Finance Watch

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A trillion dollars of climate risk

Banks' fossil fuel exposures and the cost-effective case for a climate systemic risk buffer

A Finance Watch Report

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Executive Summary

Key Recommendation: The EU should introduce a dedicated climate systemic risk buffer, as part of its macroprudential toolkit, to address the systemic dimension of banks' climate-related financial risks.

This report looks at fossil fuel exposures among the 60 largest global banks, updating an earlier estimate with 2023 data and a revised methodology. It considers how the transition risks could be better managed and uses the fossil fuel exposure data to simulate the application of a climate systemic risk buffer, based on a loan-to-value mechanism. It also estimates the size of the implicit subsidy that fossil fuel companies enjoy due to the current underpricing of transition risks. The results show that banks have more than USD 1.1 trillion of exposures to coal, oil and gas extraction and fossil fuel-powered electricity production on their balance sheets, or more than USD 1.6 trillion when off-balance sheet exposures are included. The calculations in this report indicate that a climate systemic risk buffer could be implemented to mitigate the systemic risks of these exposures, with limited impact on bank profits and little to no impact on lending.

Key takeaways:

1. **Systemic risks in the banking system include the rising threat of climate-related losses from transition and physical risks. These risks are currently undermanaged, from a prudential point of view.**

2. **The 60 largest global banks have an estimated USD 1.6 trillion in credit exposures to coal, oil and gas production, and fossil-fuel electricity production, of which more than USD 1.1 trillion are on balance sheets and nearly USD 0.5 trillion are additional commitments recorded off-balance sheet. These assets contribute to the system-wide buildup of climate-related physical risks, while being subject to a high level of transition risk themselves.**

3. **A Climate Systemic Risk Buffer would be an effective tool to increase resilience and slow the buildup of these systemic risks. It could be implemented in the EU to improve financial stability with only a small impact on banks' profits and little to no impact on bank lending capacity.**

4. **As co-benefits, a Climate Systemic Risk Buffer would improve the efficiency of the market for energy finance and could make European banks more attractive to investors.**

5. **This report develops a numerical illustration of the possible implementation and impacts of such a buffer.**

Introduction

In 2015, the "Tragedy of the Horizon" speech warned that climate risks would cause losses outside the typical planning cycles of finance and politics.[1] A decade later, Mark Carney's warning has not translated into meaningful shifts in how finance operates. Disclosure has increased but actual financing patterns remain largely unchanged.

This inertia matters. The financial system is not just a passive observer in the climate transition, it can act as a brake to positive change. Existing risk models, collateral valuation rules, and capital rules embed path dependencies that favour carbon-intensive incumbents. Subsidised funding terms for fossil fuel firms reinforce the status quo, making it harder for low-carbon alternatives to compete.

Meanwhile, climate-related losses – both physical and transition – are rising alarmingly. From floods and storms to heatwaves and wildfires, the economic costs are piling up. Future losses could be far worse.[2] But large-scale losses affecting the financial system and leading to financial instability, from a disorderly transition to climate upheavals, are still preventable with the right tools and policies. In the domain of financial regulation, these include, above all, measures to address systemic financial risks.

This is where macroprudential tools come in. Their twin purposes are to absorb losses when they occur and, crucially, to prevent the buildup of systemic risks in the first place.

The ten-year anniversary of the "Tragedy of the Horizon" speech is a reminder that disclosure is only the first step to managing these risks; further steps are needed.

This report uses a unique dataset to illustrate the impact of a prudential tool – a climate systemic risk buffer – to address some of these risks. The illustration is based on a new estimation of the volume of banks' exposures to fossil fuel activities, using 2023 data and an updated methodology.[3]

Earlier analysis by the European Central Bank (ECB), European Systemic Risk Board (ESRB) and others show that such a measure is desirable, has a strong rationale and can be calibrated.[4] With the numerical illustration in this report, Finance Watch aims to show that it is also feasible to implement with manageable impacts on banks' capital positions.

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1 Bank of England, *Breaking the Tragedy of the Horizon – climate change and financial stability*, September 2015.

2 Actuaries and climate scientists have warned that global income could halve by 2070-2090 unless immediate policy action on climate risks is taken, see IFoA, *Planetary Solvency*, January 2025.

3 For the previous estimate, see Finance Watch, *A safer transition for fossil banking*, October 2022.

4 ECB/ESRB, *The macroprudential challenge of climate change*, July 2022; See also ECB, *Climate transition risk in the banking sector: what can prudential regulation do?, working paper 2910*, 2024; ECB, *Working Paper No 2943, Designing a macroprudential capital buffer for climate-related risks*; and CEP, *Principles for Addressing Climate Systemic Risks With Capital Buffers*, October 2024.

The European Banking Authority (EBA), under its Capital Requirements Regulation Article 501c mandate, is examining the riskiness of loans and investments subject to environmental risks and if a dedicated prudential treatment of such risks is warranted. The delivery of the mandate is due by January 2026. Finance Watch urges the EBA to prioritise a macroprudential response to the threat of climate-related systemic risks, before they start to materialise at scale.

I. Global banks have an estimated USD 1.1 to 1.6 trillion in exposures to the riskiest fossil fuel activities

"Climate risks may pose a systemic threat to financial stability beyond the idiosyncratic risks faced by individual institutions." ECB[5]

Finance Watch estimates that the world's 60 largest banks by total assets together have more than USD 1.1 trillion of on-balance sheet credit exposures to the riskiest fossil fuel activities. This includes coal, oil and gas extraction and fossil-powered electricity production, according to this report's analysis of banks' credit quality and sustainability disclosures.[6] The figure rises to more than USD 1.6 trillion when off-balance sheet exposures, such as undrawn loan commitments and guarantees, are included.

These exposures are of special interest for prudential regulation because they represent transition and physical risks on bank balance sheets and increase the risk in the financial system as a whole. If global carbon emissions are not significantly reduced, climate scientists predict devastating impacts of climate change, which will be irreversible beyond earth system tipping points, and cause large economic and financial losses. Combined with the quantity of fossil fuel exposures, this underlines the need for a macroprudential response to manage and discourage the further buildup of systemic climate-related financial risks.[7]

It is important to note that the estimate does not include other exposures subject to climate-related risks, such as potentially uninsurable real estate, the transport, storage and distribution of fossil fuels, oilfield services, or petrochemicals, which have their own transition pathways. Nor does it include banks' exposures to market risks, for example through oil and gas company securities and derivatives, or commodities trading. The physical and transition risks for these exposures are significant in their own right and raise their own prudential concerns, especially in the event of a disorderly transition or market shock.

When these other risks are considered, the prudential concerns are even larger. They are, however, outside the scope of this report, which focuses only on the riskiest fossil fuel exposures, as described above.

The estimate in this report mainly comprises on-balance sheet loans and advances. Banks also make lending commitments that can remain (partially) undrawn, trade

5 ECB, *Macroprudential Bulletin, Article No. 15*, October 2021.

6 The fossil fuel exposures have been estimated from banks' credit quality and TCFD or other sustainability disclosures, using economic and energy data to isolate relevant sub-sector lending amounts. For further details, please see the methodology section.

7 As a historical note, the fossil fuel exposure amounts are similar to the amount of subprime debt outstanding in 2007, just prior to the global financial crisis, although only a portion of this was held by banks (Exhibit 3.8, *Greenlaw et al 2008*).

derivatives contracts that might result in future exposure and offer guarantees and letters of credit, which are all treated as off-balance sheet exposures. While disclosure methods differ by region, Finance Watch estimates that such off-balance sheet exposures to corporate customers in general average about 80% of on-balance sheet amounts for the EU, more for North American banks and less for banks in Asia Pacific in the sample. Adding the off-balance sheet exposures raises the total corporate credit exposure to fossil fuel activities to more than USD 1.6 trillion.

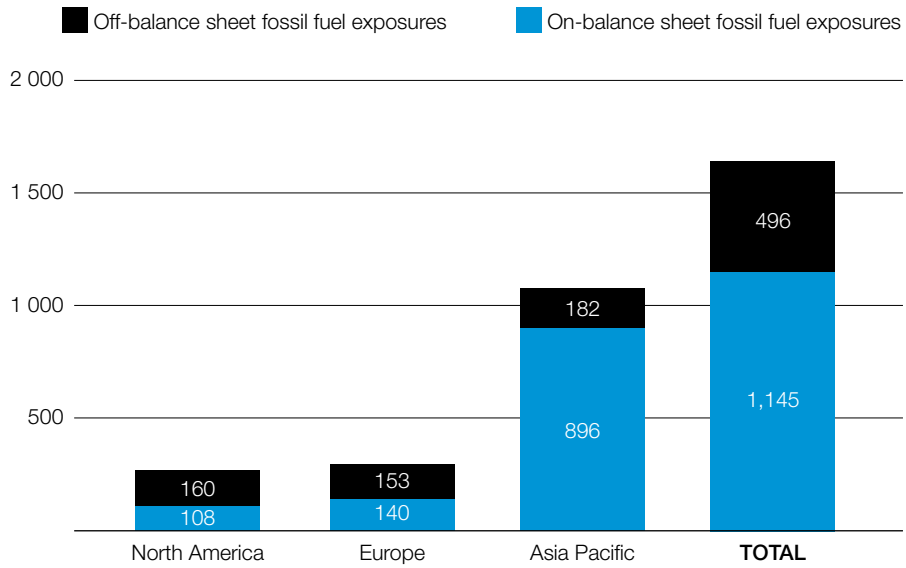
Fossil fuel exposures are largely concentrated among the largest Asian banks: half of all the global fossil fuel exposures in the sample come from just seven banks in China and Japan (Industrial Commercial Bank China, China Construction Bank, Agricultural Bank of China, Bank of China, Mizuho FG, SMBC Group, and Mitsubishi UFJ).

