OILCHANGE INTERNATIONAL

RECLAIM Finance

FEBRUARY 2021

# NGFS SCENARIOS:

## GUIDING FINANCE TOWARDS CLIMATE AMBITION OR CLIMATE FAILURE?

# EXECUTIVE SUMMARY

In June 2020, the Network for Greening the Financial System (NGFS) published a report outlining energy and climate scenarios intended to provide "a common starting point for analyzing climate risks to the economy and financial system"[1] for central banks and financial supervisors. The NGFS report comes at a time of increased scrutiny on the responsibility of central banks and financial regulators in combating the climate crisis.

The NGFS's work on climate scenarios is a welcome contribution to efforts to address climate-related risk in the financial sector. The present report examines the NGFS's work, and identifies instances in which the NGFS could improve communication, highlight more precautionary mitigation pathways, and promote transparency around the assumptions behind its scenarios.

While the NGFS's intent is admirable, to be decision-useful, its guidance should reflect the full range of the risks of climate change and chart a clear and decisive pathway toward ambitious climate mitigation. Achieving this is urgent, as the COP26 presidency has made "embed[ding] use of scenario analysis in the financial sector using the NGFS reference scenarios"[2] a priority.

As the NGFS prepares an updated version of its scenarios, its choices and presentation of climate scenarios should be improved in a number of ways in order to ensure that they do not end up increasing climate risks and undermining mitigation efforts:

1. **The framing of the NGFS scenarios guides climate action toward slower and riskier pathways.** While the NGFS scenarios are designed to allow financial actors to conduct climate risk analysis, the normative framing of these scenarios appears to normalize certain trajectories and to marginalize other, more ambitious ones. By putting forward and branding as "representative" scenarios that would let global warming reach 2 degrees Celsius (°C) or higher, the report implicitly encourages readers to ignore scenarios that would limit warming to 1.5°C. This has the effect of downplaying the difference in physical risk associated with 2°C warming compared to just 1.5°C warming, despite the findings of the United Nations' Intergovernmental Panel on Climate Change (IPCC) that the difference in climate impacts between 1.5°C and 2°C warming is stark.

2. **The highlighted scenarios rely heavily on massive carbon dioxide removal (CDR) as a climate solution, suggesting that fossil fuel combustion can continue far into the future while still remaining within climate limits.** This strong reliance on carbon dioxide removal over the medium term poses a grave threat to financial stability, as it gives central banks and financial supervisors the mistaken impression that the pace of transition can be more modest, such that we can afford to continue burning significant quantities of fossil fuels for decades to come. From a risk management perspective in a different realm, this is akin to encouraging social contact during the current pandemic on grounds that medical research might come up with a cure for COVID-19. Instead, financial stability would be better preserved by highlighting mitigation pathways that minimize the risk of catastrophic levels of climate change in the first place. Even the NGFS scenarios described as "limited CDR" rely on potentially highly risky amounts of CDR. Nearly every scenario considered in the NGFS report would exceed the realistic mitigation potential for CDR according to the IPCC's assessment of CDR as a method of sustainable mitigation.

3. **While integrated assessment models (IAMs) are powerful tools, their limitations are not sufficiently noted by the NGFS.** The limitations of IAMs, including their sensitivity to underlying key assumptions, should be carefully explained in the framing the NGFS provides to contextualize the scenarios. The NGFS should encourage central bankers and financial supervisors to take strong action to limit both the support provided to fossil fuels and the financial system's exposure to fossil fuel assets, even in the absence of certainty regarding which scenario will ultimately play out.

### TO ADDRESS THESE CHALLENGES, WE RECOMMEND THAT THE NGFS:

- Put a 1.5°C scenario with a precautionary approach to CDR at the center of the NGFS scenarios to guide decision-makers toward the highest end of the Paris Agreement's ambition, and to limit the risks from overreliance on CDR technologies which are unproven at scale;
- Reframe the value-laden "orderly/disorderly" labeling of scenarios to avoid giving readers the perception that scenarios that pursue rapid emission reductions in the near term are inherently "disorderly" or undesirable;
- Acknowledge and explore the risks inherent in scenarios reliant on large-scale deployment of CDR, and the potential real-world consequences of such a reliance;
- Make clear recommendations around near-term no-regrets actions, including phasing out support to fossil fuels and reforming prudential regulation to account for the risks associated with fossil fuels.

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# INTRODUCTION

The Network for Greening the Financial System (NGFS), launched at the One Planet Summit in December 2017, defines itself as "a group of central banks and supervisors" that are "willing, on a voluntary basis, to share best practices and contribute to the development of environmental and climate risk management in the financial sector and to mobilize mainstream finance to support the transition to a sustainable economy."[3] This "coalition of the willing" works on how best to integrate climate into monetary policy, financial supervision, and other financial practices.

In light of this mission, in June 2020 the NGFS published a set of reference climate scenarios[4] to guide the work of its core members and audience. The scenarios are intended to:

- Provide central banks and supervisors with a common basis for analysis, notably to conduct climate stress tests and evaluate both the financial system as a whole and individual institutions' exposure to climate risks.
- Respond to the growing interest of financial institutions for such tools, making it increasingly necessary to create reference scenarios to ensure the comparability and quality of analysis and commitments, and help financial institutions choose between several available scenarios that rely on very different hypotheses.

In the context of the recent shift of prominent central banks to integrating climate risks into their operations, the NGFS scenarios are a positive development likely to have a strong impact on both financial supervision and financial practices and, ultimately, will help support efforts to green monetary policy. The COP26 presidency has even listed "embed[ding] use of scenario analysis in the financial sector using the NGFS reference scenarios" as an explicit priority.[5]

While the NGFS is currently reviewing its first batch of scenarios, this report aims to provide constructive criticism to ensure that these scenarios actually achieve their ambition. It shows that both the framing and the assumptions used in the NGFS work could actually drive financial institutions to opt for low ambition and high-risk climate pathways, contrary to the NGFS's intentions.

# 1) THE SELECTION AND POSITIONING OF SCENARIOS CAN LEAD TO SLOWER AND RISKIER CLIMATE MITIGATION

## HIDING CLIMATE SCENARIOS THAT AIM TO LIMIT GLOBAL WARMING TO 1.5°C

The NGFS report classifies scenarios according to two dimensions: whether the 2°C climate target is met or not, and how the transition to a decarbonized economy takes place. The report further divides scenarios in which targets are met into:

- **Orderly scenarios**, which assume optimal climate action starts immediately and becomes gradually stronger over time. Orderly scenarios are assumed to entail relatively low physical and transition risks.
- **Disorderly scenarios**, which assume either climate action is delayed until 2030 and abrupt emissions cuts are enacted thereafter, or climate action is disruptive and generates strong transition risks.

The NGFS paper makes the choice to center two marker scenarios that are meant to be "representative" of orderly and disorderly pathways. **Both so-called "representative" scenarios aim at limiting temperature increase to 2°C compared to the pre-industrial era. Scenarios with a stronger chance of limiting temperature increase to 1.5°C, a key objective that the signatories of the Paris Agreement committed to pursue,[6] are framed as "alternate" scenarios.**

The relative positioning and framing of a scenario have a significant impact on how the scenario is interpreted and used. For instance, the International Energy Agency's (IEA) choice to position a "business as usual" (stated policies) scenario at the center of its annual World Energy Outlook report, and focus attention on that scenario, has enabled governments and companies to perceive unsustainable levels of fossil fuel investment as "necessary" or "inevitable."[7] By centering more modest scenarios, the World Energy Outlook report also diminishes the visibility, and therefore credibility, of more ambitious scenarios that come closer to reflecting the changes necessary to meet the objectives of the Paris Agreement. As *Bloomberg* columnist Liam Denning pointed out, climate scenarios are like "[a] map used by the people, companies and institutions planning and building the roads. If [the World Energy Outlook report's] scenarios point a certain way, then investments will be made accordingly in such things as power plants, pipelines and oil and gas fields, facts on the ground with multi-decade lifespans."[8]

This self-fulfilling dynamic is at play with the current NGFS climate scenarios. **By granting principal status to a 2°C scenario and labelling it "orderly," the report creates the perception that other, more ambitious scenarios are unrealistic, dangerous, too costly, or all three, and do not warrant serious consideration by financial regulators and central banks.** In the report, 1.5°C scenarios are barely mentioned; when one is, it is presented as less credible than "representative" scenarios that do not fully align with the Paris Agreement goals. This creates the risk that, on the basis of the NGFS's "representative" scenarios, financial actors will continue to support polluting technologies, like fossil fuels, thus increasing the probability that global warming will far exceed 1.5°C.

