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From Stranded Assets to Assets-at-Risk:

Reframing the narrative for European private financial institutions

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CONTENTS

EXECUTIVE SUMMARY

Private financial institutions must rethink their approach to managing stranded asset risks. The current narrative on quantifying fossil fuel sector exposures within a limited scope of financial portfolios (mostly loans) largely underestimates potential stranding losses. As the low-carbon transition impacts all economic sectors, private financial institutions (FIs) must consider material transition-driven stranding risks within their overall transition risk management framework using a 'whole of economy' lens. Traditional risk management approaches are ill-suited to the methodological and quantification challenges of transition-driven stranding risks, so a flexible, dynamic, forward-looking approach is necessary. Strong, incentivising public policy coordinated with financial regulatory and supervisory impetus is necessary to preemptively identify, monitor and manage stranding losses on 'assets-at-risk' (*i.e.*, potential stranded assets). The European Central Bank (ECB) finds that 40% of the total loan portfolio of euro area banks is exposed to energy-intensive sectors[1], making them vulnerable to transition risks, including stranding. It is time for an urgent reframing of the stranded asset narrative to avoid significant financial losses (endangering financial stability) and direct orderly transition finance flows to retire or transform assets-at-risk before they become fully stranded.

1 Shifting from the narrow and static 'Stranded Assets' to the wide and dynamic 'Assets-at-Risk'

Private FIs must shift their perspective from quantifying exposure to stranded assets in the fossil fuel industry toward anticipating future stranding losses through a 'whole of economy' lens. Stranding risk like any other transition risk is contingent on the evolution of the transition pathway, which remains highly uncertain. **Financial players must take a proactive, dynamic approach to managing potential stranding losses on assets-at-risk, encompassing both direct (loans, bonds, equity) and indirect financial exposures (sovereign exposures, interbank loans, bank and non-bank interlinkages)**. Assessing stranding risks within a comprehensive transition risk framework is crucial, as it allows for better anticipation of future financial losses by **assessing a counterparty's ability to withstand stranding losses** on assets-at-risk.

2 However private FIs face several obstacles in monitoring and managing stranding risks proactively

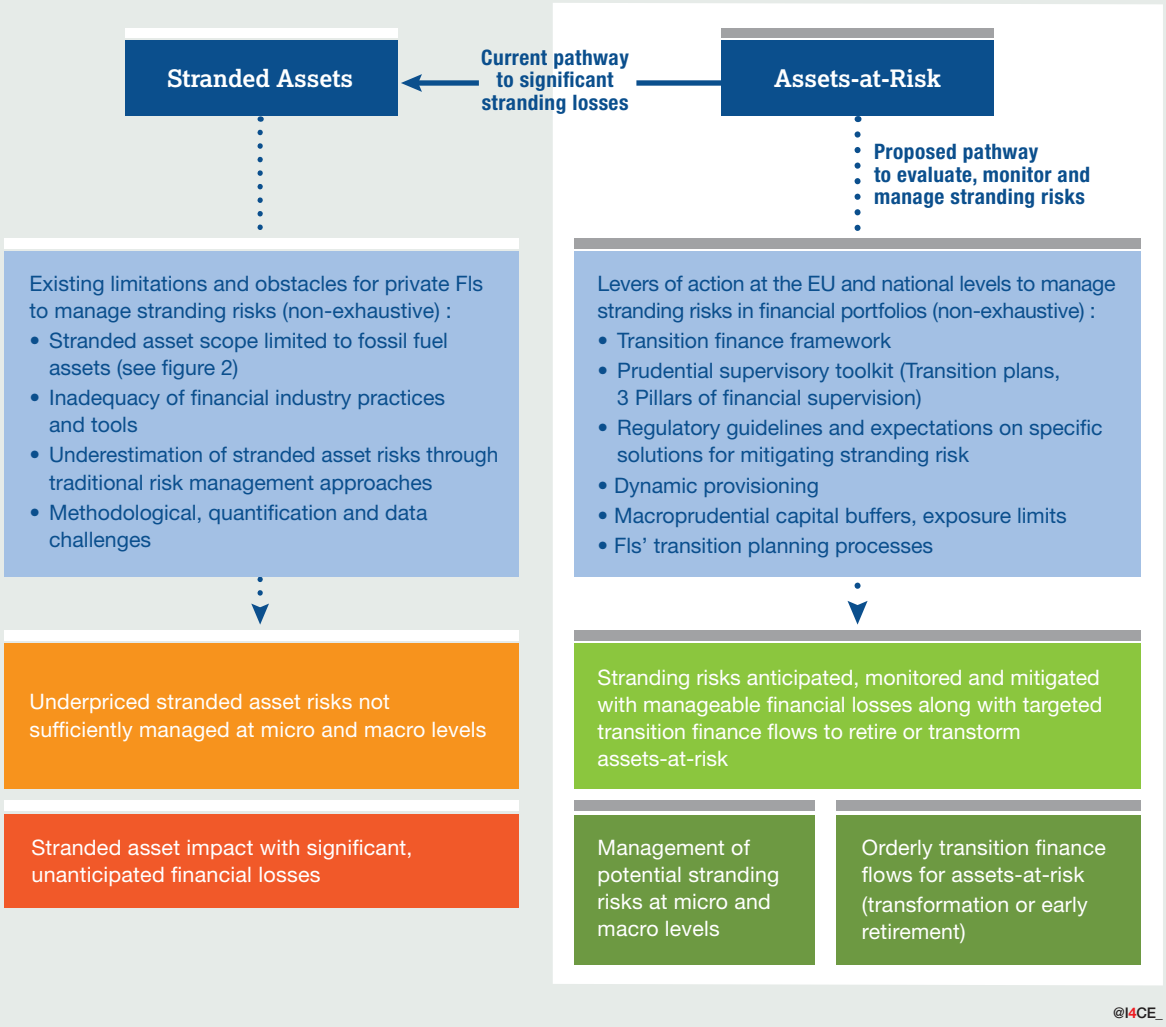
The existing tools, policies and practices adopted by private FIs are insufficient to capture potential stranding risks. Sector financing policies, net-zero commitments and alignment measures often do not include relevant financial exposures across the entire value chain. The **traditional risk-based approach underestimates future stranding risks** which usually lie beyond short-term risk-reward perceptions. Like transition risks, stranding risk assessments are burdened with the same quantification, methodological and data challenges. **FIs face difficulty in relating asset 'greenness' with 'transition readiness' of counterparties, with limited capacity to finance the dynamic transformation pathway of assets (from non-green to green[2]).** Primary and secondary finance sectors both underprice stranding risks, which amplify through financial interlinkages, threatening overall financial stability.