Table 1. Banks' estimated total credit exposures to fossil fuels, 2023, USD billion (bn)

	Number of banks in the sample	On-balance sheet fossil fuel exposures USD bn	Off-balance sheet fossil fuel exposures	Total on- and off-balance sheet fossil fuel exposures	Total fossil fuel exposures as % of total assets
North America	**12**	**108**	**160**	**269**	**1.3%**
Europe	**25**	**140**	**153**	**293**	**0.9%**
- of which, EU	***19***	***109***	***87***	***196***	***0.9%***
- Germany	3	15	19	34	1.3%
- France	6	40	29	69	0.6%
- Italy	2	12	11	23	1.2%
- Spain	3	24	15	39	1.1%
- rest of EU	5	18	13	30	0.9%
- of which, non-EU	***6***	***31***	***67***	***98***	***1.0%***
- UK	5	28	62	91	1.2%
- Switzerland	1	3	4	7	0.4%
Asia Pacific	**23**	**896**	**182**	**1,079**	**2.4%**
TOTAL	***60***	***1,145***	***496***	***1,641***	***1.7%***

Source: Finance Watch estimate, based on bank disclosures

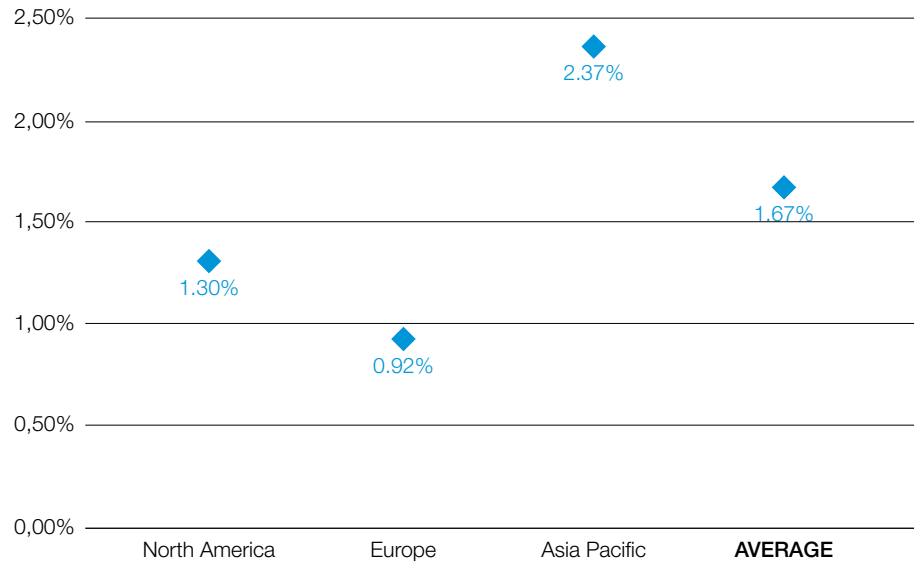
Graph 1. Banks' total exposures to fossil fuels, 2023, USD bn



Source: Finance Watch estimate, based on bank disclosures

Including on-balance sheet and off-balance sheet amounts, the banks' total credit exposures to fossil fuels represent on average 1.7% of their total assets. There are, however, substantial regional disparities, as shown in Graph 2 below.

Graph 2. Banks' combined on- and off-balance sheet exposures to fossil fuels as a percentage of total assets, 2023



Source: Finance Watch estimate, based on bank disclosures

This report's analysis of the *stock* of fossil fuel credit exposures complements data about the *flow* of credit to fossil fuel companies collected annually in the Banking on Climate Chaos (BoCC) report. *Stock* in this case refers to credit exposures on and

off bank balance sheets, to which prudential capital requirements apply. *Flow* refers to the amount of new financing arranged by a bank, regardless of whether the bank retains the exposure or sells or transfers it to other banks or investors. The latest BoCC report counted USD 869.4bn of new financing *flow* to fossil fuel companies in 2024, of which North American and Japanese banks were the largest originators.[8]

When the stock and flow data are viewed together, a picture emerges of Chinese and Japanese banks originating and retaining fossil fuel exposures; of North American banks originating but distributing fossil fuel exposures (i.e. banks acting as arrangers of capital market financing such as corporate bonds or syndicated loans without acting as lenders themselves); and European banks reducing their fossil fuel exposures.

8 RAN, *Banking on Climate Chaos*, 2025.

II. Assessing climate-related risks

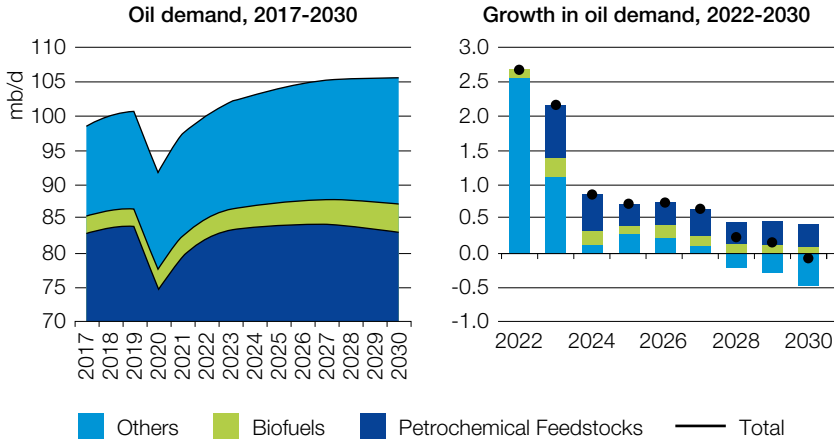
"An insufficiently orderly transition to a green economy may translate into significant losses for the banking sector on exposures related to high-emission firms and to exposures vulnerable to climate hazards." ECB/ESRB[9]

The USD 1.6 trillion of fossil fuel exposures identified in this report are vulnerable to transition risk because they could become stranded. *Stranded* assets refers to investments that lose value unexpectedly because of changes to market prices, technological developments or policy, for example as a result of the transition to clean energy.[10]

A. Peak fossil fuel and the risk of a market crash

Fossil fuel companies are continuing to invest heavily in new supply and infrastructure, especially liquefied natural gas and coal-fired electricity, according to the International Energy Agency.[11] Despite this confidence, the sector is increasingly exposed to stranding risk because of the fast growth of clean energy sources and the electrification of energy end-uses including transport in all regions of the world. Fossil fuels still dominate the energy mix globally but the trend is clear: the International Energy Agency (IEA) expects non-fossil energy to receive twice as much investment as fossil energy this year and for global oil demand to plateau by the end of the decade. The IEA's 2024 Energy Outlook predicted that under its Stated Policies Scenario, the growth of renewables means that the global economy will be able to grow *without* additional amounts of oil, natural gas or coal as early as 2030.

Graph 3. World oil demand forecast to plateau this decade, IEA



Source: IEA, Oil 2025[12]

9 ECB/ESRB, *The macroprudential challenge of climate change*, July 2022.

10 For a fuller definition, please refer to *Carbon Tracker Initiative*, which first introduced the concept.

11 IEA, *World Energy Outlook 2024*, October 2024; IEA *World Energy Investment 2025*; IEA *Oil 2025.*

12 IEA, *Oil 2025*.

If global demand for all fossil fuels reaches a peak in the next few years as the IEA expects, at the same time as supply increases in response to recent capital expenditure, the resulting **supply/demand imbalance** could impact the profitability and cashflows of some fossil fuel companies and reduce their market valuations and creditworthiness.[13]

Other things being equal, banks with exposures to the sector could expect to see more loan losses and collateral impairments, a change that banks ought to be anticipating in their credit assessments and risk models (but most are not).[14]

The **risk of market disorder is also rising**: if transition risks are not priced in by banks in a timely way, they will continue to accumulate and could result in large adjustments if and when the risks materialise, especially where such risks are uncertain. The increasing occurrence of extreme climate-related events is likely to accelerate the materialisation of transition risks affecting fossil fuel assets, potentially in the form of abrupt policy shifts, market shocks and sudden asset repricing. Such risk materialisation can have financial stability implications, as it could lead to fire sales, abrupt deleveraging and a procyclical decline in lending activity.

Yet banks are not taking sufficient action to guard against these risks. Supervisory assessments of UK and European banks concluded that climate risk management frameworks at banks were "still in their infancy", few institutions have allocated capital to material climate-related risks, and only a quarter of banks that use the internal ratings-based (IRB) approach were including climate-related risks in their IRB models.[15]

This deficiency in the management of banks' climate risks and lack of commonly accepted and sound methodologies for estimating these risks are causes for concern.

