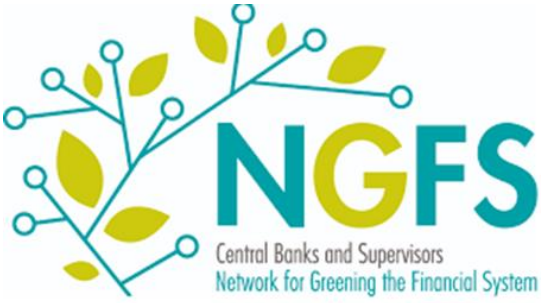
Not too late – Confronting the growing odds of a late and disorderly transition

September 2022



The NGFS has been developing climate scenarios together with a consortium of academics since 2018. It has already published two vintages[1] aiming at providing a common starting point for analyzing climate risks to the global economy and financial system. The NGFS has just released the third vintage of its scenarios.

The scenarios are neither a forecast of what is likely to happen nor a description of what should happen, but an illustration of what *could* happen. This includes some adverse scenarios that explore the impact of a delayed or a disorderly transition towards net zero. But the ongoing global spike in energy prices is both more adverse and more immediate than any of the scenarios designed ex ante.

These relatively recent events are not reflected in the third iteration of scenarios released in September 2022 owing to the lead time required for their completion. The NGFS is therefore presenting this note, prepared by an ad-hoc group led by Luiz Awazu Pereira da Silva (Bank of International Settlements), to demonstrate the relevance of the NGFS scenarios to the current situation. It also examines the feasibility of achieving the objectives of the Paris Agreement and the narrow but unique opportunity presented by current events.

[1] NGFS (2020) & other references

Summary of key findings

- The ongoing global spike in energy prices represents a crossroads in the world's journey towards net zero. We have a choice between two paths that have significantly different implications. One path will take us backward by increasing the carbon intensity of our energy systems and raising the odds of a delayed and disorderly transition further down the road, if not leading us to miss the net zero target and significantly overshoot the "well below +2°C" objective (as in a too-little-too-late scenario). The other path will take us towards net zero, even if it may need to be more sudden than expected, through a decisive and coordinated move away from fossil fuels that improves the chances for a less costly low carbon transition.

- The current energy crisis presents both challenge and opportunity. While policy measures to alleviate the current energy crisis may entail some increase in the carbon intensity of energy systems (e.g. substituting coal for natural gas), it is critically important that these measures do not result in increased carbon lock-in that will make it substantially more difficult to return to a Paris-aligned pathway. Any increase in carbon intensity must be reversed as soon as possible. The greater imperative is to capitalize on the current high prices of fossil energy to accelerate the transition towards renewable energy and increased energy efficiency and seize the opportunity to advance decisively towards a world with much less greenhouse gas (GHG) emissions. A stronger focus now on reducing carbon emissions can avoid a delayed, disorderly or disruptive transition in the medium or longer term.

- The abrupt price changes in the short term and the need to maintain high fossil energy prices for an accelerated low carbon transition pose challenges to society, especially low-income households. At the same time, the NGFS scenarios show that a no-transition (scenario) would have extremely negative economic and social costs in the medium to long term, driven by more frequent and adverse natural disasters alongside chronic and irreversible changes in climate.

- Meeting the Paris targets is thus imperative, and an early green transition is the least costly way to reach these goals. On the one hand, the role of governments is crucial in ensuring a just transition and cushioning the impact of decarbonization on the most vulnerable groups in society. Central banks and regulators should play a supporting role within their mandates to facilitate the journey to net zero. On the other hand, important investments in research and innovation are necessary in the short-term to advance technological solutions and ensure that the decarbonization objectives can be really met.

Introduction

The release of the phase III of the NGFS scenarios coincides with very particular circumstances for the global economy with three main developments.

First, the Russian invasion of Ukraine in early 2022 exacerbated the increases in fossil fuel prices, which had started already in 2021. Compared with their levels in December 2020, the prices of oil and natural gas increased by a factor of 2.5 to 4, respectively, as of mid-2022 (Graph 1 left and centre panels). In turn, attempts to find quick substitutes to ease the shortage of natural gas spurred demand for coal dramatically, leading to an even larger increase in coal prices (Graph 1, right panel). Oil, coal and gas prices spiked in the immediate aftermath of Russia's invasion of Ukraine and have been high and volatile ever since.