This risk is not theoretical: it has already materialized in the case of the IEA's scenarios; which fossil fuel companies and financial institutions are using to justify inadequate climate targets. Most recently, the Dutch bank ING used the IEA's Sustainable Development Scenario to justify a policy to reduce its oil and gas investment by only 19% by 2040.[9]

## THE NECESSITY OF HIGHLIGHTING THE REAL-WORLD DIFFERENCES BETWEEN GLOBAL WARMING OF 1.5°C AND 2°C

**By centering a 2°C scenario, the NGFS implicitly downplays the difference between 1.5°C and 2°C of warming**, despite the IPCC's warning that "robust global differences in temperature means and extremes are expected if global warming reaches 1.5°C versus 2°C above the pre-industrial levels."[10] For instance, 2°C of warming could expose 2.6 times as many people to severe heat, and significantly increase the number of people exposed to severe droughts. Additionally, 2°C of warming would virtually wipe out coral reefs and lead to the loss of an additional 2 million square kilometers of permafrost, which, in turn, would increase the chance of triggering feedback loops in the climate system.[11]

Moreover, these impacts would not be felt equally around the world: the same 2018 IPCC report notes that "small island states and economically disadvantaged populations are particularly at risk,"[12] and that the Global South is likely to suffer the brunt of the economic and human impacts of an additional 0.5°C of warming.

**Therefore, positioning 2°C-compatible scenarios at the center of the report appears to give greater weight to transition risks compared to physical risks associated with climate change**. This choice probably relies on the idea that key actors in the global financial system will experience transition risks more immediately, and that managing transition risks may appear more critical to preserving financial stability. This assumption does not reflect the reality of climate risks.

First, deep and cascading uncertainties around the climate system's reaction to ever-increasing $CO_2$ concentrations means that the probability of catastrophic levels of climate change – in the absence of deep and rapid emissions cuts – is non-negligible. Standard economic analysis of climate change has tended to underestimate the economic impact of such "fat tail" events, which could prove destructive to civilization, and therefore to the economy. According to economist Martin Weitzman, "deep structural uncertainty about the unknown unknowns of what might go very wrong is coupled with essentially unlimited downside liability on possible planetary damages."[13]

Second, transition risks are in fact easier to manage. Unlike physical risks, transition risks are mediated by political and social structures and can be directly mitigated by economic support and just transition policies. As researchers Sivan Kartha and Paul Baer note, managing transition risks will always be "less formidable and more imaginable than the [...] measures that would be needed if we fail to act ambitiously and cooperatively to prevent much more global warming."[14]

**As a result, mitigation pathways should only be called orderly if they adopt a precautionary approach to climate mitigation, seeking to minimize the potential of harm in the presence of radical uncertainty. This implies centering pathways that:**

- **Assume early and rapid decarbonization;**
- **Are compatible with a high likelihood of keeping global temperature increase below 1.5°C.**

Such an approach also requires that principal scenarios take a precautionary approach to CDR technologies, the reliance on which may exacerbate the risk of catastrophic mitigation failure.

# 2) SCENARIOS ASSUME A STRONG ROLE FOR CARBON DIOXIDE REMOVAL, WITHOUT HIGHLIGHTING THE RISKS OF SUCH RELIANCE

## CDR TECHNOLOGIES ARE UNPROVEN AT SCALE AND RAISE SIGNIFICANT SUSTAINABILITY, HUMAN RIGHTS AND JUSTICE CONCERNS

CDR is the process of capturing $CO_2$ from the atmosphere and sequestering it for long periods of time through a variety of technologies usually called negative emissions technologies. These include afforestation and reforestation (planting trees) and bioenergy with carbon capture and storage (BECCS). Relying on large-scale deployment of CDR to achieve climate mitigation objectives is a dangerous gamble that the IPCC itself calls "a major risk in the ability to limit warming to 1.5°C."[15]

First, the technical feasibility of large-scale deployment of CDR, in particular BECCS, is unproven. As a recent piece highlighted, "A typical 2°C climate scenario requires the funding, construction and operation of as many as 16,000 plants that combine biomass burning with carbon capture and storage by 2050. Today there are three demonstration projects."[16]

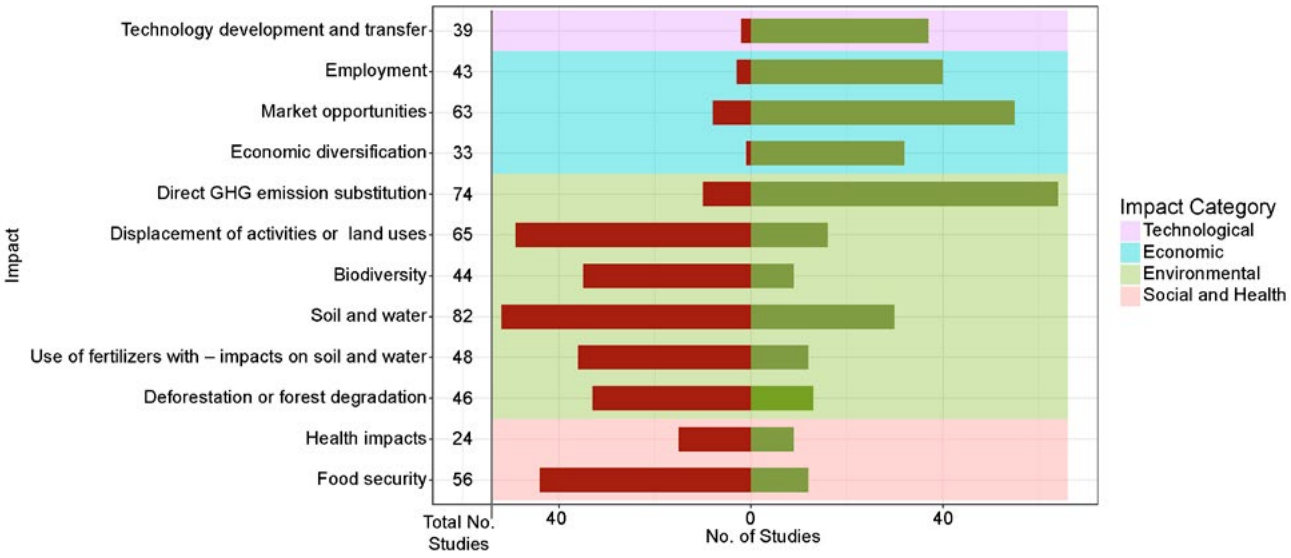
Additionally, even if large-scale deployment were possible, it would raise significant concerns in terms of sustainability, human rights, and justice.[17] A growing body of research (Figure 1) has shown that deploying BECCS on a large scale could negatively impact core dimensions of human and ecosystem well-being. The IPCC warns that "large-scale deployment of land-based CDR would have far-reaching implications for land and water availability [...] and may impact food production, biodiversity and the provision of other ecosystem services."[18] Due to its land-use impact, BECCS could lead to increased food prices as a result of competition between agriculture and other land uses.[19] It could also push some fundamental ecological systems beyond the brink of safety or repair, in particular those regarding freshwater use and the integrity of the biosphere.[20]

## MOST NGFS SCENARIOS RELY ON POTENTIALLY UNSUSTAINABLE AMOUNTS OF CDR, EVEN WHEN THEY ARE BRANDED AS "LIMITED CDR"

In light of the concerns and risks surrounding CDR deployment, assessing whether a scenario hypothesizes an amount of CDR that is compatible with the best scientific estimates of its deployment potential is important to justify its credibility. The best available scientific estimates[23] of sustainable mitigation potentials from CDR technologies by 2050 is as follows:

- 0.5 to 5 Gt $CO_2$ sequestered per year using BECCS;
- 0.5 to 3.6 Gt $CO_2$ sequestered per year by afforestation and reforestation.

**Figure 1: Distribution of Studies Discussing Negative and Positive Impacts of BECCS for Key Side-Effects. Red bars indicate negative impacts and green bars indicate positive impacts.**




Source: Fuss et al. 2018[21], adapted from Robledo-Abad et al. 2017[22].