B. Forward-looking perspective and short-term climate scenarios

It is not possible to manage unprecedented forward-looking climate risks using historical data. However, banks can use **forward-looking climate scenario analysis** as part of their internal risk management process to assess their climate-related vulnerabilities and drivers of risk. Many banks already do this and in the EU it will be a requirement from 2026.[16] The European Banking Authority (EBA) as well as the Bank of England are preparing guidelines on the use of climate scenarios, on which Finance

13 Carbon Tracker, *Energy Monitor*, December 2023.

14 A 2024/2025 international survey of 32 banks found that 82% are not incorporating climate risk factors into their IRB models and concluded that "the incorporation of climate risk into regulatory and economic capital estimates and provisions remains in the initial stages, with observed approaches to incorporate climate into credit risk modelling reliant on expert judgement." UNEP-FI, *Bridging Climate and Credit Risk*, July 2025.

15 Bank of England, *PRA consultation CP10/25 (update to SS3/19)*, April 2025; ECB, *Walking the talk, Results of the 2022 thematic review on climate-related and environmental risks*, November 2022.

16 EBA, *Guidelines on the management of environmental, social and governance (ESG) risks*, January 2025.

Watch published recommendations earlier this year.[17]

In May 2025, the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) published its first set of short-term climate scenarios, which are helping to inform this work.[18] The scenarios cover a five-year horizon from now to 2030, matching the average maturity of banks' non-financial corporation (NFC) exposures. They include a range of economic and financial outputs, such as GDP predictions and probability of default (PD) adjustments for credit exposures by industry sector, variables that are designed to be plugged straight into credit risk and other models.

While modelling limitations in general mean that climate scenarios cannot give a full picture of the losses that climate change will bring (for example, users need to make their own adjustments to capture tail risks and tipping points),[19] the outputs of short-term scenarios show the direction of travel. An increase in PDs is already clearly visible in certain sectors (see Section C below). The scenarios should help to make internal stress tests more credible and comparable across banks and to create benchmark data for the Supervisory Review and Evaluation Process (SREP), against which supervisory add-ons can be assessed, among other uses.

Policymakers are still considering how best to tackle the deficiencies in banks' climate risk management, including data and methodological challenges, and have a variety of micro and macroprudential, Pillar 1 and Pillar 2 measures available to choose from. Whichever route is eventually chosen, it is clear from the short-term scenario outputs that **the prudential treatment of fossil fuel exposures needs to be calibrated well above current levels**, to reflect their higher risk due to the underestimation of the climate-related risk component. The following section illustrates what this might look like, if one considers PDs.

C. Impact of transition risks on probabilities of default

A key task for banks' risk management processes is to estimate future default rates. For the reasons given above, the probability of default (PD) for fossil fuel credit exposures is likely to increase as the energy transition progresses.

In the NGFS's short term scenarios, the *Sudden Wake-Up Call* scenario imagines that an event in the next two years, such as a natural disaster or a surprise election result, causes a sudden tightening of climate policies, including carbon pricing. In this scenario, the NGFS estimates that the 2027 PDs for the gas, oil and coal sectors worldwide would increase by an additional 7.8%, 11.1% and 35% above baseline levels. PDs for fossil-powered electricity generation would increase between 0.2% and 12.7%.

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17 EBA, *The EBA consults on Guidelines on ESG scenario analysis*, January 2025; Bank of England, *PRA Consultation 10/25, Update to SS3/19*, April 2025; Finance Watch, *A safer use of climate scenario analysis by banks*, May 2024; Finance Watch, *Response to PRA consultation on improving banks' and insurers' approaches to managing climate-related financial risks*, August 2025

18 NGFS, *Short-term Climate Scenarios*, May 2025.

19 NGFS, *Explanatory Note*, January 2024; Finance Watch, *Bridging the gaps in climate scenarios*, March 2025.

Table 2. Credit risks if climate policies tighten within two years

Sudden Wake-Up Call (SWUC) scenario	Adjustment to PD in 2027 (worldwide)
Gas (extraction)	+7.8%
Crude oil (extraction)	+11.1%
Coal (mining)	+35%
Gas-fired (electricity)	+3.2%
Oil-fired (electricity)	+0.2%
Coal-fired (electricity)	+12.7%

Source: NGFS short-term scenarios, May 2025

The NGFS's *Disasters and Policy Stagnation* scenario imagines that climate policies remain weak but a series of extreme weather events causes high physical losses. In this scenario, which seems closer to today's reality, the 2027 PDs for European gas, oil and coal exposures would increase by 5.4%, 3.2% and 4% above their baseline. PDs for fossil-powered electricity generation would increase between 4.7% and 11.6%.

Table 3. Credit risks if extreme weather worsens within two years

Disasters and Policy Stagnation (DAPS) scenario	Adjustment to PD in 2027 (EU27)
Gas (extraction)	+5.4%
Crude oil (extraction)	+3.2%
Coal (mining)	+4%
Gas-fired (electricity)	+6%
Oil-fired (electricity)	+4.7%
Coal-fired (electricity)	+11.6%

Source: NGFS short-term scenarios, May 2025

The NGFS's other two short-term scenarios also result in increased PDs for fossil fuel assets, with slightly different timings and magnitudes: *Highway to Paris*, where transition losses are limited by an early implementation of ambitious but gradual climate policies; and *Diverging Realities*, where regional weather events induce supply-chain disruptions, which inflate transition costs.

Other research supports this trend towards increasing PDs. Researchers from the Deutsche Bundesbank found that, under a stress scenario in which carbon prices rose to USD 200 a tonne (a proxy for stringent climate policies that might cause transition risks to materialise faster than expected), the PDs for companies in the mining and quarrying sectors, which includes oil, gas and coal production, would increase more than 2.5 times their initial level, albeit from a low base.[20]

20 Gross, C. et al, Deutsche Bundesbank, *Climate stress test for the German banking sector: Impact of the green transition on corporate loan portfolios*, May 2025.

Due to the limitations of the scenarios, these numbers are only indications of the risk, whereas the actual effects are likely to be considerably more severe over time. In addition, these PDs consider credit risk only and banks would also need to prepare for market losses from any asset repricing in potentially disorderly circumstances.

The precise effect of these PD adjustments on IRB banks' risk management is hard to predict: it would vary between banks and clients, reflecting the idiosyncratic nature of the credit risks and clients and the baseline PDs, as well as other variables, such as exposure at default (EAD) and loss given default (LGD).

However, the general scale of adjustments needed for the NGFS short-term scenarios points to **two conclusions**:

- A more robust capital treatment is needed in the short term as these risks are within current exposure maturities.
- A minimum capital treatment needed to absorb future losses can already be calibrated for supervisory and regulatory purposes.

D. Impact of climate-related physical risks

The physical risks of climate change such as flooding, storms and heatwaves are still not well understood, as the timing and extent of their materialisation are radically uncertain. Loss estimates typically exclude hard-to-model outcomes such as earth system tipping points, migration, nature-related risks, and polycrises. The NGFS's most recent Current Policies scenario (Phase V) includes a new damage function and tripled its previous estimate of the expected economic damages from chronic physical risks from 5% to 15% of global GDP by 2050, warning that the actual effects could be even more severe when the hard-to-model outcomes above are included.

As economies have limited capacity to adapt, the best strategy is to mitigate climate change in the first place, which is a task for climate policy. However, to the extent that climate change threatens the stability of the financial system and the solvency of individual institutions, it is a relevant consideration for prudential policy. Banks' financing of fossil fuels perpetuates economic activities that worsen climate change and feed physical risks; in other words, banks' activities are an endogenous factor contributing to the increasing systemic risk of climate change and all the financial risks that flow from that.

III. Preventing a Financial Crisis

There is a prudential case for discouraging banks from lending to an activity when it is known that those exposures will increase losses on a much larger portion of their other activities – and those of other banks.

Banks had an estimated USD 1.6 trillion of the riskiest fossil fuel exposures as of 31 December 2023. With the world currently on track to cause 3.1°C of warming by 2100,[21] the systemic concerns include feedback loops between the financial system and the real economy, and the possibility of risks spilling over between financial sectors, as climate-related disruptions at scale affect different parts of the financial system.

The interlinkages are becoming more visible, for example as flood risk impacts the availability of insurance and collateral values to protect banks' mortgage lending.[22]

From the macroprudential perspective, regulatory responses so far have tended to focus on system-wide scenario analyses and stress tests.[23] Unfortunately, as mentioned above, modelling limitations mean that the **economic costs of climate change** are currently **underestimated** in climate scenarios, making any conclusions for macroprudential risk management uncertain. Yet, empirical estimations by supervisors and central banks show that an orderly transition is the best scenario for financial stability. Given the limited time remaining to achieve this goal, there is an **urgent need for macroprudential tools** to prepare banks for a world in which orderly transition is not achieved. That includes preparing banks for climate risk-related losses and, as important, preventing the buildup of such risks in the first place.