Second, inflation has picked up globally, notably on the back of the increase in oil and gas prices with a possible contribution from the energy transition. Central banks are addressing this with determination and in a timely fashion through the current monetary policy tightening. However, increasing the supply of clean energy is more necessary than ever.

Finally, the global economy has been confronted over the past year with an unprecedented number of climate related extreme weather events, from floods in Europe and China a year ago and, more recently, in Pakistan, to repeated extreme heatwaves and droughts in South Asia, Europe and elsewhere over the past six months, not to mention a series of wildfires. These events are an already strong illustration of worst developments to come as climate change becomes more visible and chronic consequences accelerate[2].

The NGFS phase III scenarios provide a first attempt at measuring the impact of the increase in frequency and intensity of acute physical risks on the GDP trend while also improving previous estimates of the impact of chronic physical risks. Although this is still a conservative and partial estimate, the GDP impact of physical risks in the current policies scenario is strongly diverging from that of an orderly transition (Net Zero 2050) as early as in 2030, rising to a 5pp difference in 2050 and increasing dramatically afterwards.

The shift away from natural gas to coal observed over the past few months (e.g. in some European countries, due to the huge increase in gas price), the global coal consumption reaching its all-time high and likely exceeding it next year as well as the expansion of natural gas infrastructure are major immediate setbacks for the decarbonisation of the global economy. Further, the latest estimate showed that carbon emissions were on the rise again in 2021, further depleting the remaining carbon budget[3]. The jury is still out regarding the longer-term effects of these changes in relative prices on the primary energy mix and whether they can spur the much-needed reduction in greenhouse gas (GHG) emissions.

However, the NGFS scenarios can shed light on the impact of these developments on the transition and help navigate the current difficult choices.

[2] [2] See Van den Broeke, M. et al. (2017): Greenland Ice Sheet surface mass loss: recent developments in observation and modeling. *Curr. Clim. Change Rep*. 3, 345–356.

[3] Global Carbon Budget, sponsored by the UK Met Office, the Intergovernmental Panel on Climate Change (IPCC) and World Meteorological Organisation (WMO) and Kemfert, C., Präger, F., Braunger, I. et al. (2022): The expansion of natural gas infrastructure puts energy transitions at risk. *Nat Energy* 7, 582–587.

The growing odds of a late and disorderly transition

The war in Ukraine, in addition to being a tragedy, is a wakeup call to the costs and risks of fossil fuel dependence. It has offered a unique opportunity to accelerate the transition to low-carbon energies. The higher cost of producing energy with fossil fuels has three effects. First, it spurs energy efficiency, necessary to reach net zero emission by 2050, as evidenced by the massive adjustment following the 1970s oil price shocks. Second, it is making renewable and nuclear energies much more economically attractive. At a time when part of the world has already been investing in the energy transition, the (relative) returns to such investments are much higher than they were a year ago, especially should the fossil energy prices remain high. Third, it may also spur investment to increase fossil fuel production, although the return could be compromised by the future tightening of climate policies (via regulation or carbon pricing mechanisms).

It is mainly on these second and third aspects that the NGFS scenarios are particularly useful as we elaborate in the next section.

The transition requires major investments in renewable electricity infrastructure and storage (about 40% more in investment each year on average in the net zero 2050 scenario than in the current policies scenario) but it also involves a decrease in investments in fossil fuel extraction and fossil fuel generated electricity (respectively -40% and -70% in the net zero 2050 scenario relative to the current policies scenario). Eventually, the success of a transition hinges on this capital reallocation, where overall additional yearly investment in the energy system is kept limited, to about +5%.

The current situation has two major effects. It is making this capital reallocation even more challenging. Supply bottlenecks or technological advances were already critical issues constraining the pace of the transition. Now, the new investments undertaken to increase the supply and diversify the sources of fossil fuel increase the probability of a too-little-too-late scenario. It is also putting international collaboration at risk and raising the odds of a disorderly transition.

While the odds of a too-little-too-late scenario are growing, a successful net zero transition is still in reach. In fact, the cost-benefit analysis of such an option are by far more favourable due to the importance of granting energy security.