**Table 1: Key Scenarios Analyzed in the Present Report and their Labeling.**

| Scenario | NGFS label | Our label |
|---|---|---|
| **REMIND[b] Immediate 1.5°C with limited CDR** | Alternate, disorderly | Fast Transition this scenario entails the fastest cuts in $CO_2$ emissions out of all the scenarios in the NGFS scenario Explorer database |
| **GCAM[c] Immediate 2°C with CDR** | Representative, orderly | Marker |
| **REMIND delayed 2°C with limited CDR** | Representative, disorderly | Marker disorderly |
| **MESSAGE[d] Current policies (assumes no significant departure from current policies in the future)** | Representative, hot house (assumes warming above 2°C) | Business as usual |

The following analysis mostly focuses on the scenarios described in the chart above, which identifies the NGFS scenarios according to their corresponding OCI label[a]:

In the figures below, we use the following color code:

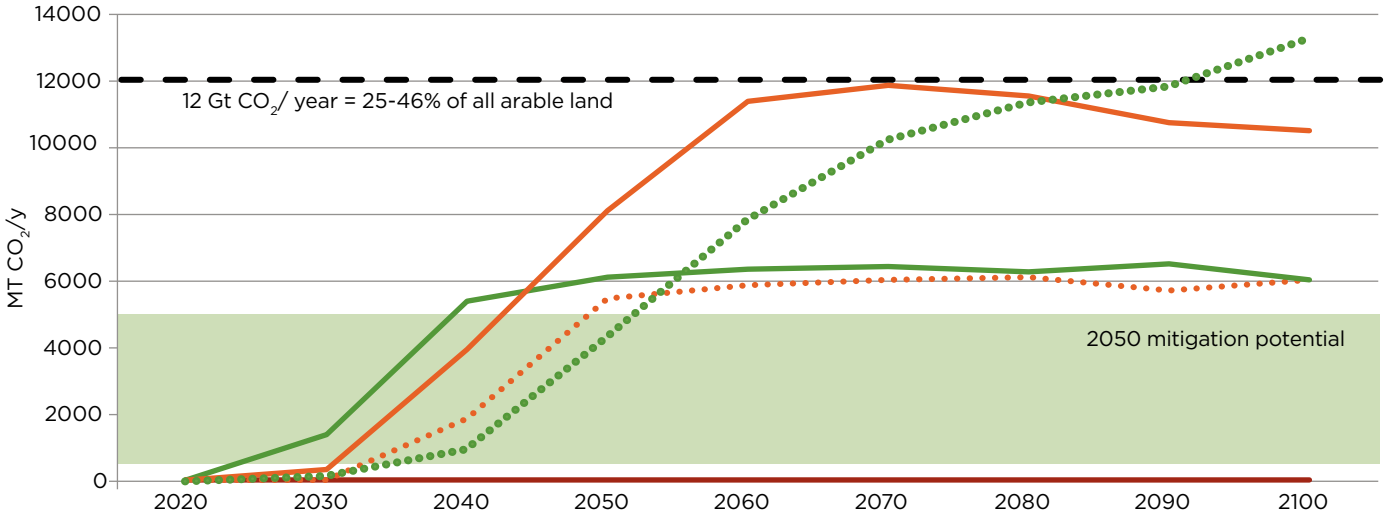
- Red: scenarios that assume more than 2°C of warming by the end of the century;
- Orange: scenarios that assume up to 2°C of warming;
- Green: scenarios that assume 1.5°C of warming.

When considering CDR levels in NGFS scenarios, Figure 2 shows that:

1. **The marker scenario assumes levels of mitigation from BECCS by 2050** (8 Gt $CO_2$/year) **that are significantly outside of the sustainable range**. The marker scenario reaches close to 12 Gt $CO_2$/y in BECCS mitigation by the 2070s, a level that would require a land area of 380 to 700 Mha exclusively dedicated to that purpose, which represents 25 to 46 percent of all arable land globally[24]. For context, the European Union's total land area is 447.6 Mha, and India's is 330 Mha.
2. The marker disorderly scenario assumes rapid deployment of CDR above the 2050 sustainable range, but constrains the growth of BECCS after 2050.
3. The only two scenarios targeting both 1.5°C and limited CDR, including the fast transition scenario, would theoretically entail a more careful approach to CDR, but yield very different results from each other. While the fast transition scenario assumes rapid deployment of BECCS in the 2030s followed by a stabilization until the end of the 21st century, the other scenario assumes a delayed start followed by a massive build-up throughout the century, even surpassing 12 Gt $CO_2$/year by 2090. **Despite their labeling as "limited CDR," both assume levels of BECCS that reach or surpass the aforementioned 2050 sustainable mitigation range**. It is therefore unclear what the label actually means.

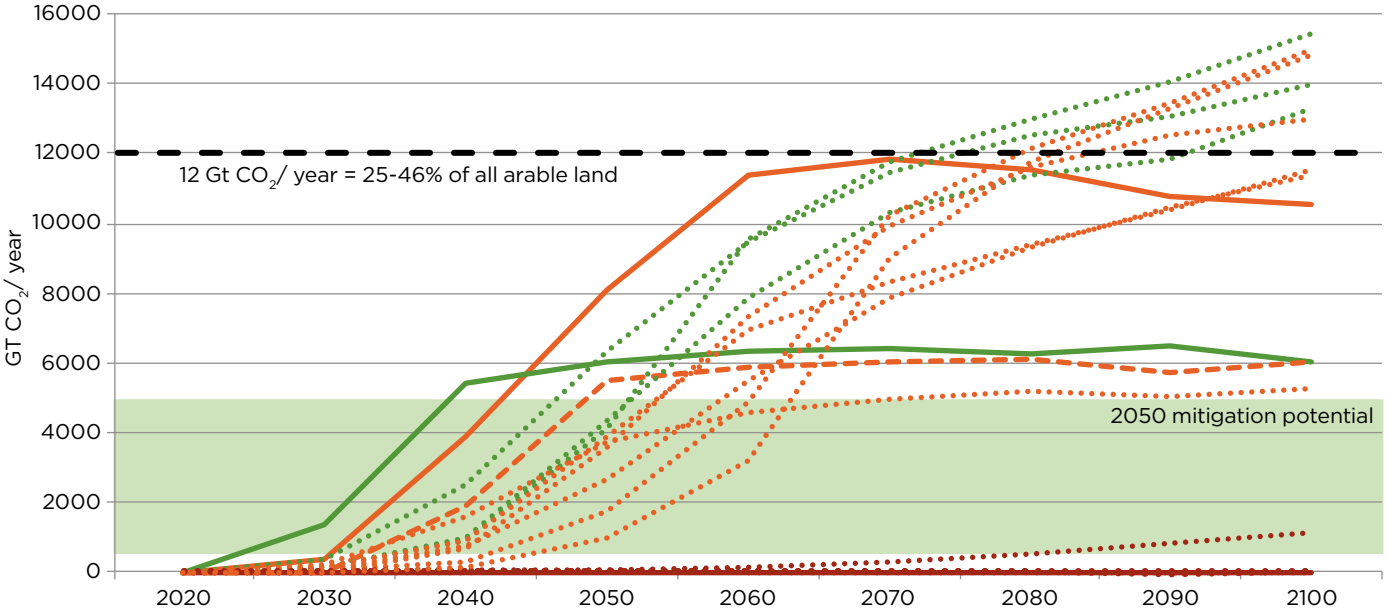
a When specific data points were unavailable in some of these scenarios, we based our analysis on scenarios given the same label by the NGFS. For instance, the NGFS scenario explorer did not provide data under the Global Change Analysis Model (GCAM) on mitigation from afforestation or investments in fossil fuel extraction, meaning the marker scenario could not be used as a comparison point. Accordingly, we used another scenario, labeled, "orderly, representative."
b The Regional Model of Investments and Development (REMIND) is a mathematical model developed by the Potsdam Institute for Climate Impact Research that incorporates the climate, the economy, and an in-depth analysis of the energy sector. See: https://www.pik-potsdam.de/en/institute/departments/transformation-pathways/models/remind.
c The Global Change Analysis Model (GCAM), developed by the Pacific Northwest National Laboratory, models the interactions between the energy system, water, agriculture and land use, the economy, and the climate. See: http://www.globalchange.umd.edu/gcam/.
d The Model of Energy Supply Systems and their General Environmental Impact (MESSAGE) is an integrated assessment model developed by the International Institute for Applied Systems Analysis. See: https://iiasa.ac.at/web/home/research/researchPrograms/Energy/MESSAGE.en.html.

**Figure 2: Mitigation from BECCS in select NGFS scenarios, 2020-2100**




Source: NGFS Scenario Explorer[e]

**Figure 3: Mitigation from BECCS in all NGFS scenarios, 2020-2100**




- Marker
- Business as usual
- Fast transition
- Marker disorderly
- MESSAGE Immediate 1.5C with limited CDR (Disorderly, Alt)
- MESSAGE Delayed 2C with CDR (Disorderly, Alt)
- MESSAGE Nationally determined contributions (NDCs) (Hot house world, Alt)
- MESSAGE Immediate 1.5C with CDR (Orderly, Alt)
- MESSAGE Immediate 2C with limited CDR (Orderly, Alt)
- REMIND Delayed 2C with CDR (Disorderly, Alt)
- REMIND Nationally determined contributions (NDCs) (Hot house world, Alt)
- REMIND Current policies (Hot house world, Rep)
- REMIND Immediate 1.5C with CDR (Orderly, Alt)
- REMIND Immediate 2C with limited CDR (Orderly, Alt)
- REMIND Immediate 2C with CDR (Orderly, Rep)
- MESSAGE Current policies (Hot house world, Rep)
- MESSAGE Immediate 2C with CDR (Orderly, Rep)