3 Public policy, financial regulation and supervision could help counter these obstacles

The management of the potential stranding effects on assets-at-risk necessitates strong public policy providing clear signals and incentives to financial players. The prudential regulatory and supervisory toolkit (including progress on transition finance) is vital to **managing transition-driven stranding risks involving specific mitigation solutions to stranding such as early retirement, retrofitting and repurposing of assets**. Financial regulation could reinforce system resilience to stranding contagion effects, especially from financial interlinkages and monitor 'risk offloading' strategies that weaken transition finance mobilization. There is a need for a 2-pronged approach to **managing potential stranding risks so that 1) eventual financial losses are buffered and managed and 2) orderly transition finance flows are triggered.**

1 Emambakhsh *et al.*, 'The Road to Paris: Stress Testing the Transition Towards a Net-Zero Economy'.
2 This paper borrows the common definition of green assets (or activities) in the context of the EU Taxonomy Regulation. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0852

FIGURE 1. THE NEED TO ACTIVATE THE LEVERS OF ACTION TO MANAGE POTENTIAL STRANDING RISKS IN THE PRIVATE FINANCIAL ECOSYSTEM



INTRODUCTION

With accelerating climate change effects, governments, regulatory authorities and civil society are ramping up actions on climate change mitigation and adaptation. Ambitious actions are needed to transition real economy activities to align with the temperature goals of the Paris Agreement. This means achieving an orderly 'climate mitigation transition' in a socially just manner[3]. Given their exposure to real economic assets, private financial players need to better understand the financial consequences of material transition risks within their portfolios. This means also acknowledging the **indirect and direct transmission channels of stranding risks arising from transition-driven devaluation of high-carbon assets and the specific risk mitigation solutions to limit these future losses.**

However, the debate on stranded asset risks within private finance is currently quite restrictive. It is oftentimes focused on 1) quantifying potentially stranded assets, 2) with a scope limited to assets in fossil fuel-based energy supply, thereby 3) resulting in proposals creating financial buffers to reduce financial risk exposure such as additional capital requirements. **This discussion paper proposes reframing the current debate to embrace a wider, dynamic narrative on stranded assets.**

The quantification of the potential stranding losses on economic assets is a methodological and data challenge since assets, including even some fossil fuel-related ones, are not necessarily "stranded" in all low-carbon transition scenarios. The quantification exercise is riddled with **high uncertainty over future economic signals and decarbonization drivers (or, factors determining the pace of the transition) that influence the economic lifespan of assets (or, eventual degree of stranding).** Moreover, the narrow focus of the debate on fossil fuel reserves is not representative of other significant economic sectors in need of transition due to their high carbon intensity such as the real estate, automotive and agricultural sectors. **Not all 'assets-at-risk' are necessarily fully stranded in a decarbonized world, though most may suffer some degree of depreciation in economic value during decarbonization.**

Mitigating the stranding effects of 'assets-at-risk' requires specific strategies to limit significant financial losses that could even endanger financial stability at a macro level. While it is necessary to prematurely retire some energy-intensive assets in their current function, the associated financial costs could be reduced through repurposing and upgrading some assets (steel plants, pipelines) or using innovative financing approaches for the managed phase-out of others (JETPs[4]). **Thus, the focus of the debate needs to shift from quantifying the potential value of stranded assets focused on fossil fuel reserves toward a wider landscape encompassing assets-at-risk across sectors with risk mitigation approaches that ensure the early retirement or transformation of assets.**

Due to the limitations of the current narrative, **private FIs largely undervalue stranded asset losses in their financial portfolios.** There is an urgent need to address these shortcomings through financial regulatory and supervisory tools and policies that would help the private financial ecosystem adopt a wider 'whole of economy' lens to manage assets-at-risk. **A coordinated effort at the EU macro, micro and national supervisory levels aligned with local government decarbonization policies would provide an encouraging regulatory signal to trigger transition finance for assets-at-risk.** It would also limit further carbon lock-in within financial portfolios.

The ongoing EBA guidelines[5] could help address some of these limitations for the private banking sector. However, it is necessary to identify other EU prudential supervisory policy tools, including transition plans, that address the rest of the private financial ecosystem[6]. This remains an area for future research as it lies beyond the scope of this paper. The paper's scope is limited to climate transition risks impacting private FIs with an emphasis on commercial banks. The topic for the paper is inspired from past I4CE work on transition finance, whereas the research and recommendations emphasized are based on literature review. The paper is divided into three parts: Chapter 1 calls into question the limited narrative of stranded assets around fossil fuels, Chapter 2 highlights the obstacles facing private financial institutions, especially banks, to manage stranded asset risks, and the conclusion makes recommendations for policymakers.

3 International Platform on Sustainable Finance, 'Transition Finance Report'.
4 JETPs or Just Transition Energy Partnerships are being used to finance the phase-out of fossil fuels in developing countries. See Kachi, Bendahou, and Outlaw, 'Financing Coal Phase-out: Public Development Banks' Role in the Early Retirement of Coal Plants'.
5 European Banking Authority (EBA), 'Consultation Paper - Draft Guidelines on the Management of ESG Risks'.
6 For the scope of this paper, the private financial ecosystem implies private commercial banks, insurers, non-banking financial institutions (NBFIs) and other private institutional investors.

CHAPTER 1

COULD ASSETS BECOME STRANDED IN ECONOMIC SECTORS OTHER THAN THE FOSSIL FUEL SECTOR?