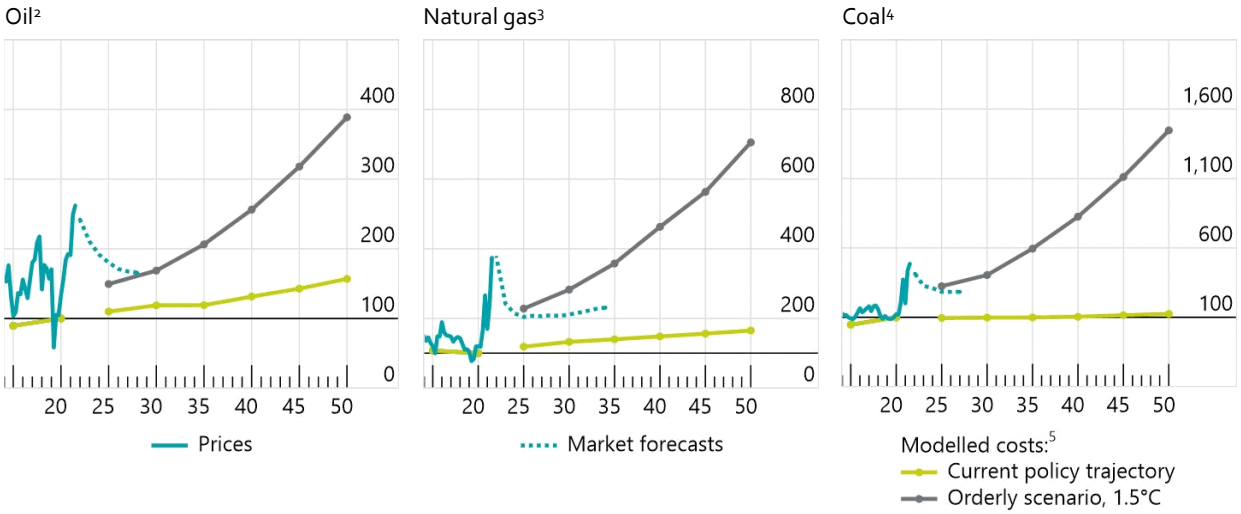
So how could we make this happen?

The more certainty investors have about the commitment of governments to achieving the temperature objectives of the Paris Agreement and about their willingness and capacity to maintain prices for fossil fuels at a high level (relative to low-carbon alternatives) even after the war (e.g., be it via higher carbon pricing or incentives for low-carbon energy), the larger the scale of funding channelled to greener production and consumption.

One obvious way is to take this crisis as an opportunity to tighten regulations (e.g. phase-out of fossil fuel vehicles) in the real economy and/or to accelerate the implementation of carbon pricing systems or to provide subsidies for renewable and other transition technologies to at least compensate the normalisation of fossil fuel prices foreseen by market forecasts in the near term (Graph 1). Of course, this also means giving up the possibility of cheaper fossil fuel energies in the future, which also means missing (partially) on their potential disinflationary impact, if not compensated by lower renewable energy

Price developments and transition scenarios[1]

Real prices, 2020 = 100 Graph 1



[1] For realised prices, quarterly average price; for market futures, latest futures prices. [2] For realised prices, Brent futures. [3] For realised prices, CME natural gas physical futures. [4] For realised prices, Rotterdam coal futures. [5] The modelled costs show the sum of primary energy price and carbon tax projections based on average emission intensities. These are also indexed to 2020 model period, though this represents an average price level over the modelled 5-year period. Indexing the green curves to the same average value would shift the green curves down a bit.

Sources: NGFS scenarios; Bloomberg; BIS calculations.

make sure that time is wisely spent to implement the adjustments needed to stay away from fossil fuels. And the consensus among experts is that an early and orderly transition is less costly than a late and disorderly adjustment. If fossil fuel prices are simply maintained at current level, there is no further inflationary impact, therefore, turning to price stability, central banks are well placed to secure the return of inflation to low and stable levels even without such windfall deflationary effects of future decreases in fossil fuel prices.