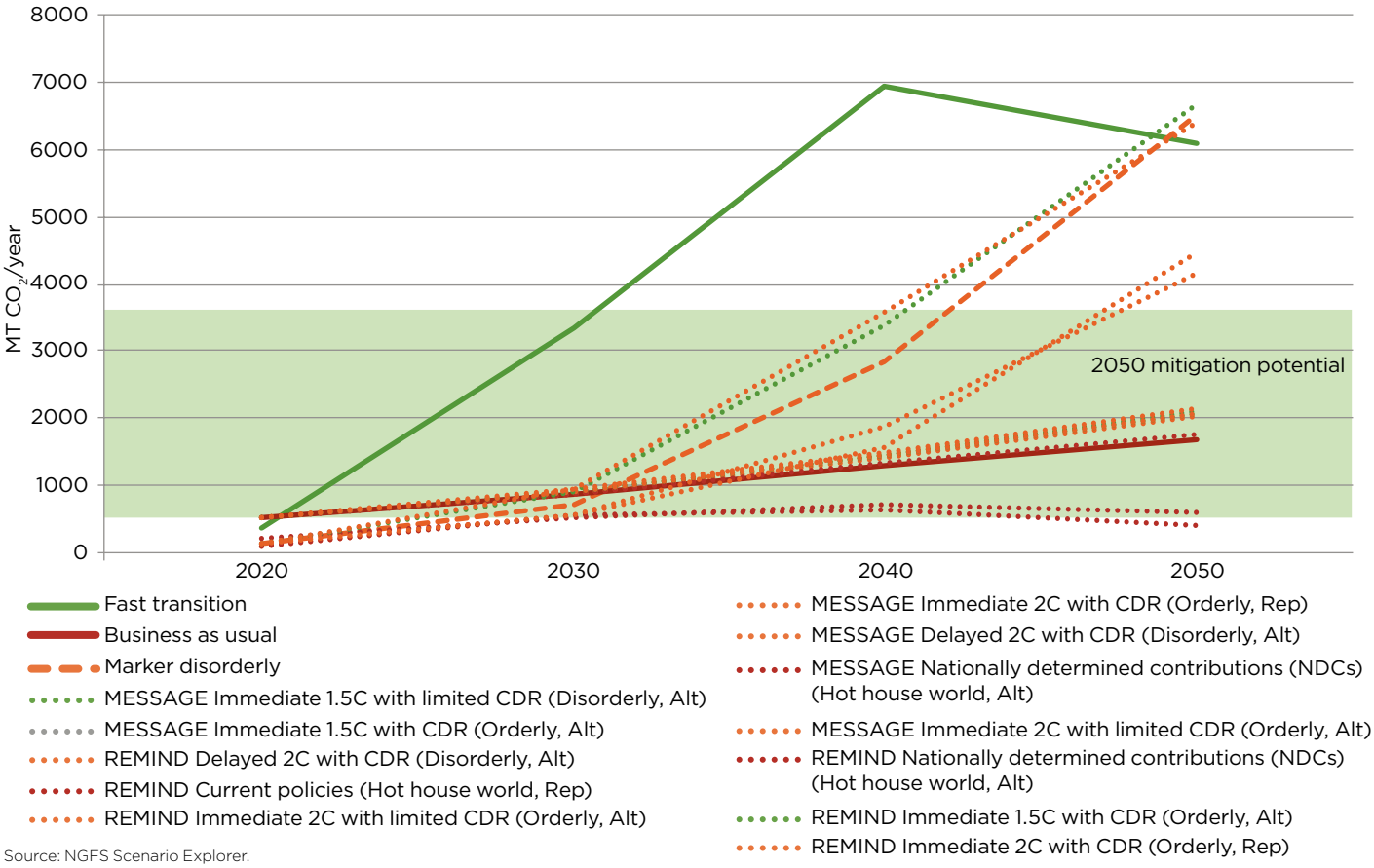
Source: NGFS Scenario Explorer.

Figure 3 shows that **a strong reliance on BECCS is a characteristic of multiple NGFS scenarios**. By 2100, the majority of scenarios either approach or surpass the 12 Gt $CO_2$/year mark. While this number is not an absolute limit, it highlights the disconnect between the levels of assumed BECCS deployment in NGFS scenarios and the potential real-world consequences of such use, which are never made explicit in the report. Moreover, **Figure 4 reveals that just over half of the NGFS 1.5°C- and 2°C-compatible scenarios assume levels of mitigation from afforestation and reforestation that surpass the sustainable potential**.

In order to ensure that the result of its work is as transparent as possible – and to allow those who use its scenarios to fully grasp what they imply – **the NGFS must highlight both the high degree of reliance on CDR technologies that its marker scenarios assume and their potential real-world consequences**.

e The NGFS Scenario Explorer is an online database "for transition scenario results selected for the NGFS. This provides intuitive visualizations & display of timeseries data and download of the data in multiple formats". The data from the present report was accessed through the Scenario Explorer. It can be accessed at: https://data.ene.iiasa.ac.at/ngfs/#/workspaces

**Figure 4: Mitigation from Afforestation in NGFS Scenarios (1.5°C and 2°C compatible), 2020-2050.**




Source: NGFS Scenario Explorer.

## BOX 1: HOW THE CHOICE OF SOCIOECONOMIC SCENARIO ASSUMPTIONS LEADS TO A HIGH RELIANCE ON CDR

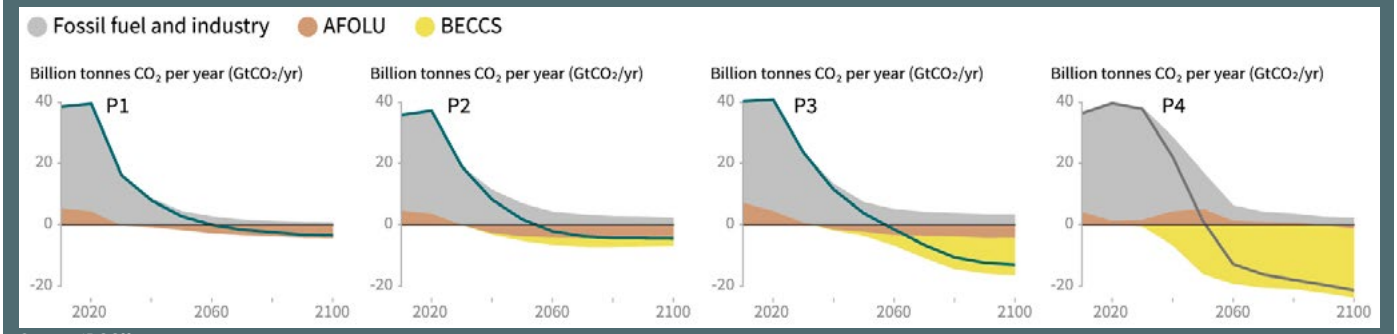
The role of CDR technologies in meeting the objectives of the Paris Agreement is contentious. While all 1.5°C-compatible pathways outlined by the IPCC require some use of CDR, the mitigation levels provided by such technologies by 2100 vary widely depending on the key assumptions behind the scenarios.

Scientists have developed a set of Shared Socioeconomic Pathways (SSPs) that describe five possible directions for the evolution of society and the economy over the course of the 21st century, from sustainability-focused growth and equity (SSP1) to rapid, unconstrained growth and energy use (SSP5).[25] Based on the SSPs, the IPCC's Special Report on Global Warming of 1.5°C featured four illustrative 1.5°C pathways (shown below), each with divergent macro-assumptions that affect the possible speed of decarbonization and scale of reliance on CDR.

**The scenarios presented in the NGFS paper are based on the "middle of the road" Shared Socioeconomic Pathway (SSP2)**, which is represented by the P3 pathway in the IPCC report. **In this pathway, social, economic, and technological trends follow historical patterns.** As a result, energy demand remains high relative to the P1 and P2 pathways, and the mitigation potential of energy efficiency and demand reduction is underutilized. The slower relative decline in fossil fuel use by 2050 is compensated by large-scale deployment of CDR in the second half of the century.

**By limiting its scenarios to "middle of the road" socioeconomic assumptions, the NGFS report sidelines lower energy demand pathways with greater potential for sustainability and equity.** In this way, the NGFS is limiting its field of vision, excluding pathways that show how society could achieve a rapid fossil fuel phase-out while minimizing reliance on CDR technologies.

**Figure 5. IPCC Illustrative Pathways.**




Source: IPCC[26]

# 3) HIGH RELIANCE ON CARBON DIOXIDE REMOVAL IN THE SELECTED SCENARIOS LEADS TO CONTINUED RELIANCE ON FOSSIL FUELS

## THE NGFS SCENARIOS NORMALIZE A DELAYED PHASE-OUT OF FOSSIL FUELS

CDR can be seen as the "substitution of the dream of later negative emissions for immediate mitigations."[27] This approach to mitigation amounts to deferring risk from present generations to futures ones, which raises strong ethical questions. CDR is also potentially detrimental to the goal of minimizing climate-related financial risks, as it increases both the risk of mitigation failure (and thus of significant physical risks) and of abrupt transition risks. Indeed, the same governments that could bet on a slow fossil fuel phase-out on the basis of expected CDR deployment would be forced to adopt abrupt emergency measures to shut down emitting sectors should this deployment at scale fail. In this sense, relying on CDR for mitigation can be seen as a risky gamble and a "moral hazard."[28] Additionally, there is a risk that CDR proves less effective at sequestering carbon than initially hoped, because of damages to the biosphere due to rapid climate change.[29] This is why the IPCC warns that "reliance on such technology is a major risk in the ability to limit warming to 1.5°C."[30] **Ultimately, relying on vast quantities of CDR to meet climate targets increases the risk of mitigation failure and thus may lead to a transition that proves disorderly.**

Centering such scenarios sends a potentially counterproductive signal regarding the necessary pace of the transition.