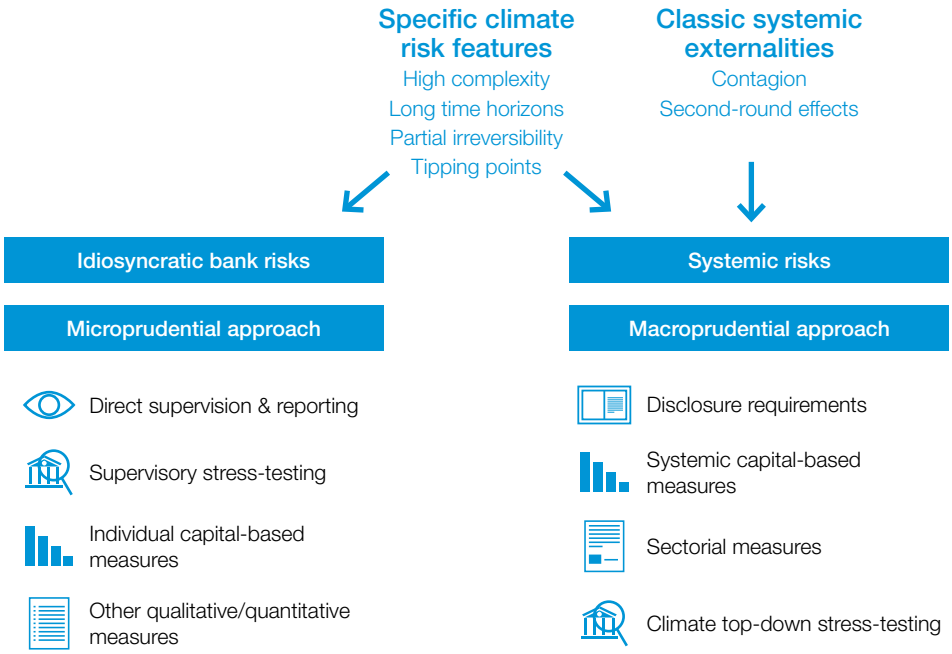
21 UN, *Emissions Gap Report 2024*, October 2024.

22 Fontana, A. et al. ECB Working Paper No. 2025/3036, *From flood to fire: is physical climate risk taken into account in banks' residential mortgage rates?*, 2025.

23 FSB Final report, *Supervisory and Regulatory Approaches to Climate-related Risks*, October 2022.

Graph 4. Macroprudential approach to climate risks

Figure 1: Infographic on a macroprudential approach for climate risks



Notes: This infographic is for illustration purposes and no meant to be comprehensive

Source: ECB, Macroprudential Bulletin[24]

A. Climate systemic risk buffer

One very promising proposal is for a climate systemic risk buffer with two objectives: making banks more resilient to losses, and mitigating the buildup of risks in the first place. Systemic risk buffers are already applied by national supervisors for risks such as overheating real estate markets and offer a great deal of flexibility, since they can be tailored at the level of bank, borrower, asset or country.[25] This makes their deployment in the short-term for climate risks feasible and pragmatic.

The macroprudential logic includes the fact that banks' fossil fuel exposures will contribute to higher systemic risk across the whole banking system – related to disorderly transition and the growing prospect of physical losses from climate change. Macroprudential instruments can discourage this while making banks more resilient to spillovers and cascading effects in the event of risk materialisation.

The Council for Economic Policies (CEP) has argued for a climate systemic risk buffer with two components: a common element to improve systemic loss absorption against transition and physical risks, and an individual element based on banks'

24 ECB, *Macroprudential Bulletin, Article No. 15*, October 2021.

25 For example, see ESRB *for current SyRB rates*.

exposures to climate risks to discourage the buildup of systemic risks.[26] The CEP argues that buffers could be tailored to reduce implementation costs, for example by reflecting the mix of physical and transition risks in each country and by including a reduced buffer requirement for bank customers in transition, in order to incentivise risk mitigation. It should be noted, however, that the CEP proposal addresses a much broader range of transition risk exposures than are discussed in this report, which focuses specifically on the fossil fuel sector.[27] The CEP has not published any specific, numerical proposals but researchers from the ECB have modelled systemic risk buffers along similar lines and demonstrated the potential of macroprudential capital buffers to **mitigate climate-related losses** at the system level.[28]

B. Loan-to-value approach

A specific buffer calibration proposed by Finance Watch in 2023 is to link the buffer to the remaining global carbon budget of the planet through a loan-to-value (LTV) mechanism, based on the idea of "burnable" versus "unburnable" carbon. This would trigger a capital surcharge once a certain threshold of climate-related risk has been reached, based on banks' exposures to fossil fuels that exceed the safe carbon budget. Beyond that, lending for *new* fossil fuel exploration, which poses the highest systemic risk, could be either capped or fully equity-funded.[29]

The basis for the calculation of the buffer threshold would be the ratio of fossil fuels that can be burned without breaching the remaining global carbon budget (for a given level of global warming) to the global fossil fuel reserves. A capital buffer would then be applied on exposures above this threshold. The proposed buffer calibration is to apply a 150% risk weight to the exposure amount above the threshold, which corresponds to the most commonly used conservative risk weight under the Basel Standard.

A recent estimate from the Global Carbon Project puts the global carbon budget to limit global warming to 1.7C at 585 billion tons of CO2.[30] Meanwhile, a 2022 estimate from the Global Registry of Fossil Fuels found that producing and combusting the world's proven fossil fuel reserves would yield around six times that amount, 3.5 trillion tons of greenhouse gas emissions.[31]

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26 CEP, *Principles for Addressing Climate Systemic Risks With Capital Buffers*, October 2024.

27 Given that the Paris-compatible pathway for the fossil fuel sector implies a near phase-out of fossil fuels, the benefits of a reduced buffer for firms in transition would be more relevant for electricity producers than for fossil fuel producing companies.

28 Bartsch, F. et al, ECB Working Paper No 2943, *Designing a macroprudential capital buffer for climate-related risks*, 2024.

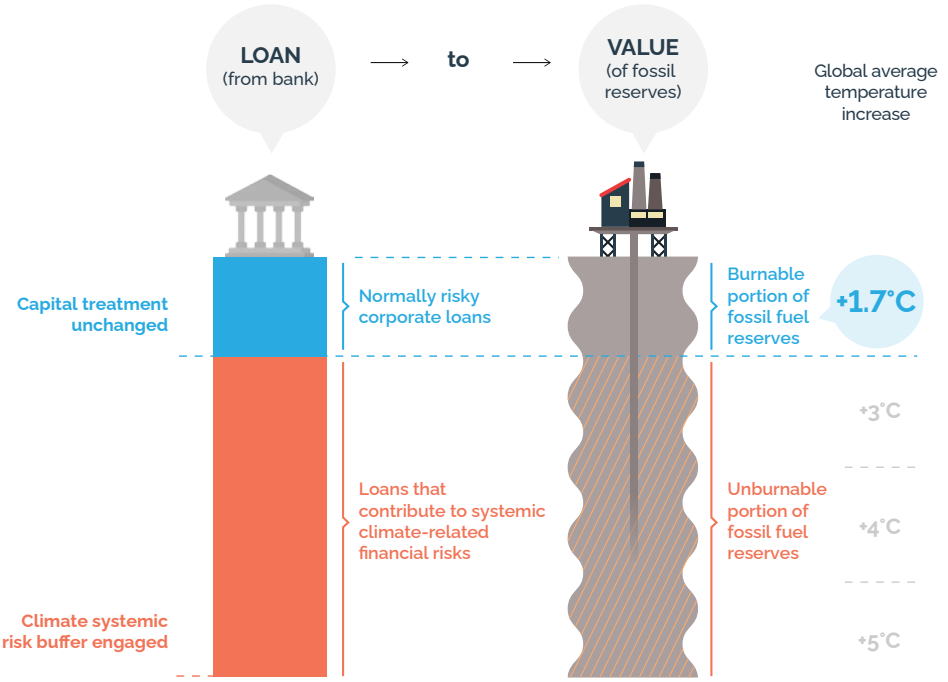
29 Finance Watch, *Finance in a Hot House World*, October 2023.

30 *Global Carbon Project*, January 2025.

31 *Global Registry of Fossil Fuels, Launch Paper*, September 2022.

Using these figures gives a ratio of burnable to unburnable fossil fuel reserves of 1 to 6 for a warming target of 1.7C (assuming that 1.5C is no longer realistic). Under the LTV proposal, 1/6 of each bank's fossil fuel exposure would be subject to the existing capital treatment and the rest of the bank's fossil fuel exposures would be subject to a capital surcharge.

Graph 5. Illustration of loan-to-value macroprudential tool for credit exposures to fossil fuel clients



Source: Finance Watch

IV. The costs and benefits of prudential action

The main benefits of prudential action would be to **make banks more resilient and discourage the buildup of climate-related risks** on bank balance sheets, given the significant threats to financial stability of climate change as outlined above. While prudential policy should not seek to deliver climate policy goals, it serves prudential goals to align prudential regulation with the economic and climate policies needed to facilitate orderly transition. This is because the speed of transition affects the level of financial system risk and, in the other direction, the behaviours of financial institutions influence the speed and path of the transition.

The next section looks at the non-prudential impacts of the proposed buffer on banks and the wider economy.

A. Limited impact on bank lending and profits

Based on the data and calculation presented in this report, the impacts of the proposed climate systemic risk buffer on bank lending and on banks' Return on Equity would be small to negligible. If a climate systemic risk buffer were calibrated as above, so that 1/6 of the fossil fuel reserves behind banks' exposures were considered "burnable" within the remaining global carbon budget and excluded from the buffer, and a 150% risk weight were applied to the "unburnable" amount to reflect its higher transition risk, there would be some impact on banks' capital requirements.

The calculation assumes that the banks in the sample have fossil fuel portfolios with an average credit rating between AA and BBB, and are currently applying risk weights to that portfolio between 10% and 50%.[32] The current level of regulatory capital requirement including all applicable buffers was calculated to be between 10.75% and 17.2%, based on the banks' disclosures and available supervisory information.