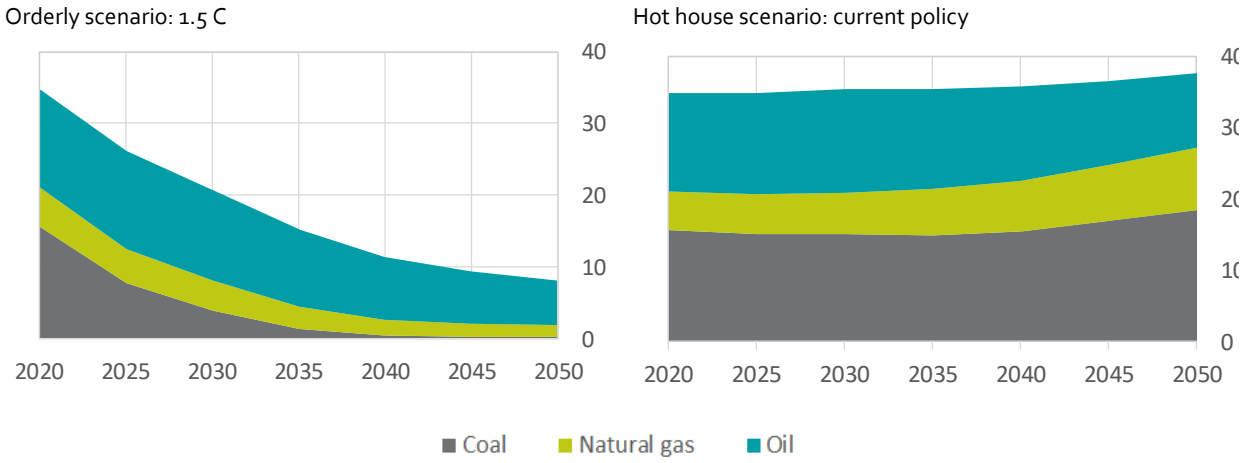
Framing the recent shift in fossil energy prices in a long term perspective

Comparing current fossil energy price developments with price trajectories in NGFS scenarios provides useful insights into the transition opportunity associated with current high prices. As shown in Graph 1, current fossil energy prices for end users[4] are much higher in the NGFS 1.5°C orderly scenario (yellow lines),

[4] The price of fossil fuels for end users adds up the market price and, where it exists, the carbon tax. The contribution of the carbon tax to the price is obviously key because it does not accrue to producers of fossil fuels. Hence, we either refer to the price for end users or the cost of burning fossil fuels.

Fossil energy emissions scenarios

Yearly emissions, in gigatons of CO_2 Graph 2



Source: NGFS scenarios.

namely, to the energy transition necessary to contain the temperature increase by the end of the century below 1.5°C, than in the hot house scenario of current policies (blue lines). The high costs of burning fossil energy are composed of the market prices of fossil energies and of a 'shadow' carbon price, which could be understood as a carbon tax for instance.

The 'shadow' carbon price in NGFS scenarios reflects countries' ambition and policy actions to mitigate climate change in various NGFS scenarios.[5] For instance, the carbon tax amounts to 50% of the price of oil by 2035 and reaches 70% by 2050 in the 1.5°C orderly scenario. The share of the 'shadow' carbon tax on coal in the same scenario is much higher compared to oil and gas, reflecting the higher carbon intensity of this fuel, as well as the need to use this pricing mechanism to reduce consumption of the most carbon-intensive fossil energies. In contrast, the carbon tax hardly increases in the current policy scenario. The effect of internalising the carbon externality through a carbon tax is massive when comparing the two NGFS scenarios on GHG emissions as shown in Graph 2.

Since the start of the war, current fossil energy prices have caught up very quickly with the level of price developments in 2030-2040 needed to achieve the NGFS 1.5°C orderly scenario. For instance, the scale of the oil price increase between 2020 and June 2022 is as large as the increase required by 2040 in the NGFS 1.5°C orderly scenario. In other words, the current price of oil, if sustained, should be discouraging the recourse to oil and other fossil energies by nearly as much as the increase in carbon tax would generate by 2040 in the 1.5°C orderly scenario. However, there are several caveats.