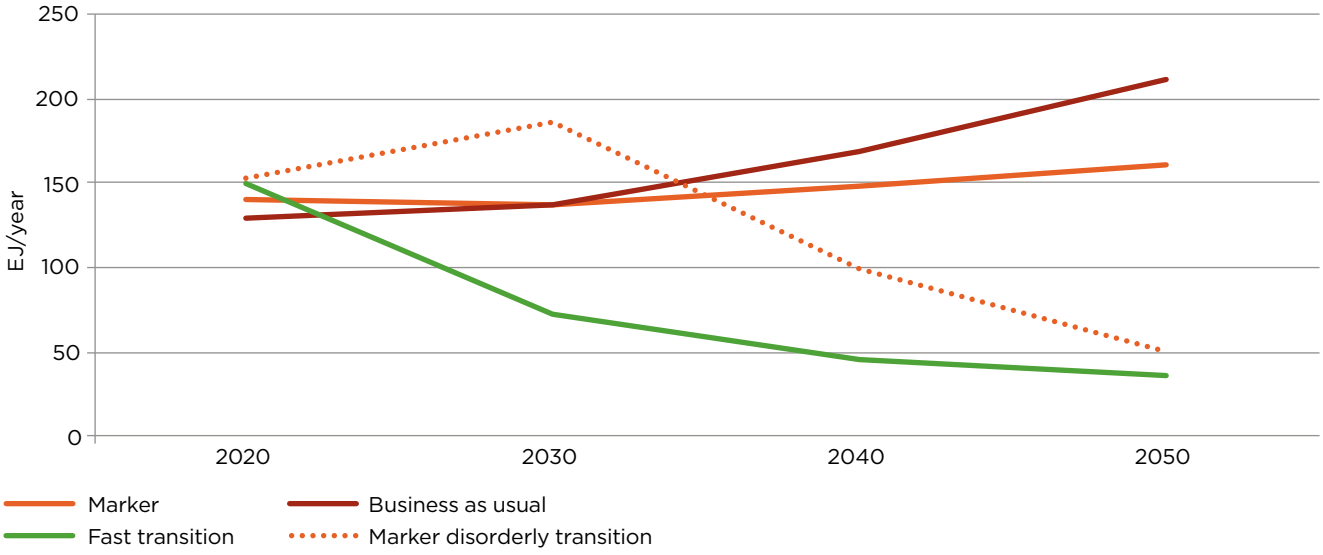
### Fossil gas[f]

Under the marker scenario, primary energy from fossil gas will increase to 161 exajoules (EJ)/year between 2020 and 2050, a level only 23 percent lower than the business as usual scenario. In so-called "limited CDR" scenarios, gas only accounts for between 35 EJ/year (fast transition scenario) and 50 EJ/year (marker disorderly scenario) of primary energy by 2050, compared to around 150 EJ/year in 2020. In the fast transition scenario, primary energy from gas in 2050 is 78 percent lower than in the marker scenario. This suggests that the role of gas in the global energy mix would be strongly reduced by following pathways that include a more precautionary approach to CDR.

### Oil

Oil's trajectory is similar to that of gas. Under the marker scenario, primary energy from oil remains constant until 2040 and decreases slightly thereafter to reach 169 EJ/year (compared to around 190 EJ/year in 2020), a level only 36 percent lower than under the business as usual scenario. However, under the fast transition scenario, primary energy from oil decreases immediately and reaches a level of primary energy 73 percent lower than under the business as usual scenario, and 58 percent lower than under the marker scenario. Under the marker disorderly scenario, delayed transition means that primary energy from oil only begins to decrease in the 2030s.

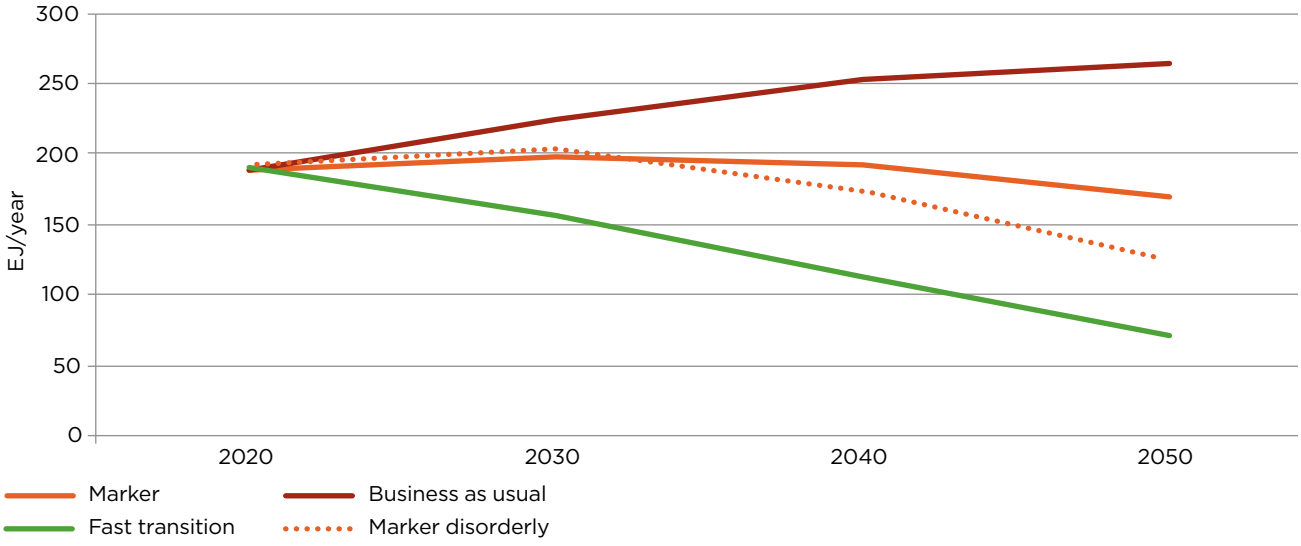
**Figure 6: Primary Energy from Fossil Gas in the NGFS Scenarios.**




Source: NGFS Scenario Explorer.

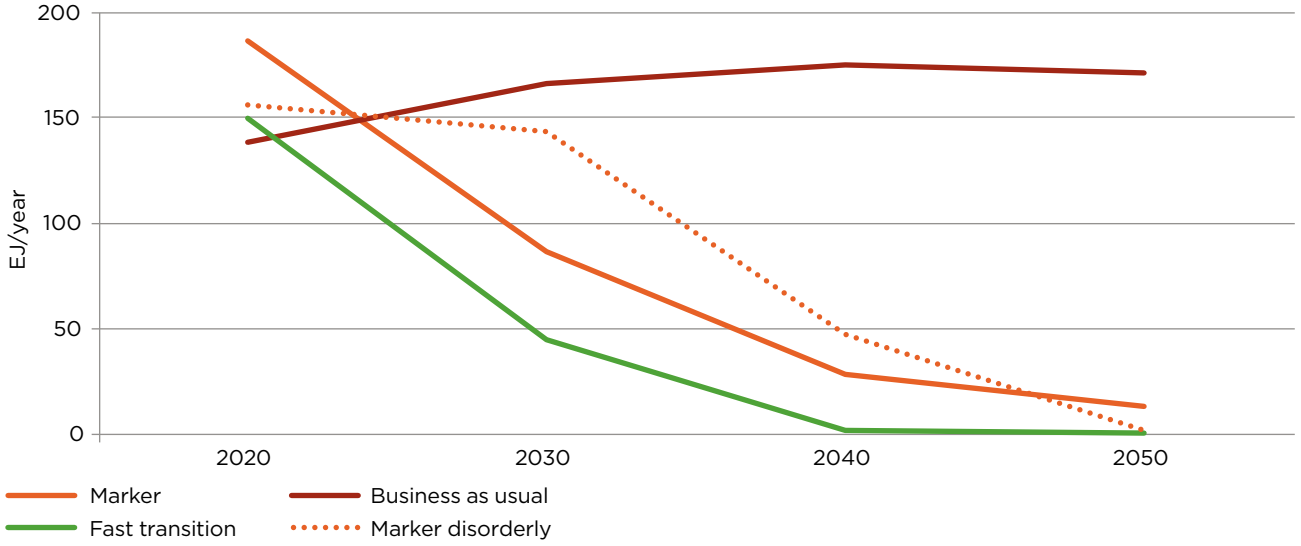
f We use the term fossil gas in place of what the oil and gas industry calls "natural gas" to highlight its contribution to climate change as a fossil fuel.