1.1 Theoretically, stranded assets are broadly defined and are sector-agnostic

Stranded assets are theoretically defined as "assets that have suffered from unanticipated or premature write-downs, devaluations, or conversion to liabilities"[7]. As such the asset partially or wholly ceases to produce economic value before the end of its anticipated economic life. As per Carbon Tracker, there are principally three drivers of asset stranding: **economic stranding, physical stranding and regulatory stranding**[8]. While both economic (change in costs and prices) and regulatory stranding (change in policy) are caused by transition risks, physical stranding is caused by physical climate events such as droughts, floods, storms, etc.

Various kinds of assets can be stranded including financial assets (financial instruments such as loans), physical assets (equipment, infrastructure) and immaterial assets (human capital, technology)[9]. Stranding losses can be borne by financial institutions through both their **direct and indirect financial holdings**. Banks could incur unanticipated stranding losses through their direct holdings in bonds and loans while insurers and asset managers could be directly exposed through their equity and bond portfolios[10]. **Stranding losses can manifest through traditional financial risk channels including credit, market and liquidity risks.**

Three-quarters of global stranded fossil assets belong to governments, with National Oil Companies (NOCs) owning close to 60% of global reserves[11, 12] further amplifying the sovereign-bank risk transmission channels through banks' (and funds') holdings of sovereign bonds that could suffer market and credit risk losses from asset stranding[13].

Importantly, the magnitude of stranding losses suffered by a private financial player depends on the financial soundness of the counterparty since these losses are first absorbed by the corporate entity or government owning the underlying economic asset. Said otherwise, ***in case of significant, unanticipated asset stranding, is a government still able to meet its debt obligations on sovereign bonds held by private FIs?*** According to estimates, three-quarters of global stranded fossil assets belong to governments, with National Oil Companies (NOCs) owning close to 60% of global reserves[11,12].

This further amplifies the sovereign-bank risk transmission channels as banks' (and funds') holdings of sovereign bonds could suffer both from market and credit risk losses due to high stranding risks[13].

7 Caldecott, Howarth, and McSharry, 'Stranded Assets in Agriculture: Protecting Value from Environment-Related Risks'.
8 Carbon Tracker Initiative, 'Stranded Assets'.
9 Bos and Gupta, 'Stranded Assets and Stranded Resources: Implications for Climate Change Mitigation and Global Sustainable Development'.
10 Beyene, Delis, and Ongena, 'Financial Institutions' Exposures to Fossil Fuel Assets'.
11 Hansen, 'Stranded Assets and Reduced Profits: Analyzing the economic underpinnings of the fossil fuel industry's resistance to climate stabilization'.
12 International Energy Agency (IEA), 'The Oil and Gas Industry in Net Zero Transitions'.
13 Jaffe, 'Stranded Assets and Sovereign States'.

1.2 Practically, stranded assets have been mainly associated with the fossil fuel industry

The narrative around stranded assets centers on fossil fuels due to their high carbon intensity which makes them the principal focus of national and global decarbonization strategies. In 2021, carbon dioxide emissions represented a total of 75% of global GHG emissions driven by the energy mix which itself is 80% composed of fossil fuels[14]. GHG emissions from energy combustion in the EU are led by electricity and heat generation and the transportation sectors representing around 30% of GHG emissions each, followed by residential and service sectors at 17%.

The high 'carbon risk' of fossil fuels has spurred the momentum of regulators and policymakers to manage climate-related financial risks from the resulting 'carbon bubble'[15,16]. The carbon bubble is, in turn, driven by eventually 'unburnable'[16] coal and proven oil and gas reserves that must be left in the ground, but whose stranding risks are not yet fully reflected in companies' balance sheets.

Various studies have attempted to quantify the **magnitude of losses from potentially stranded fossil fuel assets with figures ranging anywhere from US$1 trillion to US$4 trillion and even beyond to US$185 trillion[11].** Such large variations in estimates stem from methodological differences, model assumptions and data considerations, stemming from the uncertain pace of the ongoing low-carbon transition. **Stranding losses emanate both from the value of proven reserves that must be written-off as well as from market price decreases on fossil fuels sold during the 'climate stabilization' period[11].**

Studies estimate US$1.27 trillion in global stock market losses from listed oil majors irrespective of the geographical location of the stranded oil and gas field[17]. Stranding losses can propagate quickly through financial interlinkages, that further amplify losses through compounding effects

Private financial players are exposed to stranding losses from the eventual price correction on the carbon bubble of fossil fuel assets. Studies estimate US$1.27 trillion in global stock market losses from listed oil majors irrespective of the geographical location of the stranded oil and gas field[17]. The fossil fuel sector is deeply entrenched in global financial markets so that financial losses can propagate quickly through interconnected financial risk channels across geographies and financial players in the risk ownership chain. NBFIs such as pension funds and other managed funds are the most exposed, with private banks bearing a lower risk exposure. **Moreover, compounding risk drivers between regulated banks and less-regulated NBFIs could be a source of hidden, systemic risks that could manifest in case of significant asset devaluation or stranding.** This merits the urgent attention of prudential financial authorities to assess and ensure the resilience of the private financial ecosystem to potential stranding losses.