First, there are short-term costs associated with these abrupt shifts in fossil energy prices. When a 10- to 15-year price trajectory is known in advance, as is the case in the NGFS 1.5°C orderly scenario, the adjustment costs of the transition can be spread over time. A sudden price increase as experienced in 2021-22 is much harder. Businesses and consumers cannot adjust their

[5] The 'shadow' carbon price should therefore be seen as a proxy for all kind of climate policies (tax, regulation, subsidies, etc.). That means that in the NGFS Scenarios, governments cannot collect 100% of the 'shadow' carbon prices as if it was a pure carbon tax.

production and consumption overnight nor within a few months. In the short run, demand for energy commodities is inelastic. On the one hand, it is thus reasonable to argue that even an abrupt and immediate transition to net zero, given the current context, would be more costly than the orderly transition described in the NGFS scenarios. On the other hand, this is by far the cheapest and safest possible option. The supply constraint on natural gas and the changes in commodities' relative prices could in fact also lead to an opposite course of action, which is to replace natural gas with coal: based on preliminary studies in power generation, this could more than double GHG emissions.[6] One potential risk here is to see substitution in energy consumption translated into production of more fossil fuel energy. This, in turn, could make the low-carbon transition much less likely to occur, leading to a too-little-too-late scenario characterised by extremely high costs: on the one hand, driven by fossil fuel energy prices in the short-run; on the other hand, driven by a dramatic increase of acute and chronic physical risk in the long-run. This risk is also material, as some European countries have started to think about a return to coal. In the same vein, some emerging market economies, such as China and India, have increased their domestic production of coal following the winter power shortage that they encountered in late 2021.

The current situation is aggravated by the fact that too fast energy price increases in the short term – or fossilflation as coined by Isabel Schnabel,[7] have also impaired people's disposable income and weakened their purchasing power. Households with low income are suffering the most. Targeted government support, for instance temporary subsidies, could thus help the population in need to live through this accelerated transition by changing their consumption behaviour in the longer term. Targeted government investments in the infrastructures needed to transition (trains, low-carbon cities), as well as in research in new technologies, will also increase the chance of an orderly transition.

In the medium to long run, consumption of fossil energy is most likely to fall, were their prices kept high, while the consumption of renewable energy is likely to increase. The years following the oil shocks of the 1970s witnessed major improvement and innovation leading to energy efficiency and in a more balanced energy mix. We saw an increased use of the nuclear energy in particular as a response to oil price surges.

Maximising the odds of an orderly transition

The energy price crisis has already put us on a path towards a delayed and disorderly transition, partly because of the risk of shifting to a too-little-too-late scenario, partly because of too abrupt changes in energy prices and partly because the constraints to increase low-carbon generation capacity in the short term have heightened risks of a return to the use of coal to ensure energy security: this can strongly delay the promised carbon emission reduction, or even put the transition at risk.

What can we do to alter the transition course back and ensure we reach the Paris goals while

[6] According to the U.S. Energy Information Administration, natural gas emits almost 50% less CO2 than coal. Different types of coal produce different amounts of CO2 while burning. More details can be found here: https://group.met.com/en/mind-the-fyouture/mindthefyouture/natural-gas-vs-coal

[7] See https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220317_2~dbb3582f0a.en.html. See also Christine Lagarde (2022): https://www.ecb.europa.eu/press/blog/date/2022/html/ecb.blog220523~1f44a9e916.en.html.

minimising the related economic and social costs?

First, governments need to reaffirm their collective and individual commitment to tackling climate change. They also need to make their transition plans transparent and adapt them to the latest geopolitical developments. Hopefully, this is already happening. The European Commission has proposed a REPowerEU plan that will increase the resilience of the EU-wide energy system. The plan includes diversification of natural gas supplies, increased use of biomethane and renewable hydrogen production and imports, building more solar panels and wind turbines, as well as making buildings more energy efficient. Even more recently, the US Inflation Reduction Act provides an unprecedented support to the scaling up of wind and solar electricity production capacity and of electric vehicules and the development of clean energy technologies.

Relatedly, where possible, governments could think about the ways of making carbon pricing a pivotal instrument for the energy transition, which are the most suitable for their national and regional circumstances. The near doubling of oil prices from $55 per barrel on average in 2017-2021 to $115 in May 2022 is equivalent, for buyers of energy, to an increase of carbon tax of $144.[8] This increase in prices will likely reduce oil consumption in the long run, given the negative price elasticities of oil demand documented by the literature.[9] When the geopolitical situation eases, alleviating pressure on energy supply and lowering market prices of fossil energy, as the energy price forecasts show in Graph 1 (dotted green lines), policy makers should seize this opportunity to lock in this higher price level of fossil fuel for end users. One obvious way would be to scale carbon taxes or other pricing regulations up to discourage fossil energy consumption. Governments could act now to design and implement carbon pricing mechanisms and diverse options are available: scaling-back of energy-related tax cuts and subsidies or introducing a carbon tax or an emission trading system (ETS). Helping vulnerable households, the Government should leave the signal of relative prices to function to the extent reasonably possible – e.g. by providing monetary subsidies to these households. International solidarity and cooperation would also greatly help the implementation of carbon taxes worldwide and minimise collateral damage to competitiveness and growth.[10]

