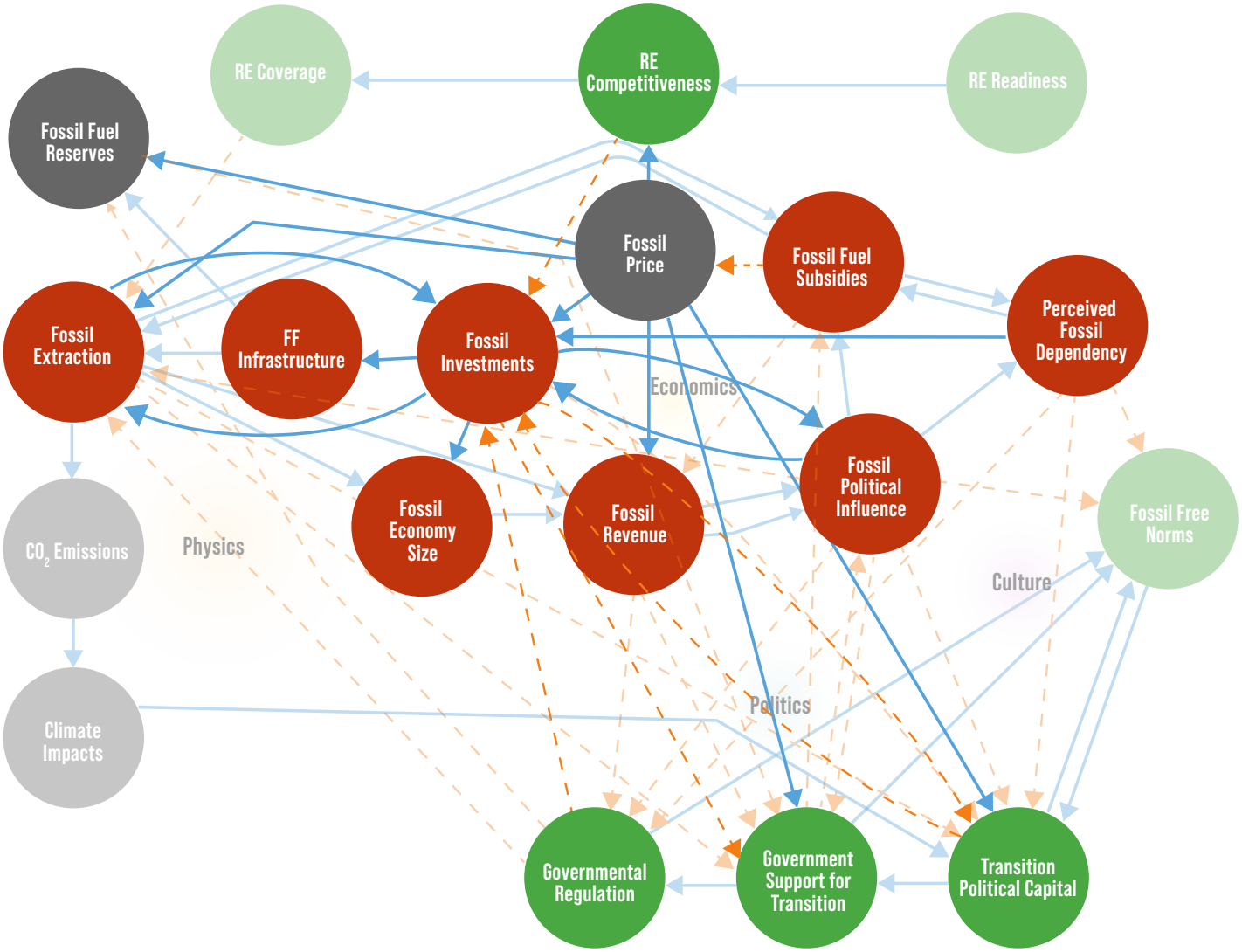


Fig. 6: Fossil Fuel Prices and Fossil Investments are well connected with a big part of the system

The full analysis can be found here. We welcome questions and feedback about this analysis and its implications or offers to jointly develop national models at:

systems-analysis@leave-it-in-the-ground.org