For the purposes of calculating capital requirements, off-balance sheet exposures are subject to credit conversion factors (CCFs), depending on the type of commitment or exposure. As disclosure methods for off-balance exposures differ by region and access to individual CCFs is not publicly available, an average CCF of 40% is assumed for off-balance sheet exposures, which represents the CCF applicable to undrawn credit commitments under the Basel Standard.[33] Thus, for the purposes of capital requirements the total exposure amount is determined as follows:

Exposure amount =
*(on-balance sheet exposure) + (off-balance sheet exposure * CCF)*

In dollar terms, the total exposure amount for this calculation would be:

*1.3 trillion = (1.1 trillion) + (0.5 trillion * 40%)*

32 Apart from the US banks, where credit risk weights are floored at 100%.

33 *Basel Framework, CRE20.98*

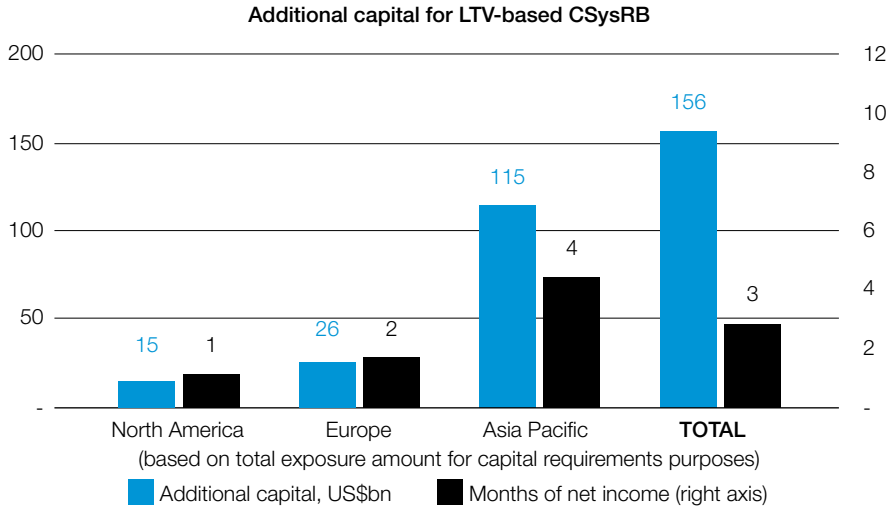
The additional capital that each bank would need to apply the buffer has been calculated, based on the "burnable" portion of its exposure amount, and compared to its existing capital and profits to assess affordability. The results are presented below, aggregated by region.

The banks in the sample together have USD 6.84 trillion of equity capital. A climate risk systemic buffer would mean increasing this by around 2.3%, or between USD 131bn and USD 180bn for the 60 banks together.

In general, banks can choose to meet higher capital requirements by retaining profits or by cutting lending or other assets. Evidence from the implementation of Basel 3 shows that much larger increases in capital were achieved without impacting real economy lending, largely because banks met the target by retaining profits.[34]

The same outcome is very feasible with a climate systemic risk buffer. The combined 2023 net income of the banks in the sample was USD 654bn, meaning that **banks could fund the buffer in full by retaining around 12.4 weeks of profits without having to reduce their lending capacity**. This is an average amount for the full sample; for EU banks it would average 8.5 weeks of profits, or 60 days, and 4.8 weeks for North American banks and 19.3 weeks for Asia Pacific banks.

Graph 6. Affordability of a climate systemic risk buffer, measured in months of 2023 bank profits



Source: Finance Watch calculations

34 BCBS, *Evaluation of the impact and efficacy of the Basel III reforms*, December 2022.

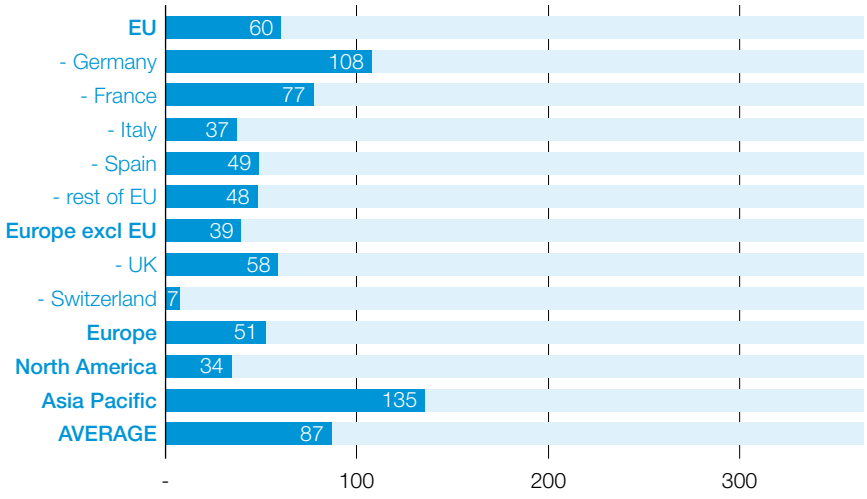
Table 4. Affordability of a climate systemic risk buffer, measured in 2023 bank profits

	Additional capital, USD bn	Maximum months of profit retention	Maximum weeks of profit retention
North America	**15**	**1.1**	**4.8**
Europe	**26**	**1.7**	**7.3**
- of which, EU	***18***	***2.0***	***8.5***
- Germany	3	3.5	15.4
- France	7	2.5	11.0
- Italy	2	1.2	5.3
- Spain	4	1.6	6.9
- rest of EU	3	1.6	6.9
- of which, non-EU	***8***	***1.3***	***5.6***
- UK	7	1.9	8.3
- Switzerland	1	0.2	1.0
Asia Pacific	**115**	**4.4**	**19.3**
TOTAL	*156*	*2.9*	*12.4*

Source: Finance Watch calculations, average of high and low estimates

With a phased implementation, for example allowing the 60 days of profit retention in the EU to be spread over a couple of years, the measures could be absorbed easily without reducing real economy lending.

Graph 7. Days of retained profits needed to cover additional capital



(based on total exposure amount for capital requirements purposes)

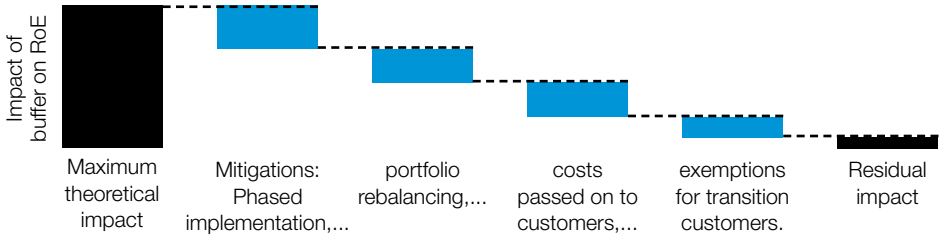
Source: Finance Watch calculations

There is also a question about the effect on banks' return on equity (RoE), a measure of profitability that is widely used by bankers and bank investors and which is mechanically reduced when banks transfer profits to their capital account. The theoretical maximum impact of the buffer is estimated as mechanically reducing RoE from an average of 9.6% to 7.3% during the implementation stage, before returning to around

9.4%. However, this is a "worst case" which assumes that banks choose to implement the changes in a single year and do nothing to adapt their credit pricing and portfolio composition. In reality, several factors would mitigate this.

Based on past experience, it is likely that banks would have several years to implement the changes, allowing the effects to be spread over more than one financial period. Banks could also reduce the impact by recouping costs from their fossil fuel customers through higher spreads and fees, and they could rebalance their energy loan portfolios to reduce the buffer amount, for example gradually redeploying capital away from fossil fuels and towards renewables or transition customers who would be exempted from the buffer. When these factors are considered together, the actual effect on RoE is likely to be smaller than the estimate above.

Graph 8. Factors that can mitigate the effect on RoE (for illustration, not to scale)



Source: Finance Watch

B. Removing a distortion from the energy financing market

As well as the prudential effects, the large global stock of fossil fuel exposures affects how capital is allocated within the energy sector, acting through the cost of capital. As transition risks are being underpriced in banks' risk models, it follows that the cost of credit for fossil fuel companies is also being underpriced, skewing the market for energy investments towards fossil fuels at the cost of economic efficiency. This analysis was confirmed by findings of the recent study of researchers at the University of Witten/ Herdecke, which identified that banks keep lending to high-greenhouse gas- emitting activities as they perceive them as more bankable due to high profits and low risks.[35]

This report estimates the size of the market distortion from risk underpricing by multiplying the amount of additional capital that banks would need to cover the risk of their fossil fuels exposures by the banks' additional cost of capital.

Assuming that the banks in the sample have a cost of debt around 4% and cost of equity of 9.6% (the average 2023 return on equity for the sample), the underpricing of transition risks can be estimated as equivalent to around 5.6% annually of the USD 131-180bn needed to implement a climate systemic risk buffer, or about USD 8.7bn a year.[36]

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35 Aguila, N. et al, *The green banking gap: how bankability, business models, and regulations challenge banks' decarbonisation*, May 2025.

36 The estimates for cost of debt and return on equity are global averages and would differ by region.

While this is small compared to the hundreds of billions (even trillions) of dollars in subsidies that the fossil fuel sector is estimated to receive each year,[37] it is enough to affect the efficiency of the energy financing market. Compared with the total of over USD 1.1 trillion of on-balance sheet bank fossil fuel exposures, **the subsidy is equivalent to artificially lowering the cost of bank credit to fossil fuel companies by 76 basis points**, marginal but enough to affect investment decisions and the allocation of resources.