Finally, even with carbon pricing in place to keep fossil-based energy expensive, the transition away from fossil fuels to alternative energies and new technologies cannot happen without a major reallocation of capital to fund more efficient energy use, storage technologies and adapt to a higher share of renewable in the energy mix. In this regard, finance – both public and private – plays a critical role.[11] And this calls for collective and timely actions to scale up green and transition finance and spur the much needed innovation and technological progress without which a green transition is just not

[8] The US Environment Protection Agency considers that an oil barrel emits on average 0.43 tons of CO2. A change in the price of the barrel on the price of carbon is obtained by a factor of 1/0.43. See https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references

[9] Brons et al (2008) estimated the mean long-run price elasticities to be -0.84, with short-run elasticity at -0.34. See Brons, M, P Nijkamp, E Pels and P Rietveld (2008): "A meta-analysis of the price elasticity of gasoline demand. A SUR approach", *Energy Economics*, vol 30(5), pp 2105-2122, September.

[10] See Chateau, J, F Jaumotte and G Schwerhoff (2022): "Economic and Environmental Benefits from International Cooperation on Climate Policies", *IMF Departmental Paper* No 2022/007.

[11] See Prasad P., E. Loukoianova, A. X. Feng and W. Oman (2022): "Mobilizing Private Climate Financing in Emerging Market and Developing Economies", *IMF Staff Climate Note*, July.

possible.[12,13] In this regard, the NGFS has leveraged its members' experiences and has set out some key considerations to enhance market transparency and to develop market incentives to unlock new efficient tools for financing the transition.[14] Finally and as previously mentioned, although an abrupt transition to net zero is the most preferable option to ensure we reach our climate goals, the economic and social costs that this implies could disproportionally impact certain parts of the population: targeted government measures are keen to limit inequalities while also incentivising changes in consumers' preferences.

Conclusion

The current energy price crisis puts the world economy at a crossroad. On the one hand, it may have significantly heightened the risk of a disorderly energy transition, or at least a significant delay thereof and is putting the entire transition at risk, with immense environmental and economic costs. Without readily available green replacements, abrupt price increases and the resulting rapid shutdown of carbon-intensive energy sources put energy security at risk and could cause a 5–10% GDP contraction within five years. Relatedly, the revived demand for coal, in the absence of sufficient natural gas supply, delays the planned reduction in carbon emissions. At the same time, an abrupt and immediate replacement of fossil fuels with renewable sources of energy is not as easy and cheap as a pre-war orderly transition scenario would have implied.

On the other hand, the increase in the market price of fossil fuel is an opportunity to accelerate the energy transition. It means that the return on renewable energy is significantly higher than was the case when the price of oil fluctuated near 60 dollars per barrel. The experience of the 1970s reminds us that abrupt increases in the price of oil led to massive increase in energy efficiency and substitution away from fossil fuels.

Against this background, a comparative reading of the Phase III NGFS scenarios against the latest energy market developments provides important insights into where we are on this transition pathway and what we can do to reverse the course back and ensure we transition to net zero. The key resides on the design of appropriate pricing mechanisms to discourage fossil energy consumption and making low-carbon energy sources more competitive via research and investment in renewable technologies. Accompanying policies to protect the most vulnerable, well-designed communication about the need to internalise social costs of carbon-intensive energy as well as certainty about the carbon pricing path are essential.

[12] See A. Born, M. Giuzio, C. Lambert, D. Salakhova, H. Schölermann, F. Tamburrini (2021): "Towards a green capital markets union: developing sustainable, integrated and resilient European capital markets", *ECB Macroprudential Bulletin* Issue 15, October.

[13] See R. De Haas, A. Popov (2019): "Finance and carbon emissions," *Working Paper Series*, No 2318, ECB, September.

[14] See NFGS (2022): "Enhancing market transparency in green and transition finance", Technical document, April. https://www.ngfs.net/sites/default/files/medias/documents/enhancing_market_transparency_in_green_and_transition_finance.pdf