1.3 The stranded asset narrative needs to be re-framed to 'assets-at-risk' across sectors

A limited but growing body of evidence highlights the likelihood of significant stranded asset risk in other economic sectors beyond fossil fuels[18,19]. This begs the question: Do private financial actors adequately identify and manage potential stranding risks within their financial value chain? ***Or do they risk succumbing to a domino effect of financial losses triggered by abrupt, unanticipated write-offs of carbon-intensive economic assets during the ongoing transition?***

Asset stranding would have a higher likelihood in a disorderly transition, especially if the asset owners' cost to transition abruptly is too high[19]. It is essential that private financial actors broaden their understanding of stranded assets beyond fossil fuels to better anticipate potential stranding risks across sectors within their overall transition risk assessment framework. **Stranding risk is a transition-driven risk as each economic sector copes with the challenges of decarbonization[20]. Financial**

14 French Ministry of the Energy Transition, Data Lab, https://www.statistiques.developpement-durable.gouv.fr/edition-numerique/chiffres-cles-du-climat-2023/en/5-global-overview-of-ghg-emissions
15 Monasterolo, 'Climate Change and the Financial System'.
16 Caldecott *et al.*, 'Stranded Assets: Environmental Drivers, Societal Challenges, and Supervisory Responses'.
17 Semieniuk *et al.*, 'Stranded Fossil-Fuel Assets Translate to Major Losses for Investors in Advanced Economies'.
18 International Renewable Energy Agency (IRENA), 'Stranded Assets and Renewables'.
19 Van der Ploeg and Rezai, 'Stranded Assets in the Transition to a Carbon-Free Economy'.
20 To be fair, stranding risk can also be driven by physical climate change impacts (energy-related infrastructure is vulnerable to heavy precipitation and wildfires). But this paper focuses on transition risk drivers of stranding.

institutions, through a dynamic approach, can monitor 'assets-at-risk' (*i.e.* potential stranded assets) and preemptively limit stranding risks through specific solutions such as managed phase-out, retrofitting and repurposing. They can be highly influential agents to limit economic losses thus preventing an asset-at-risk from becoming fully stranded. Put differently, **not all assets-at-risk become stranded assets, but all stranded assets are assets-at-risk.**

Stranding risk is a transition-driven risk as each economic sector copes with the challenges of decarbonization. FIs must adopt a dynamic approach to monitor 'assets-at-risk' to better anticipate potential stranding risks across sectors within their overall transition risk assessment framework.

The energy transition underscores the great potential of the real estate sector to reduce overall GHG emissions since buildings account for the lion's share of 42% of the EU's total energy use. 80% of this energy goes towards heating and cooling needs[21]. Recent EU energy and climate policy initiatives encourage the deployment of energy efficiency and retrofitting measures such as mandatory Energy Performance Certificates (EPCs). EPCs, along with property-related data can be used as a proxy for measuring transition-driven stranded asset risk in the real estate sector. They could help estimate the cost of retrofitting sub-standard properties in response to increasing climate policy action[22]. **Given the financialization of the global real estate market (through international mortgage markets, real estate investment trusts, unit trusts), private financial players are exposed to real estate stranding losses in both primary and secondary financial sectors.**

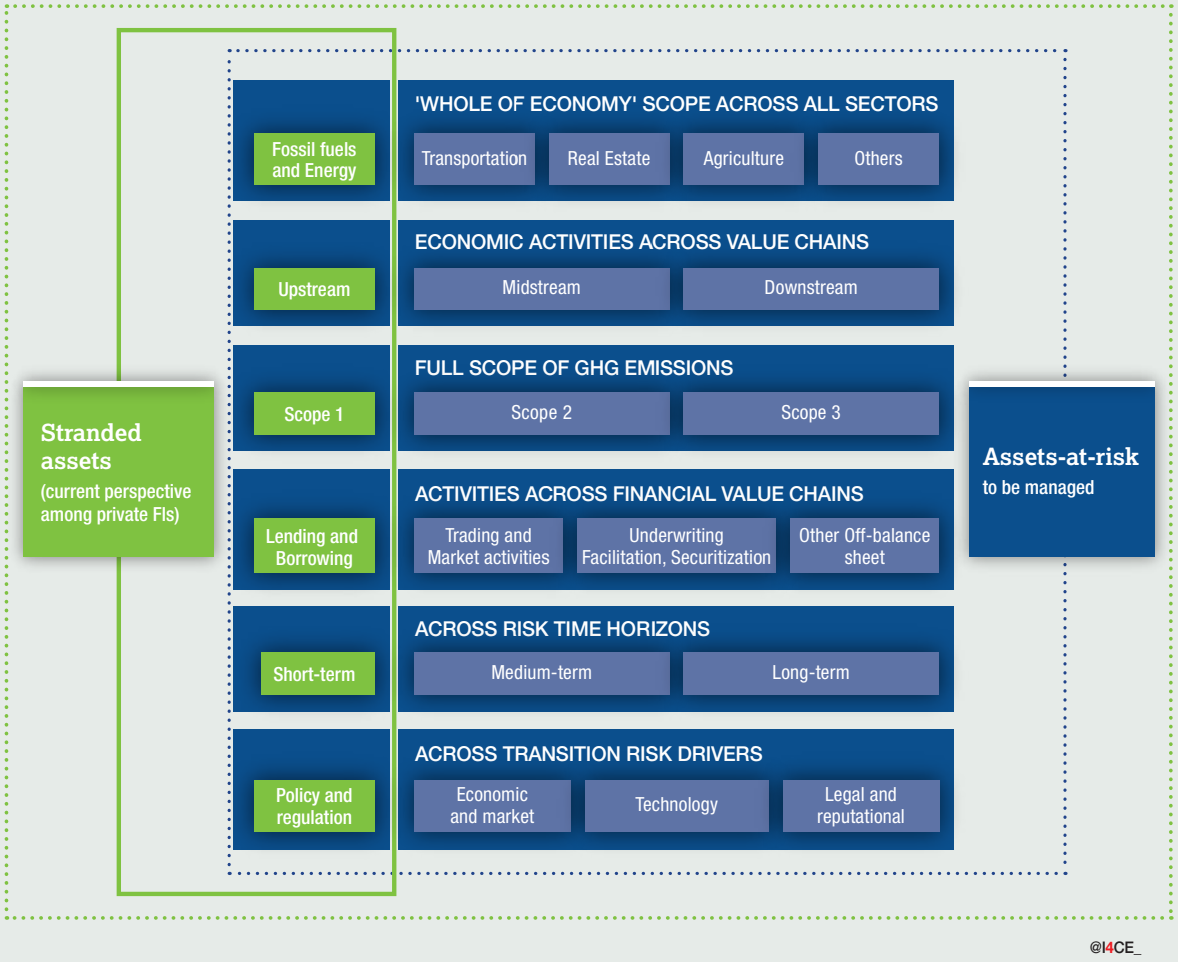
The agricultural sector faces not only apparent physical climate risk hazards but also transition risk pressures through regulatory constraints to reduce GHG emissions from production activities. In France, the highest risk of asset stranding in the agricultural sector pertains to buildings and infrastructure (due to their high emission intensity) used for livestock farming. Given the limited financial capacity of individual breeders to retrofit existing infrastructure with low-carbon efficiency solutions, they are instead forced to invest in relatively cheaper new structures. This leads to the stranding or abandoning of old, incompatible assets[23]. **Private banks exacerbate the problem as they are less inclined to finance agricultural activities which are deemed risky with unfavourably low returns.**