One beneficial side-effect of prudential measures would therefore be to reduce this market distortion, making the allocation of capital within the world's fast-changing energy market more efficient.

C. Benefits for competitiveness

The recent decline in European banks' exposures to fossil fuel activities is a positive development and may be linked to the EU's changing energy mix as well as banks' own lending policies and transition plans. It could help to make EU banks more investable and competitive: a recent academic study found that banks with more environmentally harmful loan portfolios had lower profitability and lower market valuations.[38]

This echoes the evidence that investors reward better capitalised banks by demanding lower returns on both equity and debt funding.[39]

A **climate systemic risk buffer** would consolidate these benefits by helping investors to consider European banks as **better protected** from climate-related transition risks and **more resilient** to losses from physical risks, as compared to banks from other regions.

Beyond the banking sector, the reduction of cost-of-funding distortions would benefit the EU's growing renewables sector. More widely, ECB researchers have warned that without specific prudential measures, "transition risk can generate excessive risk-taking by banks, which in turn increases the volatility of lending and output".[40] The macroprudential measures discussed in this report should, therefore, benefit the EU's wider economy by **making credit more reliably available**, even as the increasing materialisation of transition and physical risks weighs on bank profitability, with longer-term benefits for the EU's businesses and citizens.

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37 Reuters, *A trillion dollar question - fossil fuel subsidies*, November 2024.

38 Bressan, S. *Does the environmental impact of banks affect their financial performance?* Journal of Banking Regulation, August 2024.

39 BCBS, *Evaluation of the impact and efficacy of the Basel III reforms*, December 2022; IMF, *Working Paper 2019/265, Bank Capital and the Cost of Equity*, December 2019.

40 Grill, M., Popescu, A., Rancoita, E., ECB Working Paper 2910, *Climate transition risk in the banking sector: what can prudential regulation do?* 2024.

Conclusion

For a long time, traditional methods of managing risk have struggled with climate change-related risk, due to insufficient historical data, the forward-looking nature of climate threats and the time horizon mismatch first highlighted by Mark Carney a decade ago.

While there has been meaningful progress in climate-related financial risk disclosure in the last ten years, as well as in risk management, scenario analysis and transition planning, critical gaps remain. Among these are the limitations in current modelling approaches and the significant volume of transition risk embedded in bank balance sheets, which, if left undermanaged, could undermine financial stability.

The aim of prudential policy is to ensure that the financial system can cope with the risks that banks take. Banks should remain free to lend and invest in any sectors of the economy, as long as the internal and systemic risks they create are adequately capitalised - which is not the case today.

As this report reveals, global banks hold approximately USD 1.6 trillion of exposures to the fossil fuel assets most vulnerable to transition risk, and which most contribute to physical climate risks more widely in the financial system. This scale of exposure, combined with the unpredictable nature of climate-related financial risks, call for a proactive macroprudential response, especially when banks' other contributions to climate-related systemic financial risks are considered, such as arranging financing via the capital markets. The European Systemic Risk Board (ESRB) has already acknowledged the need for prudential measures that go beyond disclosure and the integration of sustainability into banks' risk management, in order "to fully address the unique features [of climate-related financial risks] and their systemic implications".[41]

The European Banking Authority (EBA), under its Capital Requirements Regulation Article 501c mandate, is exploring the effective riskiness of exposures related to assets and activities subject to the impact of environmental factors, and if an adjusted dedicated prudential treatment for such assets is warranted.

Such a treatment is warranted. This report has estimated the effects of a climate systemic risk buffer using a loan-to-value mechanism that is calibrated to the proportion of proven fossil fuel reserves that remain burnable without pushing global temperatures above 1.7C. If such a buffer were applied to on-balance-sheet fossil fuel exposures, the 60 large global banks included in this report would need additional capital in the order of USD 131-180bn. This represents around 2.3% of their current equity, or 0.13% to 0.18% of total assets. EU banks could fund that by retaining the equivalent of around 8.5 weeks, or 60 days, of 2023 net income. For banks in North America, it would be 4.8 weeks and for banks in Japan and China it would be 19.3 weeks.

41 ECB/ESRB, *The macroprudential challenge of climate change*, July 2022.

Based on the review of academic literature on the subject and the analysis of the quantitative implications of possible prudential action, we conclude that a climate systemic risk buffer represents a very effective solution to the challenges under EBA's review.

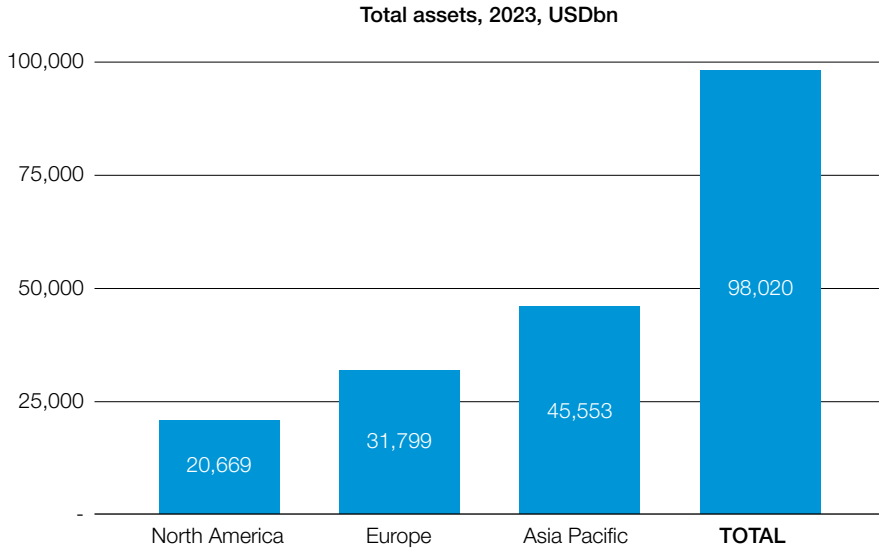
The findings suggest that such a buffer could be implemented in the EU with limited impact on bank profitability and no significant effect on lending capacity. In fact, it could enhance the financial sector's role in supporting the EU's energy transition and bolster the investment case for European banks.

Of course, careful design would be essential. A well-calibrated buffer must achieve its prudential objectives without unintended consequences. This assessment shows that a carefully designed buffer could be calibrated now and would be feasible and advantageous to implement.

As proposed by the Council of Economic Policies (CEP), a further common buffer component might be needed to strengthen banks' overall resilience against physical climate risks, which is beyond the scope of this report.

Annex A: Bank financial data

Banks' financial metrics, 2023



	Total assets (TA) USD bn	Capital USD bn	Net income USD bn	Leverage (capital / TA) %	RoE (net income / capital) %
North America	**20,669**	**1,616**	**159**	**7.8%**	**9.81%**
Europe	**31,799**	**1,742**	**185**	**5.5%**	**10.65%**
- of which, EU	***22,335***	***1,214***	***111***	***5.4%***	***9.17%***
- Germany	2,733	153	10	5.6%	6.53%
- France	10,781	503	31	4.7%	6.19%
- Italy	1,931	142	19	7.3%	13.46%
- Spain	3,512	216	26	6.2%	12.21%
- rest of EU	3,377	200	25	5.9%	12.37%
- of which, non-EU	***9,464***	***528***	***74***	***5.6%***	***14.03%***
- UK	7,747	441	46	5.7%	10.48%
- Switzerland	1,717	87	28	5.0%	32.14%
Asia Pacific	**45,553**	**3,480**	**310**	**7.6%**	**8.91%**
TOTAL	***98,020***	***6,838***	***654***	***7.0%***	***9.56%***

Source: Bank disclosures

Annex B: Methodology note

1. Sample and coverage of global banking assets

We focused on the world's 60 largest banks by assets, replacing three banks that had insufficient sectoral disclosures. The combined assets of the 60 banks included in our sample, converted to USD at the end of 2023, amounted to USD 98,020bn. The Financial Stability Board reports the consolidated banking assets of thirty countries at USD 188,660bn,[42] as of 31 December 2023. Our sample represents 52% of this amount and includes most banks of global significance/systemic relevance.

North America

JPMorgan Chase
Bank of America ML
Citigroup
Wells Fargo
Royal Bank of Canada
ScotiaBank
Toronto Dominion Bank Financial Group
Morgan Stanley
Goldman Sachs
Bank of Montreal - BMO
Canadian Imperial Bank of Commerce
US Bancorp

European Union

BNP Paribas
Credit Agricole
Santander
Société Générale
BPCE / Natixis
Crédit Mutuel
Deutsche Bank
ING
UniCredit
BBVA
Intesa Sanpaolo
Commerzbank AG
Rabobank
Nordea Bank
Danske Bank
CaixaBank
DZ Bank
La Banque Postale
ABN AMRO

Rest of Europe (excluding EU)

HSBC
Barclays
UBS
Lloyds Banking Group
NatWest Bank
Standard Chartered Bank

Asia & Oceania

ICBC
China Construction Bank
ABC Agricultural Bank of China
Bank of China
Mitsubishi UFJ
Sumitomo Mitsui BC
Mizuho FG
Industrial Bank
China CITIC Bank
Shanghai Pudong Development Bank
China Merchants Bank
China Everbright Bank
China Ping An Group
Bank of Communications
China Minsheng Bank
State Bank of India
Australia & New-Zealand Banking Group
KB Kookmin Bank Financial
Postal Savings Bank of China
Commonwealth Bank
National Australia Bank
Sumitomo Mitsui Trust Holdings
DBS

Our full dataset, including bank-by-bank data, is available on request.