**Figure 7: Primary Energy from Oil in the NGFS scenarios.**




Source: NGFS Scenario Explorer.

**Figure 8: Primary Energy from Coal in the NGFS Scenarios.**




Source: NGFS Scenarios Explorer.

## Coal

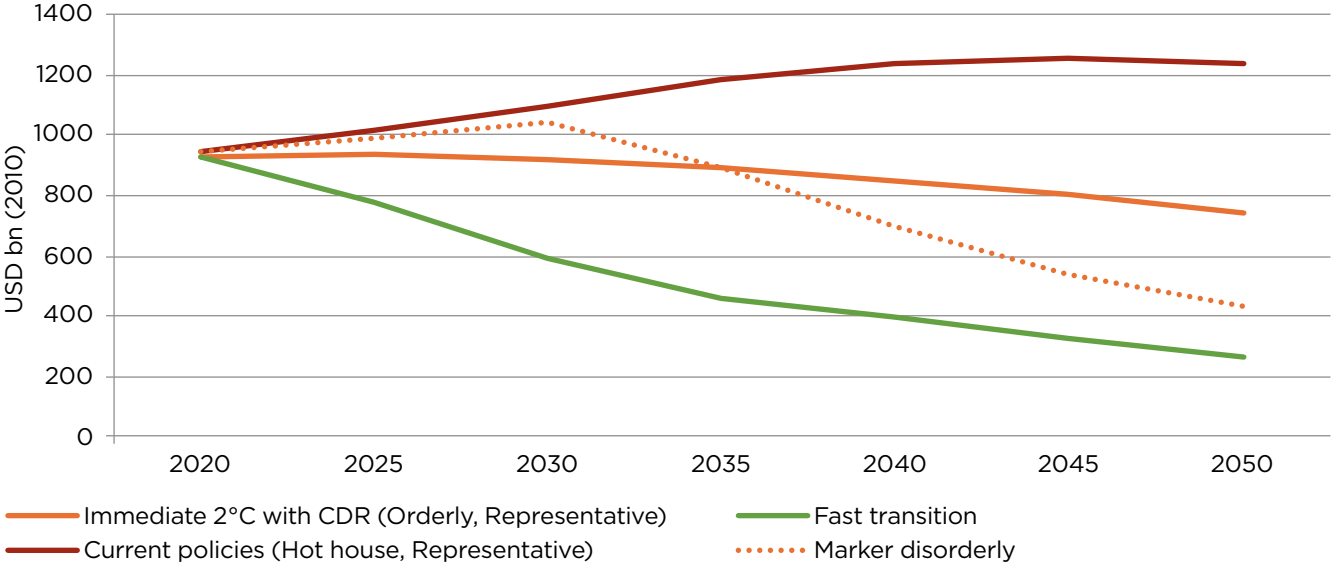
Coal consumption declines in all but the business as usual scenario, but the pace of the phase-out differs based on the temperature limit and on CDR assumptions. In the fast transition scenario, primary energy from coal declines immediately and is phased out globally by 2040, whereas it remains in limited use after 2050 in the marker scenario. In the marker disorderly scenario, a slower decline prior to 2030 leads to a rapid phase-out of coal in the 2030s and 2040s, and a complete phase out by 2050. Recent research confirms that the use of coal in electricity generation must be reduced by 80 percent between 2010 and 2030 and be completely phased out globally by 2040 to meet the 1.5°C target under the Paris Agreement goals.[31]

## Investments in fossil fuel extraction

As discussed above, the promotion of a 2°C scenario reliant on large-scale CDR to one of the central scenarios of the NGFS report creates a bias in favor of pathways with higher fossil fuel dependence. This, in turn, affects the assumed trajectory of investments in fossil fuel extraction between 2020 and 2050. In analyzing outputs related to energy investment (Figure 9), we focus here on the same group of scenarios that the NGFS report considers. The report only looks at investment outputs from the REMIND model.

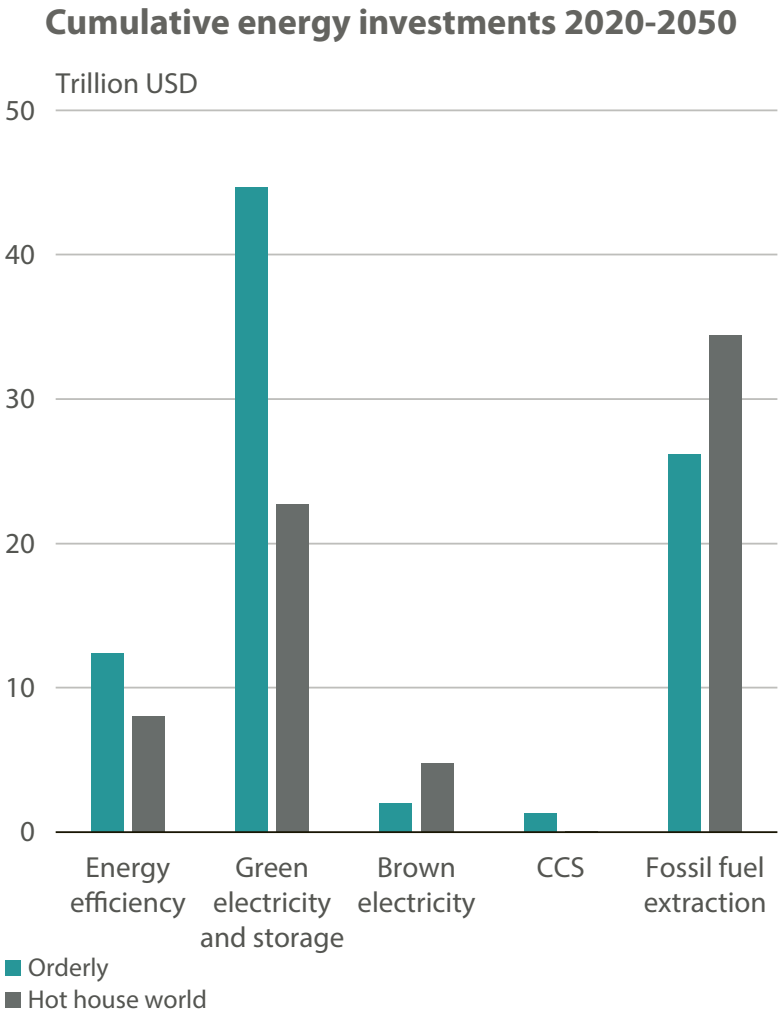
While the fast transition scenario would entail an immediate decline in investments in fossil fuel production, reaching a 71 percent reduction in 2050 (as opposed to a 54 percent reduction for the marker disorderly scenario by 2050 after an increase in the 2020s), the REMIND 2°C orderly scenario assumes a stable level of investment until 2030 and drops only 20 percent from 2020 levels by 2050. **In 2050, the remaining fossil fuel extraction investments in the marker scenario would be almost three times higher than in the fast transition scenario in the same year (USD 742 billion compared to USD 267 billion). The NGFS chooses to center a 20 percent drop in fossil fuel investments, rather than a 1.5°C-compatible, 71 percent drop**. This choice may lead decision-makers and financial actors to believe effective climate mitigation entails relatively limited risks from near- to medium-term fossil fuel industry investments when, in fact, a growing body of research indicates that a managed decline of fossil fuel production must begin now, and is the safest path to meeting the objectives of the Paris Agreement (see Box 2).

**Figure 9: Investments in Fossil Fuel Extraction 2020-2050 in the REMIND Pathways. Source: NGFS Scenario Explorer.**




Source: NGFS Scenario Explorer.

**Figure 10: Cumulative Energy Investments Highlighted in the NGFS Report.**




Source: NGFS Climate Scenarios for Central Banks and Supervisors.