The risk of asset stranding is already strikingly visible in the automobile sector due to accelerating technological and regulatory disruptions. Automobile manufacturers race to replace ICE (Internal combustion engines) vehicles with EVs (Electric vehicles), impacting all upstream players in the value chain. Current production lines are optimized for ICE vehicles where investments are locked into each car model line with a lifespan of 7-10 years, meaning that a shift to an EV model would require new equipment and investments[24]. **The ICE to EV switch could result in significant financial losses or write-offs due to the sheer size of the global ICE fleet and the associated global upstream suppliers, that would need to adapt quickly or risk going out of business.** Estimates of asset value at risk by 2025 stand at €600 billion globally with the most risk observed for plant, property and equipment and leased products (including receivables)[24,25].

There is a growing concern about legal and reputational risks that reinforce the financial liabilities of oil and gas companies for decommissioning ageing wells. 'Upside-down' oil and gas wells whose Asset Retirement Obligations (AROs) or decommissioning costs exceed the well's future net cash flows are often subject to perverse 'risk avoidance' behaviour by operators. This common industry practice has led to over **2.1 million abandoned wells across the USA as operators drain the last drops on ageing wells and distribute dividends, leaving decommissioning costs unfunded[26].** However, recent ARO creditor rights grant landowners legal rights to hold current and former well operators financially responsible for ARO costs (including liabilities for environmental damage) on leaky, abandoned wells. **In Canada, oil and gas companies are estimated to incur CAD 72 billion on future decommissioning liabilities with a high likelihood of them defaulting due to poor financial viability[27].**

21 The EU's Energy Performance of Buildings Directive targets a fully decarbonized building stock by 2050 through several measures including minimum energy performance standards https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en.
22 Muldoon-Smith and Greenhalgh, 'Suspect Foundations: Developing an understanding of climate-related stranded assets in the global real estate sector'.
23 Bonvillain, Rogissart, and Foucherot, 'Transition de l'élevage: Gérer Les Investissements Passés et Repenser Ceux à Venir'.
24 Stockholm Environment Institute, 'Framing Stranded Assets Risks in an Age of Disruption'.
25 Taken from reference 24, 'The book value of leased products is exposed to risk as it to some extent carries the risk of the residual value of the cars, after the leasing agreement ends. If the residual value of the cars changes dramatically, it would mean significant risk to the financing arm of the auto manufacturers. Financial service receivables are to a large extent tied to contracted payments for the leasing periods and are assumed to be under limited risk'.
26 Rogers, 'A New Theory of ARO Creditor Rights'.
27 Mawji, 'Canada's Oil and Gas Decommissioning Liability Problem'.

FIGURE 2. SHIFTING THE NARRATIVE FROM STRANDED ASSETS TO 'ASSETS-AT-RISK'



CHAPTER 2

CURRENT FINANCIAL INDUSTRY PRACTICES FALL SHORT OF IDENTIFYING ASSETS-AT-RISK AND ANTICIPATING LOSSES FROM STRANDING

2.1 Existing tools and practices favoured by private financial players are insufficient to assess stranding risks

The tools used by private financial institutions originating both from voluntary industry initiatives and prudential supervisory exercises are insufficient to adequately assess stranding risks in the financial ecosystem. Adopting a comprehensive and forward-looking approach is a prerequisite for evaluating stranding risks which suffer from the same weaknesses and limitations as those also observed in evaluating transition risks in general. In the case of private commercial banks, their net-zero commitments, sector financing policies and alignment measures do not address the full scope of transition risk exposure from their value chain activities. **From a macroprudential supervisory perspective, the ECB finds several inadequacies in such banking practices including the low credibility of chosen scenarios and narrow coverage of banking activities and economic sectors in banking net-zero targets[28].**

Common tools such as portfolio alignment metrics are often inaccurate as they do not cover relevant carbon-intensive activities across financial institutions' loan and investment portfolios, including off-balance sheet activities. The latter which cover **underwriting, securitization and advisory services are not included in most net-zero targets despite being greater in volume than the on-balance sheet loan portfolio for G-SIBs (Global Systematically Important Banks)[28].** Sometimes less than 10% of a bank's total portfolio is scoped under a net-zero target, leaving the rest exposed to hidden climate risks. Similarly, the **IMF highlights the inadequate net-zero alignment of global insurers' underwriting and investment portfolios with several insurers having none or weak sector policy criteria[29].**

> Off-balance sheet activities such as underwriting, securitization and advisory services are not included in most net-zero targets despite being greater in volume than the on-balance sheet loan portfolio for G-SIBs… Sometimes less than 10% of a bank's total portfolio is scoped under a net-zero target[28].