42 FSB, *Global Monitoring Report on Non-Bank Financial Intermediation*, December 2024.

2. Definitions and sources

Total assets, total equity, and **net income** figures are sourced from each bank's audited consolidated financial statements as of 31 December 2023. Values are reported in billions of local currency and converted to billions of U.S. dollars using exchange rates effective on 31 December 2023. 'Total equity' refers to shareholders' equity.

Fossil fuel assets or fossil assets refers to banks' estimated banking book exposures related to the exploration, extraction, and support services for the extraction of fossil fuels (coal, gas and oil), and the production of electricity from fossil fuels. It does not include transportation, distribution, or storage of fossil fuels. These exposure amounts are taken mostly from banks' credit quality disclosures (sometimes called CQ5 tables) and in some cases from the Task Force on Climate Related Financial Disclosures (TCFD) or sustainability reports. For consistency across regions, we have also used this approach for the 19 EU banks in our sample, with Distribution Keys for European banks based on aggregated EU Pillar 3 ESG data.

3. Estimating fossil fuel exposure amounts

The fossil fuel exposure amounts cited are our estimates, based on the data publicly available and cautious assumptions. We have collected data for the gross carrying amounts or wholesale credit exposures to relevant non-financial corporate sectors, using disclosures in annual reports, supplementary disclosures, TCFD, sustainability or non-financial reports. Exposure amounts collected include on-balance sheet credit exposures, such as drawn loans and project financing, and also off-balance credit exposures, such as undrawn credit lines, irrevocable guarantees, and letters of credit.

Where off-balance sheet exposures are not disclosed by industry, we have used the ratio of a bank's off-balance sheet to on-balance sheet corporate credit exposures and commitments, taken from CR1 or equivalent tables, to uplift the on-balance sheet industry amounts. For the purpose of calculating additional capital, we have applied a credit conversion factor (CCF) to the off-balance sheet portion of banks' exposures, in line with Basel principles. For simplicity, we have applied a single CCF rate of 40% to all off-balance sheet amounts, which is the standard rate for undrawn lending commitments. The regional totals including the CCF adjustment are as follows:

	On-balance sheet fossil fuel exposures USD bn	Off-balance sheet fossil fuel exposures	Total on- and off-balance sheet fossil fuel exposures	Off-balance sheet fossil fuel exposures x 40% CCF	Total fossil fuel exposure amount for capital requirements purposes
North America	**108**	**160**	**269**	**64**	**172**
Europe	**140**	**153**	**293**	**61**	**201**
- of which, EU	***109***	***87***	***196***	***35***	***144***
- Germany	15	19	34	8	23
- France	40	29	69	12	52
- Italy	12	11	23	4	16
- Spain	24	15	39	6	30
- rest of EU	18	13	30	5	23
- of which, non-EU	***31***	***67***	***98***	***27***	***58***
- UK	28	62	91	25	53
- Switzerland	3	4	7	2	5
Asia Pacific	**896**	**182**	**1,079**	**73**	**969**
TOTAL	***1,145***	***496***	***1,641***	***198***	***1,343***

Source: Finance Watch, estimated from bank disclosures.

Banks' wholesale credit exposures to non-financial corporations are usually disclosed under high-level (aggregated) industry headings, although the specific headings vary across regions and even within countries (for example in the US, where disclosure standards in this area are not harmonised).

To estimate the fossil fuel elements within each industry heading, we have used official economic data, such as value added or business revenue for the relevant sub-sectors in the respective country or region as a proxy to estimate the fossil fuel elements. The resulting percentages of fossil vs non-fossil parts of industry exposures are expressed in the form of **distribution keys** that are applied to banks' disclosure amounts to obtain the fossil share.

For example, where a Chinese bank discloses an amount under the heading "Mining", we have applied a distribution key of 78.83% to separate its coal, oil and gas exposures from its metals and other mining, based on the national split of business revenue between mining sub-sectors in China. Or where a US bank discloses an amount under the heading "Utilities", we have applied a distribution key of 35.84% to isolate the fossil powered electricity generation element from other utilities, from electricity transmission and distribution, and from non-fossil powered electricity generation in the US.

The data for calculating distribution keys are based on sub-sectors defined in local industry classification systems (NACE for Europe, NAICS for North America, GB/T 4754-2017 for China, and JSIC for Japan), which are then weighted with local economic data (from the Bureau of Economic Analysis (USA), Statistics Canada, China

Statistical Yearbook 2023, Japan Statistical Yearbook 2023, EU bank Pillar 3 disclosures); as well as country-level IEA data on fossil share of electricity and fossil share of energy where relevant. Regional data is used in all cases, apart from the split between electricity generation and electricity distribution and transmission, where only EU data is available and has been used as a proxy in all regions. The approach assumes that banks' exposures reflect local economic data.

The distribution keys used in this report are as follows:

Region	Industry sector	Fossil fuel share
Europe	Mining and Quarrying	60.41%
	Electricity, Steam, Gas, and Air Conditioning Supply	26.05%
	Europe Power Utilities	29.67%
NorthAm	Mining US (incl. Oil & Gas)	77.81%
	Mining US (excl. Oil & Gas)	55.86%
	Mining Canada (incl. Oil & Gas)	75.51%
	Mining Canada (excl. Oil & Gas)	12.86%
	Utilities US	35.84%
	USA power generation	44.52%
	Utilities Canada	11.20%
	Energy US	81.65%
	Energy Canada	76.17%
	Natural Resources & Utilities US	42.42%
Asia	Mining China	78.83%
	Mining, and quarrying of stone and gravel - Japan	25.93%
	Utilities ("Production and supply of electricity, heating, gas and water"), China	39.92%
	Electricity - coal and gas powered - Japan	74.93%
	Power Japan	47.92%
	Energy (Utilities excl. water) China (Ping An)	41.56%
	Other (incl. mining) China (Everbright Bank)	12.62%

For reasons of space we have not included the calculation of each Distribution Key here but these are available on request.

4. Rating composition of credit portfolio – risk weights

Approximation of IRB ratings. Given that the banks in our sample are mostly large internationally active banks, we have assumed that all of them use the IRB approach. We have approximated the risk weights determined under the IRB approach as being 50% of the risk weights applicable under the Standardised Approach for all banks except the US ones (explanation included below). This is to take account of the Basel output floor, which sets the lower bound for risk weighting of exposures assessed using internal models at 50% of the Standardised Approach amount, which is the

starting rate applicable in the phase-in period for the final Basel 3 output floor.[43]

While we do not know the reality of banks' IRB ratings, we consider a 50% output floor to be a minimum estimate. Taking the example of the EU banks, in its Basel 3 monitoring exercise per 31 December 2023, the European Banking Authority (EBA) estimated that in the first years of the output floor implementation, there would be no capital requirement increase for large and internationally active (Group 1) EU banks until the output floor reaches 65% in 2028.[44] While we do not know how this applies specifically to fossil fuel exposures, this suggests that average IRB risk weights for EU banks are already above 50% of the Standardised Approach risk weights.

Estimation of rating composition of credit portfolios. It is difficult to estimate the current credit ratings of banks' fossil fuels exposures as banks do not normally disclose this detail. Therefore, we have performed a range estimation and calculated two hypotheses, "high" and "low". In the high hypothesis, we have assumed that the average credit rating of the fossil fuel assets in a bank's portfolio is AA, which results in an assumed current risk weighting under the Standardised Approach for these assets of 20%,[45] to which is applied an output floor of 50% to give an assumed IRB risk weight of 10%. In the low hypothesis, we assume that the assets are of lower quality with an average credit rating of BBB, which results in a risk weighting of 100%, or 50% after applying the output floor. Overall, this gives an assumed range of 10% to 50% for the current IRB risk ratings of fossil fuel-related exposures.

In reality, some banks will apply higher risk weights, including for exposures rated below BBB. These exposures would need less additional capital than we have estimated (for example assets rated below BB would already have a risk weight of 150% under the standardised approach), which makes this a conservative assumption for the purposes of our estimate.

Treatment of US banks. The determination of the ratings for US banks follows a different approach as US regulations do not allow for the usage of external credit ratings for the purposes of calculating capital requirements, therefore, at the time of our research, all corporate exposures are subject to a risk weight of 100% under the standardised approach.[46] Further, since the adoption of the Collins amendment to the Dodd-Frank Act in 2010, the US regulations stipulate that the minimum risk-based capital requirements shall not be less than the "generally applicable" capital requirements determined under the standardised approach, i.e. apply an effective output

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43 The final Basel 3 output floor was to be implemented in 5% annual increments, starting at 50% in 2022 and reaching 72.5% by 2027 (BCBS, *Basel 3: Finalising post-crisis reforms*, December 2017), although this has been delayed in some jurisdictions, for example by three years in the EU (CRR Art. 465).

44 EBA, *Basel III Monitoring exercise based on data as of 31 December 2023*.

45 BCBS, *CRE20 - Standardised Approach: individual exposures*, 20.17, 2019; implemented in the EU via the Regulation (EU) No 575/2013 (Capital Requirements Regulation), Article 122.