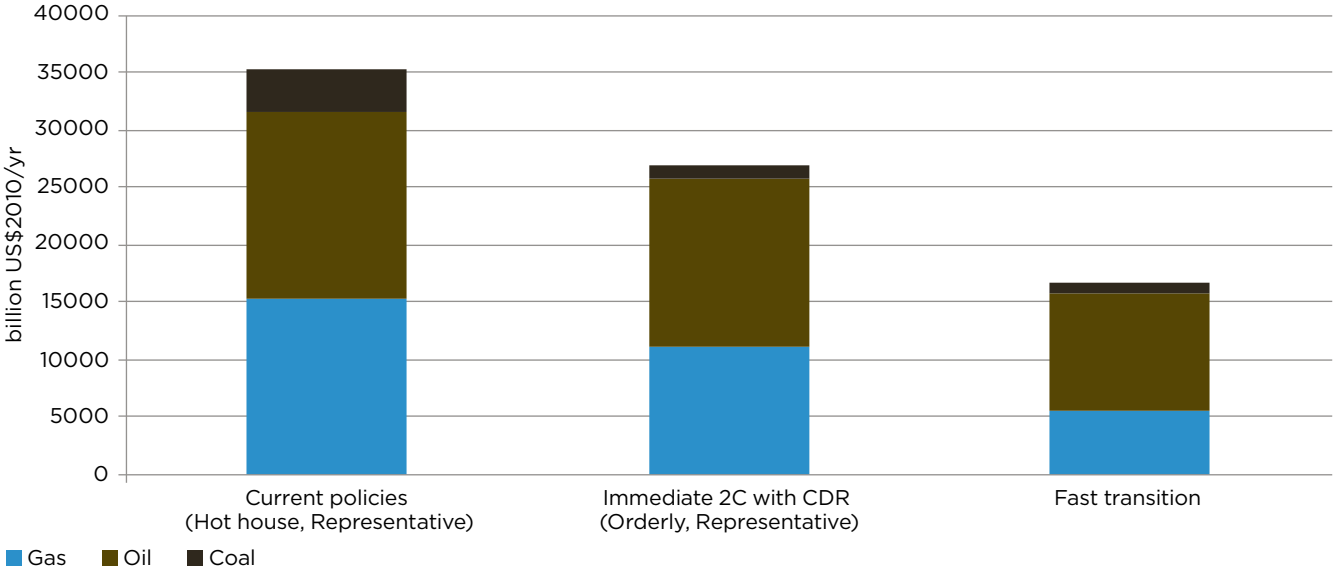
## VISUAL POSITIONING OF SCENARIOS REINFORCES THE FOSSIL FUEL BIAS

Figure 10, excerpted from page 17 of the NGFS report, highlights the difference in cumulative investments in fossil fuel extraction between 2020 and 2050 under a representative "orderly" scenario and a business as usual scenario. The NGFS did not include a 1.5°C scenario in this figure. The resulting visual indicates that an "orderly" transition could be achieved with a relatively small reduction in cumulative fossil fuel investments, compared to a scenario in which global warming exceeds 3°C (so-called "Hot House").

The graphic choice made in Figure 10 hides differences in how different fuels would fare under different scenarios. Figure 11 and Table 2, developed for the present report, offer alternative ways of presenting the same data and reveal stark gaps between the levels of total fossil fuel investment implied by each scenario.

Cumulative investments in fossil fuel extraction between 2020 and 2050 would only be 24 percent lower in a 2°C orderly scenario compared to a business as usual (called "current policies") scenario. However, this would actually entail a 72 percent drop in cumulative coal investments, a 27 percent drop in

**Figure 11: Cumulative Investments in Fossil Fuel Extraction 2020-2050.**




Source: NGFS Scenarios (REMIND model).

**Table 2: Difference in Cumulative Investments in Oil, Gas and Coal, from 2020-2050, between three NGFS scenarios (REMIND model).**

| Fuel | Current policies → orderly | Current policies → Fast transition | Orderly → Fast Transition |
|---|---|---|---|
| **Total** | -24% | -53% | -38% |
| **Oil** | -9% | -37% | -30% |
| **Gas** | -27% | -64% | -51% |
| **Coal** | -72% | -77% | -19% |

Source: NGFS Scenarios Explorer.

cumulative gas investments, and only a 9 percent drop in oil investments. Under the fast transition scenario, total cumulative investments would decline by 53 percent overall compared to business as usual, with a 77 percent decline for coal, a 64 percent decline for gas, and a 37 percent decline for oil. The fast transition scenario also entails significant reduction in investments compared to the orderly scenario: they would be halved for gas and would decline by 30 percent for oil.

From a communications perspective, the NGFS's decision to use Figure 10 as opposed to Figure 11 or Table 2 may lead the target audience to a different set of conclusions regarding the viability of short- to mid-term investments in long-lived fossil fuel extraction infrastructure over the next decades. This emphasizes the need for the NGFS to offer a broader range of scenarios that can provide its target audience a more comprehensive accounting of the fundamental economic and financial changes that will occur under more ambitious mitigation pathways.

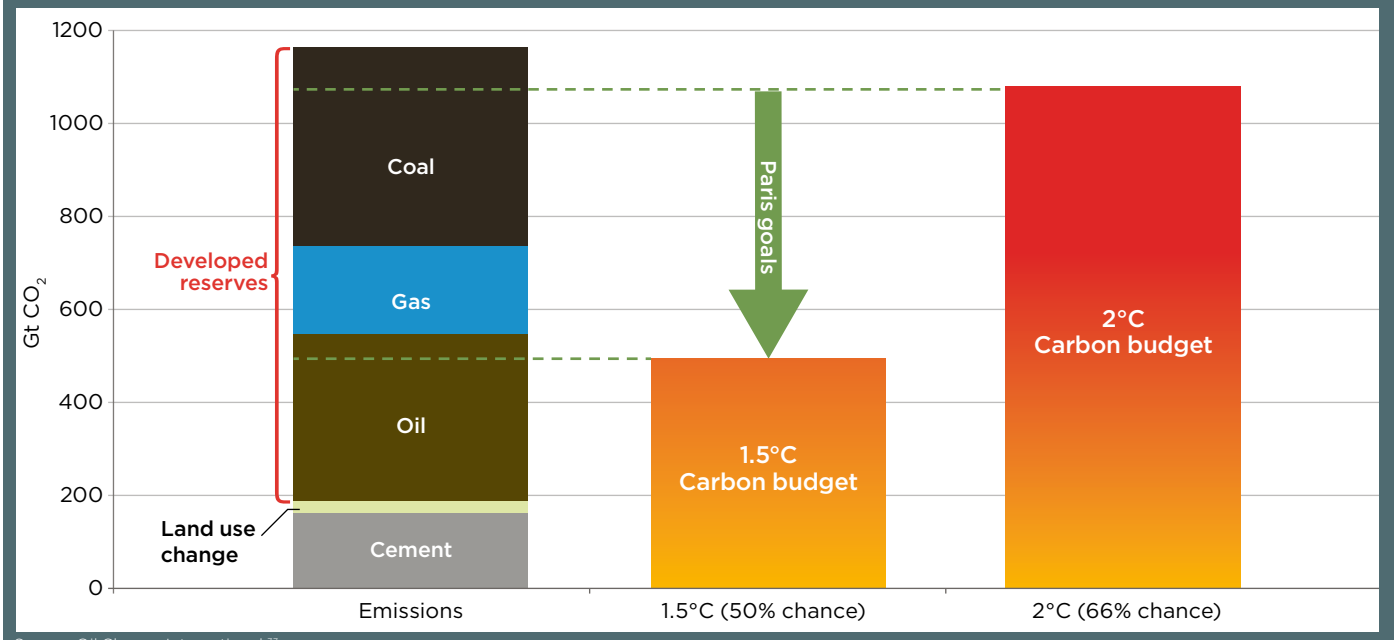
## BOX 2: THE NEED FOR A MANAGED DECLINE OF FOSSIL FUEL PRODUCTION TO MEET THE PARIS AGREEMENT GOALS

The continued central role of fossil fuels in the global energy system projected by the NGFS scenarios runs counter to the growing body of research showing that a managed decline of fossil fuel production is essential to meeting the objectives of the Paris Agreement.

Oil Change International analysis[32] has shown that the currently developed fossil fuel reserves alone would push average global temperature rise far beyond 1.5°C, and exceed a 2°C carbon budget. Even if global coal use were phased out overnight, developed oil and gas reserves would still push the world beyond 1.5°C (see Figure 12).