Existing financial industry practices fall short of monitoring the full scope of material transition risks, thereby hindering a meaningful evaluation of stranding risks. Material on-balance sheet activities of a bank's loan portfolio are not fully covered under net-zero financing commitments in part due to weak sector financing policies and incomplete disclosures. The study, Banking on Climate Chaos, reveals that **fossil fuel sector financing policies regularly focus only on project-related financing, even though this represents only 4% of annual fossil fuel financing[30].** Reclaim Finance reveals an alarming gap for financing upstream oil and gas activities, where globally 160 financial institutions have policies that restrict financing for unconventional sources[31], but only 45 institutions also cover conventional

28 Di Maio *et al.*, 'An Examination of Net-Zero Commitments by the World's Largest Banks'.
29 International Monetary Fund (IMF), 'Global Financial Stability Report'.
30 Rainforest Action Network and others, 'Banking on Climate Chaos: Fossil Fuel Finance Report 2023'.
31 Conventional oil or gas sources arise from geological formations from which it is straight-forward to extract fossil fuels using typical vertical well bores. Unconventional sources derive oil and gas from areas with poor permeability and porosity, by using specialized technologies such as hydraulic fracturing or fracking. Typical unconventional sources include fracking, tar sands, arctic, ultra deepwater. It is estimated that as of 2023, 51% of the oil and gas industry's short-term expansion projects are from unconventional sources(https://gogel.org/unconventionals101)

activities. Half of the oil and gas projects in development concern conventional sources[32]. Moreover, the ECB points out that **banks allow exceptions to their sector exclusion policies for clients 'supporting' the low-carbon transition without substantiating the scope and consequences** in their bank disclosures[28]. This further complicates meaningfully assessing how transition finance aligns with banks' net-zero commitments and interim sectoral targets.

2.2 The traditional risk-based approach underestimates stranding risk

The traditional risk-based approach employed by most private financial players underestimates stranding risks and hinders catalyzing true transition capital due to the inherent paradoxes of the approach[33]. Traditional financial risk models favour short-term, certain, higher returns (such as those from fossil fuel assets) over long-term, uncertain, 'perceived' lower returns (such as those from low-carbon agricultural assets). The underlying risk-return trade-offs perceived by financial actors fail to consider material transition risks beyond the short-term investment horizon, thus locking-in sunk capital into economic assets and value chains at risk of stranding during decarbonization**. Additionally, financial players' perception of lower future returns on low-carbon opportunities influenced by weak or uncertain policy signals (from both governments and financial regulators) inhibits the acceleration of private capital flows to finance the transformation of assets-at-risk.**

Moreover, financial actors' traditional risk-based approach can lead to risk management decisions that are counter-productive to the low-carbon transition, especially for the orderly management of stranded assets[34]. For example, if a fund chooses to mitigate its risk to a high-carbon emitter by divesting or selling off its equity share in the company, it might have little effect on real economy decarbonization. **A divestment strategy by a financial entity may incentivize other financial actors with a greater risk appetite to invest in the lucrative, high-carbon business of the emitter without encouraging it to green its activities.** Public intervention, including through prudential regulation, would be crucial to interject the contradictory actions of private financial players since voluntary market mechanisms alone cannot overcome these risk limitations[35].

2.3 There are quantification and methodological hurdles for estimating assets-at-risk

Identifying assets-at-risk through a comprehensive framework, supported by forward-looking assessments of counterparties' preparedness for the transition, can help better anticipate stranding risks among financial portfolios. However financial players face quantification and methodological hurdles along each step of the process. Backward-looking climate-related data having poor consistency, reliability and availability limit financial actors from integrating such data into their traditional risk frameworks that run on robust historical financial data. **The pace of the transition is deeply uncertain, sectorially and geographically differentiated so that assessing counterparty-level transition risk requires granular, forward-looking and context-based data.**

> Financial actors struggle to quantify the risk from the 'greenness' of an asset with the transition risk exposure at the counterparty level[36]. Transition risk assessment is a function of several parameters, including the 'transition readiness' of counterparties.

Nevertheless, the NGFS finds that financial actors use various forward-looking, climate-related data, both qualitative and quantitative (heatmaps, scoring, scenario analysis, stress testing, etc.) to assess 'transition readiness' of their counterparties. However, they struggle to quantify the risk from the 'greenness'

32 Oil and Gas Policy Tracker, 'Top Practices and Trends: Key Insights on Oil and Gas Policies'.
33 Noguès and Evain, 'Implementing Prudential Transition Plans for Banks: What Are the Expected Impacts?'.
34 Hubert and Hilke, 'Connecting the Dots between Climate Risk Management and Transition Finance'.
35 Cardona, 'The Limitations of Voluntary Climate Commitments from Private Financial Actors'.

of an asset with the transition risk exposure at the counterparty level[36]. **Importantly, identifying greenness of assets does not translate into a measurement of transition risk for a financial portfolio**[37]**.** Transition risk assessment is a function of several parameters including the transition readiness of the counterparty as supported by a credible corporate transition plan.

The inherent quantification and data difficulties, exacerbated by the lack of a universal classification of 'green' and 'non-green' activities, prompts financial actors to use a heterogenous mix of proprietary and industry classifications[36]**.** However, given the binary nature of most classifications (green vs. non-green), **FIs struggle to recognize the dynamic transformation pathway for non-green assets.** This further aggravates the risk of future asset stranding since several non-green assets may lose out on necessary transition finance flows (example, for retrofitting and repurposing) as FIs strive to green their financial portfolios. In doing so, FIs may favour financing already green activities, thus protecting themselves from possible climate litigation risks from financing non-green assets. **Interestingly, transition-driven stranding risks could also be observed on fundamentally green assets depending on the underlying disruption drivers.** A green asset such as an EU solar energy farm could carry high transition risk from market competition coming from new entrants with updated, cost-effective technology that threatens its economic viability. Thus, assessing the transition readiness of this solar energy manufacturer would be essential for a bank to limit its financial exposure to potential stranding risks from significant future asset write-offs.