46 *US Electronic Code of Federal Regulations (e-CFR), Title 12, Chapter ,I Part 3, Subpart D (f)(1)*.

floor.[47] However, the output floor does not cover operational risk and credit value adjustment risk and, once corrected for the methodological differences, it converts into an effective floor of approximately 75%, according to estimates.[48] It is therefore this figure that we have taken for the current IRB risk weights of existing fossil fuel-related exposures under both the high and low hypotheses for US banks.

Risk exposures beyond credit risk. As the proposal in this report concerns credit risk, we have not accounted for operational risk, market risk or credit value adjustment (CVA) risk and assume that the amounts for these other risk types remain unchanged.

Total RWA and output floor. The output floor applies to the total risk-weighted assets, which includes credit, counterparty credit, CVA, securitisation, market and operational risk RWA (for the specific US output floor application see above). We did not account for the fact that the output floor might affect different risk types and also risk weights at asset level vs aggregated level. While this is a simplifying assumption, we do not expect that it would have a significant impact on our estimation, given that credit risk is the largest component of banks' risk weighted assets.[49]

Specialised lending. We cautiously assume that no assets have been risk weighted under the IRB approach for specialised lending (the supervisory slotting approach) and only risk weights for exposures to corporates are applied. To the extent that the use of the supervisory slotting approach usually leads to higher risk weights, for example for specialised lending such as project finance, this assumption would tend to overestimate the additional capital and can be considered cautious.

5. Capital requirements

Basel 3 sets a minimum capital ratio of 10.5% of risk weighted assets, comprising 8% **minimum regulatory capital requirement** and 2.5% **Capital Conservation Buffer (CCB)**.[50] However, the CCB is not used significantly in the United States (at least not for the banks in our sample). Instead, the US banks have **Stress Capital Buffer (SCB) requirements**.[51]

Systemic risk buffers are required for systemically important banks. A distinction is made between, on the one hand, **G-SIBs – Global Systemically Important Bank** (banks which, due to their size, interconnection and complexity, are considered to have a significant impact on the global financial system) and on the other hand,

47 See Office of the Comptroller of the Currency, Treasury; Board of Governors of the Federal Reserve System; and the Federal Deposit Insurance Corporation, "Risk-Based Capital Standards: Advanced Capital Adequacy Framework – Basel II; Establishment of a Risk-Based Capital Floor," *76 Federal Register 37620-37629*, June 2011

48 BNP Paribas economic research department note dated 6 December 2017, "Output floor": On the eve of a (bad) agreement?"; the estimate was further verified for plausibility using banks' balance sheet data.

49 For example, according to the EBA, as of June 2024, credit risk RWA accounted for 84% of the total RWA of the EU banks; see EBA, *Capital and risk-weighted assets*.

50 Basel Framework, *RCB 20.1* and *RCB30.2*

51 Federal Reserve, *Large Bank Capital Requirements*, page 4, August 2024.

D-SIBs - Domestic Systemically Important Banks and O-SIIs – Other Systemically Important Institutions (those which, although not necessarily significant on a world scale, play a crucial role in their national or regional – mostly European – financial system). In case an institution is designated both as a G-SIB and a D-SIB in its jurisdiction, only the highest requirement applies.

The list of **G-SIBs** and applicable G-SIB buffer requirements is determined each year by the Financial Stability Board[52] in consultation with the Basel Committee and the national authorities. Of the 29 banks on this list, 27 are included in our study.[53] However, the Federal Reserve applies higher capital requirements to these banks than those required by the Financial Stability Board.[54]

In addition, Groupe Crédit Agricole's G-SIB buffer will increase from 1% of total risk weighted assets to 1.5% in January 2026. Given that we simulate a future capital increase, we have chosen to apply this rate of 1.5%.[55]

The list of **D-SIBs** and **O-SIIs** is determined by each country's national regulator for systemically important banks at the national and regional level. We determined the size of these buffers as follows:

- Using information from the national authorities websites for the EU,[56] United Kingdom,[57] China,[58] India[59] and South Korea,[60] which set the buffer rates for each designated bank individually.
- The Canadian regulator has set the Domestic Stability Buffer level at 3.5%.[61] It also indicates that a 1% surcharge must be applied,[62] which is confirmed by the analysis of the total capital requirements in the annual reports of the five Canadian banks in our sample.
- For banks designated as D-SIBs,[63] the Australian Prudential Regulation Authority (APRA) has set a capital ratio of 3.5%. However, it specifies that this ratio will be

52 FSB, *2024 List of Global Systemically Important Banks (G-SIBs)*, November 2024.

53 We have excluded the custodian banks Bank of New York Mellon and State Street Corporation.

54 Federal Reserve, *Large Bank Capital Requirements*, page 4, August 2024.

55 ACPR, *Liste des Autres établissements d'importance systémique (A-EIS)*, 2024.

56 ESRB, *Systemically important institutions, overview of national capital-based measures*, March 2025.

57 Bank of England, *PRA, 2024 list of UK firms designated as other systemically important institutions (O-SIIs)*, November 2024.

58 Chinese SIBs, which have to meet certain requirements on capital surcharge, are classified into five buckets, from 1 to 5 which are subject to a capital surcharge of 0.25%, 0.5%, 0.75%, 1%, and 1.5% respectively, see *PBC, Order No. 5 2021* Art. 4 and *PBOC and NAFR List of China's Systemically Important Banks, 2023*, which assigns 20 Chinese D-SIBs into these groups.

59 Reserve Bank of India, *2024 list of Domestic Systemically Important Banks (D-SIBs)*, November 2024.

60 FSC, *FSC Identifies D-SIBs and D-SIFIs for 2024*, July 2023.

61 OSFI, *OSFI maintains Domestic Stability Buffer at 3.5%*, December 2024.

62 OSFI, *Overview of risk-based capital requirements*, page 17, January 2024.

63 APRA, *Domestic systemically important banks in Australia*.

increased to 4.5%[64] from the beginning of 2026. As we are trying to anticipate a future increase in capital requirements, we have chosen to apply this latter rate.

- For Japan and Singapore, where no information regarding D-SIB buffer is available from the regulators, we have used the buffer requirements reported in each bank's financial statements.
- The United States does not have designated D-SIBs, only G-SIBs.

The aim of the **Countercyclical Capital Buffer (CCyB)**, which could be called a dynamic buffer, is to prevent systemic risks associated with credit expansion during economic cycles. The CCyB is adjusted depending on the macroeconomic environment / economic cycles. Our research of the rates applicable to the banks in our study is mainly based on information from the European Systemic Risk Board (ESRB),[65] the Basel Committee on Banking Supervision (BCBS)[66] and banks' annual reports.

We have not taken into account the **Systemic Risk Buffer (SyRB)**, which is a tool designed to prevent or mitigate systemic risks not covered by other buffers. In most of the jurisdictions, SyRB is applied to sectoral exposures only, such as real estate or, in fewer cases, certain types of corporate exposure, and in most cases it is not possible to know if fossil fuels exposures would be covered.[67] In the EU, only Finland applies a general SyRB, i.e. applicable to all banks' exposures, at the level of 1%, which we have taken into account for Nordea.

Total capital requirement. Taking the minimum regulatory capital requirement and all the buffers together, the total required capital ratios for the 60 banks in our sample are between 10.75% and 17.2% of risk weighted assets, with an average of 13.03% and a median of 12.5%.

6. Calculation of the required capital increase under the "climate LTV buffer" proposal

As seen above, the loan-to-value proposal would affect only the "unburnable" portion of banks' fossil fuel exposures, estimated at 83.3% (5/6ths), based on the ratio of global fossil fuel reserves to the remaining global carbon budget to limit heating to 1.7C. We have calculated the additional capital needed to apply a 150% risk weight on this portion of banks' fossil fuel exposures by working out the difference between banks' assumed current risk weightings and the proposed risk weighting, and multiplying this difference by the total capital requirement and the estimated stock of "unburnable" fossil fuel assets.

64 APRA, *Finalising loss-absorbing capacity requirements for domestic systemically important banks*, December 2021.

65 ESRB, *Current and pending CCyB rates* and ESRB, *Systemically important institutions, overview of national capital-based measures*, March 2025.

66 BCBS, *CCyB Dashboard*, July 2025.

67 ESRB, *Combined buffer requirements*, March 2025 (downloadable table).

For example, Industrial and Commercial Bank of China (ICBC), which has the highest fossil fuel exposure amount for capital requirements purposes in our survey at USD 128.9 bn, has an "unburnable" amount of USD 128.9 x 83.3% = USD 107.3bn. The bank has a total capital requirement including buffers of 12% of risk-weighted assets. In the high scenario, where we cautiously assume that its fossil fuel assets have an average credit rating of AA, applying a 150% risk weight compared with an assumed IRB risk weight of 10% would result in an additional capital need of USD 18 bn:

*107.3 * (150% - 10%) * 12% = 18*

This is equivalent to just over four months of the bank's 2023 net income.

In the low scenario, where we assume that ICBC's fossil fuel assets have an average credit rating of BBB, applying a 150% risk weight compared with an assumed IRB risk weight of 50% would result in an additional capital need of USD 12.9 bn:

*107.3 * (150% - 50%) * 12% = 12.9*

This is equivalent to three months of the bank's 2023 net income.

For comparison purposes, the amounts of additional capital are calculated alongside each bank's total assets, total equity, net income in the previous year, and the number of months it would take each bank to cover the additional capital from its net income should it decide to fund the additional capital from retained earnings. For ease of presentation, we have then aggregated these results by region, using an average of the estimates from the high and low scenarios.

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