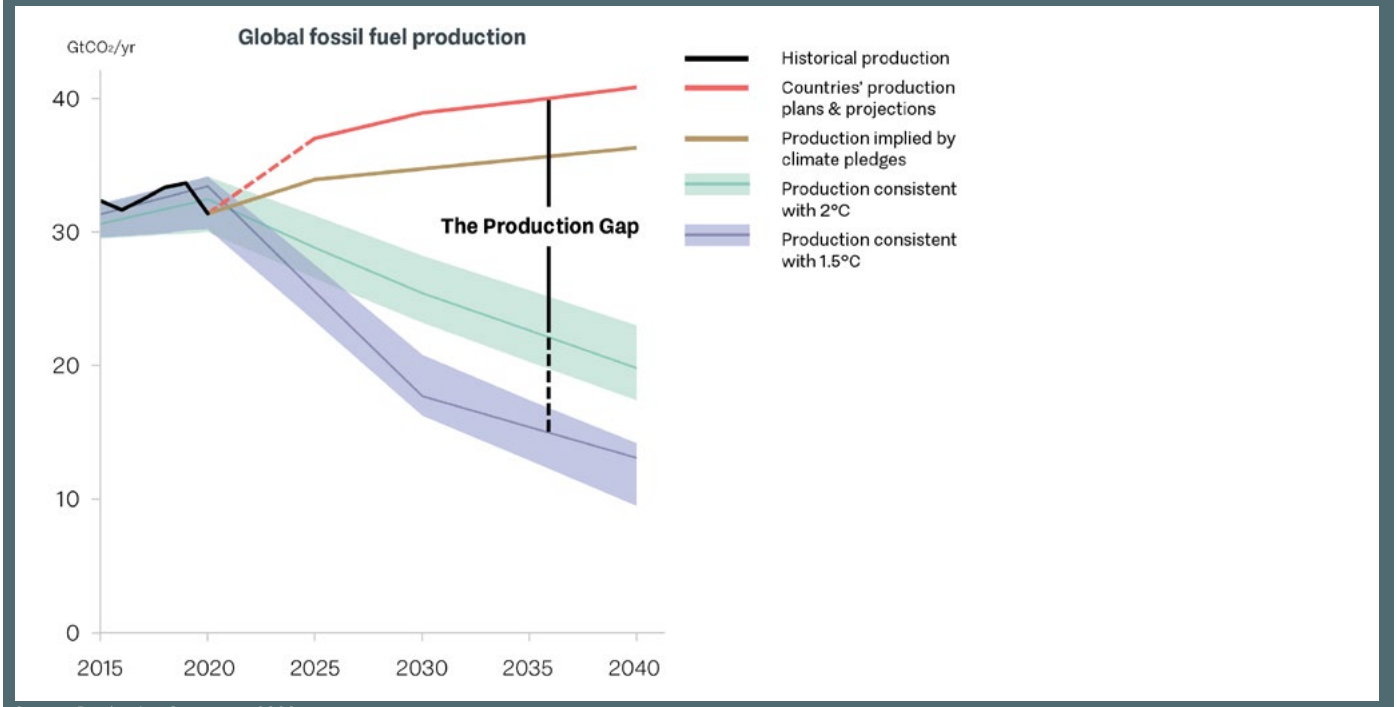
Additionally, the Production Gap 2020 special report[34] shows that the world will need to decrease fossil fuel production by 6 percent per year between 2020 and 2030 to follow a 1.5°C compatible pathway. Coal extraction would have to decline by 11 percent annually, oil by 4 percent, and gas by 3 percent. Countries are instead planning and projecting an average annual increase in fossil fuel production of 2 percent, which by 2030 would result in more than double the production consistent with the 1.5°C limit.

**Figure 12: $CO_2$ Emissions from Developed Global Fossil Fuel Reserves, Compared to Carbon Budgets within Range of the Paris Goals.**




Source: Oil Change International.[33]

**Figure 13: Planned Production of Fossil Fuels 2020-2040.**




Source: Production Gap report 2020.

# 4) THE LIMITS OF INTEGRATED ASSESSMENT MODELS SHOULD DRIVE THE NGFS TOWARD A PRECAUTIONARY APPROACH

In this paper, we analyzed the NGFS climate scenarios extensively, pointing out that both the framing and the assumptions used could drive financial institutions to opt for low ambition, high-risk climate pathways. The NGFS should modify its choice of climate scenarios significantly, including the assumptions used to categorize them, to provide a balanced view of fossil fuel industry risk and to center credible, precautionary trajectories that fully align with the Paris Agreement goals.

In many ways, the shortcomings of the NGFS approach are not unique. They point to the limits of integrated assessment models (IAMs) and the need for stakeholders to interpret the results of them with great care. In fact, although IAMs are critical tools for designing responses to the climate crisis[35] – because they evaluate the technological and economic feasibility of climate goals – they remain highly imperfect tools. Over the years, IAMs have been subject to growing criticism. While the NGFS notes in other publications the limits of IAMs[36], this is not made sufficiently clear in the scenarios paper. The limitations of IAMs are relevant to the NGFS's aim to analyze climate risks to the economy and financial system:

- **IAMs assume full-market efficiency and do not fully account for path dependency:**
  IAMs are techno-economic models that "tend toward the goal of minimizing the aggregate economic costs of achieving mitigation outcomes."[37] They assume the existence of fully functioning competitive markets, which translates into the efficient deployment of least-cost technologies. IAMs are unable to reflect the complex interplay between capital, politics, institutions, and technology[38] that lead to path-dependent economic development models, and in particular to carbon lock-in.[39]
- **Results of IAMs depend on a set of uncertain assumptions, while creating the illusion of certainty:**
  IAMs are heavily dependent on assumptions, in particular about the cost curves of mitigation technologies.[40] IAMs have been criticized for relying on outdated assumptions, especially regarding the future cost of solar photovoltaics[41], which is consistently overestimated. The frequent lack of transparency[42] around key assumptions and the way they are communicated can create the illusion of scientific certainty. This can mask the significant uncertainties and gaps in knowledge that still exist concerning climate impacts, the feasibility and costs of proposed mitigation pathways, and non-linearities in both human and natural systems.
- **IAMs may ignore technical feasibility and sustainability limits to the deployment of unproven mitigation solutions:**
  IAMs tend to rely heavily on CDR technology, a point we discussed above. They also have various assessments of the contribution of bioenergy to climate mitigation and can rely on carbon capture and storage to reduce greenhouse gas emissions in the energy sector.

While climate scenarios and models are useful tools, the known limitations of IAMs necessitate a careful analysis of their assumptions and how these relate to desirable policy or social choices.

Unless specifically constrained, the scenario outputs of IAMs may rely on levels of CDR, bioenergy, and/or CCS that exceed estimated sustainability limits or assume these technologies are more effective in mitigation than has been demonstrated in the real world.

# CONCLUSION: THE NEED FOR A PRECAUTIONARY APPROACH TO CLIMATE-RELATED FINANCIAL RISK

The financial sector will play an essential role in mobilizing and shifting the financial flows to sustainable energy investments at the scale and pace needed to meet the objectives of the Paris Agreement. Central banks and financial regulators have a responsibility to create the right regulatory framework to enable that shift.

In this regard, both the creation of the NGFS and its work to provide tools to guide the design of this regulatory framework are welcome developments in a field that is only starting to acknowledge its role in contributing to the climate crisis.

However, the NGFS should not rely solely on climate models. While climate models are useful tools to guide policy decisions, their inherent and well-documented limitations warrant a high degree of caution when considering using their outputs to make decisions that will impact the lives of millions.

The design and framing choices the NGFS made in publishing its climate scenarios lead to an implicit bias toward higher temperature pathways with relatively slower fossil fuel phase-outs, thus downplaying the speed and depth of the energy transition that may be required. In doing so, the NGFS risks perpetuating the fossil fuel status quo that is at the heart of the climate emergency the network was created to help tackle. While these choices may have been to reflect a cautious, "middle of the road" approach, they risk guiding financial practices and regulation onto pathways that will ultimately prove riskier, costlier, and more disruptive both to human lives and to the economy. The NGFS should address these methodological and communications choices, and make their potential consequences transparent to its target audience.

Central banks and financial regulators are faced with a double uncertainty. On the one hand, they only have imperfect, assumption-dependent tools to assess the extent of climate risk to the financial system and the optimal pathways to achieve the Paris Agreement objectives. On the other, it is unclear whether developing better tools and gathering more data would ever yield the degree of clarity that central banks appear to expect before they are willing to act decisively. Many leading financial institutions use these uncertainties as a reason to avoid taking concrete measures now, despite a worsening climate crisis. For example, the United States Federal Reserve System, the NGFS's newest member, describes its near-term agenda as "evaluating and investing in ways to deepen [their] understanding of the full scope of implications of climate change for markets, financial exposures, and interconnections between markets and financial institutions."[43]

But incomplete information is not a valid justification to delay action. It is logical to act on the information we already have, while simultaneously deepening our knowledge. In fact, we already have a significant amount of information on the climate crisis and which activities need to be swiftly scaled down or phased out entirely. This is especially the case for the production of fossil fuels, the continued expansion of which is incompatible with a safe climate (see Box 2).

While careful evaluation is important, it must coincide with decisive, immediate action. **Central banks and financial regulators must adopt a precautionary approach to climate-related financial policy**. According to a paper by researchers at UCL, this means guiding "market actors in a clear direction — towards a managed transition — to ensure that a scenario that minimizes harm to the financial system and wider economy in the future is the scenario that actually occurs."[44] In other words: financial institutions must mitigate climate change to mitigate the financial risks it will generate. **The NGFS should go beyond the necessary updating and reframing of its climate scenarios. It must push its members to adopt concrete measures[g] to mitigate the climate crisis now, starting with the reduction of financial support of fossil fuels – through monetary operations[45] and investments in alternative energy sources[46] – and the reform of prudential regulation to account for the risk they bear.[47]**

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**Oil Change International is a research, communications, and advocacy organization focused on exposing the true costs of fossil fuels and facilitating the coming transition towards clean energy.**
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**Reclaim Finance is an NGO affiliated with Friends of the Earth France. It was founded in 2020 and is 100% dedicated to issues linking finance with social and climate justice. In the context of the climate emergency and biodiversity losses, one of Reclaim Finance's priorities is to accelerate the decarbonization of financial flows. Reclaim Finance exposes the climate impacts of some financial actors, denounces the most harmful practices and puts its expertise at the service of public authorities and financial stakeholders who desire to to bend existing practices to ecological imperatives.**
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**February 2021**