Regarding the methodological framework, hurdles also arise from the underlying modelling assumptions and parameters used to make financial forecasts under existing climate transition scenario analyses and stress tests. Commonly used scenarios developed by international research organizations, scientific authorities, and financial supervisors can lead to an **underestimation of the financial consequences (including stranding costs) of a disruptive or disorderly transition**. The IMF argues for improved scenario design by considering the increasing likelihood of a disorderly transition, including the consequences of further carbon lock-in (and reduced deployment of renewable energy), macroeconomic impacts of higher-for-longer interest rates and emerging geoeconomic fragmentation[38]. **Indeed, the ongoing polycrisis calls for re-assessing the evolution of climate variables among plausible outlier or non-central scenarios to better capture transition-driven stranding risks in the short-term and long-term horizons.**

2.4 Primary and secondary finance sectors have not fully priced in stranded asset risk

Primary finance[39] **participants including investment banks and private equity have not fully priced in stranded asset risk, but there is some degree of carbon risk pricing observed after the ratification of the Paris Agreement**[40]**.** Interestingly the pricing of carbon risk in syndicated bank loans is reflected across sectors rather than only for the fossil fuel sector. However, the risk premium pertains only to scope 1 carbon emissions (from own operations) of the borrower firm, leading to an inefficient underpricing of material stranded asset risk. **Nonetheless, banks tend to cut syndicated loan supply to carbon-intensive firms driven more by banks' own preference for green assets rather than the associated higher financial risk of such firms**[41]**.** However, in the broader euro credit market of which syndicated loans represent only 10%, banks appear to charge some risk premium for higher-emitting borrowers[42]. **The overall underpricing of stranded asset risk by primary finance participants is worrying for policymakers as it makes transition capital deployment more expensive (due to delayed action by financial players) and further magnifies the degree of asset repricing (due to underpriced risks) from a sudden policy shock**[10]**.**

The secondary finance sector[39]**, including the financial markets for equity and corporate debt, is more reactive than the primary finance sector in pricing stranded asset risks**[10]**.** Investors' reaction depends on the expectation of the likelihood of asset stranding as well as the credibility of policy signals[43]. Carbon Tracker reveals that **stock markets are usually quick to price**

36 Network for Greening the Financial System (NGFS), 'Capturing Risk Differentials from Climate-Related Risks - A Progress Report: Lessons Learned from the Existing Analyses and Practices of Financial Institutions, Credit Rating Agencies and Supervisors'.
37 Alessi and Battiston, 'Two Sides of the Same Coin: Green Taxonomy alignment versus transition risk in financial portfolios'.
38 Gardes-Landolfini *et al.*, 'Energy Transition and Geoeconomic Fragmentation: Implications for Climate Scenario Design'.
39 Primary finance represents funding for new investments. It includes bank credit facilities, private equity as well as initial public offerings (IPOs) for new equity and debt issues. As such, 'primary finance has the most direct impact on the transition' as it provides additional capital for financing projects. Secondary finance represents the exchange of pre-existing securities (equity, debt) in financial markets and thus has an indirect impact on the financing the transition (through divestment, engagement, advocacy, etc.). See reference 35.
40 Ehlers, Packer, and de Greiff, 'The Pricing of Carbon Risk in Syndicated Loans: Which Risks Are Priced and Why?'.
41 Kacperczyk and Peydro, 'Carbon Emissions and the Bank-Lending Channel'.
42 Altavilla *et al.*, 'Climate Risk, Bank Lending and Monetary Policy'.
43 Sen and Von Schickfus, 'Climate Policy, Stranded Assets, and Investors' Expectations'.

in anticipated losses in ex-ante returns[44] before the actual write-down of physical fossil fuel assets[45]. Evidence suggests that equity investors demand significant risk premia on equity prices of some carbon-intensive large-cap US firms to compensate for higher risk-taking[46]. Similarly, as investors increasingly factor carbon risk into bond prices, corporate debt financing becomes more expensive for fossil fuel firms seeking financing from the secondary financial markets. **These firms appear to substitute financing from bonds to syndicate bank loans to benefit from relatively favourable interest rates offered by large banks[47]. This leads to a flight of some carbon risk from the costlier secondary finance sector to the relatively cheaper primary finance sector.**

> There is a flight of some carbon risk from the costlier secondary finance sector to the relatively cheaper primary finance sector as fossil fuel firms engage in bond-to-loan substitution due to higher risk premiums on bond prices[47].

Overall, the financial sector, both primary and secondary, not only significantly underprices stranding risk across economic sectors, but also amplifies financial losses through interlinkages among investors. This is concerning for policymakers as it highlights the vulnerability of the private financial ecosystem when faced with unanticipated asset repricing (and accompanying stranding losses) in case of a disorderly transition. The globally, interconnected nature of financial markets creates scope for risk amplification through interlinkages among private financial actors. **Some of these risk propagation channels are visible (such as the inter-bank loan market) due to regulated, transparent linkages, while others are less visible (such as bank-NBFI activities) with the participation of relatively less regulated participants (hedge funds, private equity).**

Financial supervisors need to identify and monitor potential risk amplification channels among private financial players to control the contagion effects of asset stranding. Due to their risk ownership, both listed and non-listed private financial players amplify economic losses from fossil fuel asset stranding with one study estimating an **amplification factor of 29% on FIs' balance sheets[17].** More so, since banks primarily use syndicated loans for cross-border corporate lending, the amplified financial losses of underpriced stranded asset risk could be significant once stranding materializes. **Such losses are also compounded by 'risk-offloading' decisions to reallocate loan portfolios between domestic and foreign borrowers by increasing loan supply to the latter as the stringency of domestic climate policy increases[48].** Such 'policy arbitrage' behaviour of private financial players is counter-productive to financing the decarbonization of assets-at-risk as it further diverts urgent private capital needed for national climate policy objectives.

44 Ex-ante returns or 'before the event' are the expected returns on an asset based on forecasts and predictions of future performance. Stock and bond prices are majorly driven by such analysis. The opposite, ex-post returns or 'after the event', represents actual or historical returns already observed. Hence, ex-post is the actual performance of an asset, while ex-ante is the forecasted performance.
45 Bond, Vaughan, and Benham, 'Decline and Fall: The Size and Vulnerability of the Fossil Fuel System'.
46 OECD, 'Financial Markets and Climate Transition: Opportunities, Challenges and Policy Implications'.
47 Beyene *et al.*, 'Too-Big-to-Strand? Bond versus Bank Financing in the Transition to a Low-Carbon Economy'.
48 Benincasa, Kabaş, and Ongena, '"There Is No Planet B", but for Banks "There Are Countries B to Z": Domestic Climate Policy and Cross-Border Lending'.

CONCLUSION

This discussion paper makes the following recommendations for EU policymakers, including financial supervisors, to help anticipate, identify and manage potential stranding risks on assets-at-risk.

Existing weaknesses	Recommendations	Possible measures
SCOPE OF TRANSITION-DRIVEN STRANDING RISKS		
• Narrow view of stranded assets limited to fossil fuel sectors • Limited scope of FIs' activities considered when assessing stranding risks • Limited scope of corporate activities considered when assessing stranding risks	• 'Whole of economy' perspective on assets-at-risk from transition-driven pressures (policy, legal, technology, market, reputation) • All financial activities to be considered (loans, bonds, equities and off-balance sheet activities such as advisory services, underwriting, securitization) • The whole economic value chain of businesses to be considered	• Prudential transition plans (PTP) could i) mandate the monitoring of stranding risks within PTP and ii) provide a framework for a comprehensive approach on stranding risks by setting guidelines to define the proper scope in terms of: - Economic sectors - Financial activities - Value chain of businesses
EVALUATION OF ASSETS-AT-RISKS		
• Insufficient data for FIs to identify assets-at-risk of clients • Stranded assets cannot be accurately quantified due to the highly uncertain pace of the transition • Difficulties for FIs to evaluate stranding risks in the absence of a standardized classification for transitioning activities • Underpricing of stranding risks by financial markets and private financial actors	• Identification of assets-at-risk to be done at a granular level (*i.e.* asset-level) based on information provided by FIs' clients • Use of forward-looking approach is mandatory supported by credible quantitative and qualitative data at the entity level. Improved scenario analyses, stress tests are key • Develop transition finance framework (with clear eligibility criteria, safeguards and appropriate forward-looking metrics) to help evaluate assets-at-risk • Financial regulation and supervision to complement the signals of the economic policy facilitating the transition to help correct the underpricing of stranding risks	• PTPs could provide regulatory guidelines to identify assets-at-risk in the financial value chain • FIs' transition planning processes could help estimate stranding risks using credible scenario analysis, stress tests, forward-looking metrics and indicators at a granular level • Regulatory guidelines (via a 'transition taxonomy' or other dynamic classifications) to assess the level of 'greenness' of assets (non-binary approach) and eventual degree of stranding at the counterparty level • Supervisory expectations for assessing 'transition readiness' of counterparties to estimate potential stranding risks • Prudential regulatory measures (such as banks' pillar 1 capital requirements or macroprudential capital buffers)
MANAGEMENT OF STRANDING RISKS FROM ASSETS-AT-RISK		
• Potentially significant stranding risks due to FIs' limitations to proactively identify and manage assets-at-risk before they become stranded • Transition-driven stranding risks might not benefit from specific risk management solutions • FIs are unable to anticipate the magnitude of stranding losses • Significant stranding risks could threaten financial stability at both micro and macro levels due to financial interlinkages that amplify stranding losses • 'Risk dumping' behaviour as FIs transfer or offload their assets-at-risk to other economic agents	• FIs to proactively monitor assets-at-risk to limit eventual stranding losses • FIs to engage their clients to raise awareness on stranding risks and discuss available options for risk management • FIs should recognize specific solutions for stranding risks and direct transition finance flows to retire or transform these assets • FIs to smoothen the provisioning for asset write-off over the transition period when assets-at-risk are still profitable • Resilience of the private financial ecosystem to stranding risks must be strengthened • Monitoring risk propagation channels given the transboundary nature of financial flows to detect risk offloading and potential contagion effects	• PTPs to push FIs to closely monitor stranding risks • Other prudential measures could help anticipate and limit the size of potential stranding losses (ex: exposure limits, banks' pillar 2 risk management processes) • Regulatory guidelines on the specific solutions to manage stranding such as early decommissioning, repurposing and retrofitting • Regulatory guidelines for a managed phase-out approach with safeguards to prevent FIs from unduly prolonging the operating life of high-emitting assets • Prudential regulation to set up a dynamic or forward-looking provisioning on assets-at-risk to mitigate the procyclicality of accounting rules • Financial regulatory bodies to increase capital buffers against stranding assets (at the micro and macro levels) • Prudential supervisors to monitor transboundary risk propagation channels

Stranded asset risks in the private financial ecosystem are largely underestimated. Private financial players face several challenges and weaknesses for scoping transition-driven stranding risks as well as for evaluating and managing assets-at-risk. The current narrative of stranded assets is too limited to allow a meaningful estimation of the stranding effects from assets-at-risk which emerge from all economic sectors facing decarbonization pressures. This is worrying for policymakers and financial regulators as it could not only **threaten financial stability from the contagion effects of stranding but could also delay necessary transition finance flows (and increase the cost of capital) to retire or transform assets-at-risk. Additionally, FIs require supporting regulatory and supervisory guidelines to finance the early retirement of misaligned assets, the repurposing or retrofitting of compatible assets and the scaling-up of aligned assets.**

A prudential regulatory and supervisory response would help better anticipate and mitigate eventual risks from asset stranding in an orderly manner that limits financial stress on markets[49]. EU regulatory guidelines are needed to define a transition finance framework, supplemented by clear eligibility criteria and minimum safeguards. **However, due to the radical uncertainty of transition risks, policymakers should embrace the 'proactive precautionary approach' that would allow them to better anticipate and manage stranding risks without waiting for perfect information**[50,34]**.** Having such a broad, flexible policy framework that leverages a mix of appropriate policy tools would be useful to tackle the quantification complexities, transition uncertainties and risk perception challenges that are inherent in managing transition-driven stranding risks.

Moreover, prudential transition plans could support FIs in setting granular, sectorial pathways with time-bound targets that align their portfolios with low-carbon transition objectives[33]. Macroprudential supervisors would also be able to better ascertain systemic risks from stranding losses by comparing FI transition plans**. The onus lies on regulatory authorities to intentionally accelerate capital flows to finance an orderly, low-carbon transition that prevents the further build-up of stranding risks in the real economy, limiting significant financial costs for private financial players.**

49 Allen *et al.*, 'Climate Transition Scenarios: Short-Term Economic Effects'.
50 Chenet *et al.*, 'Finance, Climate-Change and Radical Uncertainty: Towards a precautionary approach to financial policy'.

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