



EUROPEAN CENTRAL BANK

BANKING SUPERVISION

Climate risk stress test

SSM stress test 2022

BANKENTOEZICHT

October 2021

BANKTILSYN BANKU UZRAUDZĪBA

BANKŪ PRIEŽIŪRA NADZÓR BANKOWY

VIGILANZA BANCARIA

BANKFELÜGYELET

BANKING SUPERVISION

SUPERVISION BANCAIRE BANČNI NADZOR

MAOIRSEACHT AR BHAINCÉIREACHT NADZOR BANAKA

BANKING SUPERVISION

PANGANDUSJÄRELEVALVE

SUPERVISÃO BANCÁRIA

BANKOVNI DOHLED

БАНКОВ НАДЗОР

BANKTILSYN

BANKENAUF SICHT

ΤΡΑΠΕΖΙΚΗ ΕΠΟΠΤΕΙΑ PANKKIVALVONTA

SUPRAVEGHERE BANCARĂ BANKOVÝ DOHL'AD

SUPERVIŽJONI BANKARJA

SUPERVISIÓN BANCARIA

BANKING SUPERVISION

SUPERVISÃO BANCÁRIA

BANKENAUF SICHT

Contents

1	Introduction	2
1.1	Background	2
1.2	Objectives of this note	2
2	Quality assurance process	3
2.1	Purpose of the quality assurance process	3
2.2	Timeline of the exercise	3
3	Instructions on how to fill in the templates	5
3.1	Module 1: Qualitative questionnaire	5
3.2	Module 2: Climate risk metrics	7
Box 1	Examples of Scope 3 GHG emission proxies	12
3.3	Module 3: Bottom-up stress test projections	13
Box 2	Examples of EPC rating proxies	18
	Annexes	37
	Annex A.1: Module 1 questionnaire (to be provided to banks in Excel format)	37
	Annex A.2: -	55
	Annex A.3: Guidance for nGAAP banks	56
	Annex A.4: Provisional set of scenario variables	57
	Annex A.5: List of industries	59
	Annex A.6: Examples of climate-related and environmental events relevant for conduct and physical risk	60

1 Introduction

1.1 Background

As a competent authority, the European Central Bank (ECB) is required to carry out annual stress tests on supervised entities in the context of its Supervisory Review and Evaluation Process as set out in Article 100 of CRD IV.

The draft European Banking Authority (EBA) Guidelines on institutions' stress testing¹ leave room for competent authorities to follow various approaches.

The ECB will carry out a stress test exercise on climate risk as its annual supervisory stress test for 2022.

The methodological requirements described in the following sections of this document are to be considered as a uniform methodology for conducting a bottom-up exercise and are not intended to form the basis of any future regulations.

This document draws on several sources, including the [ECB Guide on climate-related and environmental risks](#)² and the EBA Report entitled "[On management and supervision of ESG risks for credit institutions and investment firms](#)".³

1.2 Objectives of this note

This note outlines the main characteristics of the 2022 climate risk stress test exercise and provides banks with guidance on how to conduct the exercise.

The remainder of the document is organised into two chapters:

- Chapter 2 sets out the process for the banks' submissions and provides a high-level overview of the quality assurance process for institutions participating in the exercise;
- Chapter 3 provides instructions on how to complete the stress test templates.

¹ See [EBA Guidelines on institutions stress testing](#), EBA/GL/2018/04, 19 July 2018.

² See [ECB Guide on climate-related and environmental risks: Supervisory expectations relating to risk management and disclosure](#), ECB, November 2020.

³ See "[On management and supervision of ESG risks for credit institutions and investment firms](#)", Report, EBA/REP/2021/18, EBA, 23 June 2021.

2 Quality assurance process

2.1 Purpose of the quality assurance process

The 2022 climate risk stress test exercise is considered to be a joint learning exercise with pioneering characteristics. One of its main objectives is to enhance the capacity of both banks and supervisors to assess climate risk. In this context, the quality assurance process also serves to enhance the supervisory understanding of what climate-relevant data banks have available and the limitations when assessing climate-related risks, to identify best practices and to ensure that banks follow the instructions as set out in this document.

In line with the proportionality principle, the intensity and granularity of the quality assurance conducted by the ECB for banks participating in this exercise will be commensurate with the materiality of the issues identified.

2.2 Timeline of the exercise

The exercise will be conducted from March 2022 to July 2022. It will comprise several phases including data collection, quality assurance and the computation of results.

2.2.1 Phase 1: Data collection

Banks are required to complete the template and produce results based on the instructions set out in this document.⁴

Banks are responsible for ensuring that the data and templates submitted are correct, verified appropriately and meet the standards set out in this document, and that the format and structure of the official version of the templates distributed by the ECB are not altered.

2.2.2 Phase 2: Quality assurance

During the quality assurance phase, the ECB will analyse the information submitted by banks to ensure that the submissions are i) of a satisfactory quality, ii) aligned with the instructions set out in this document, and iii) provide comprehensive and reliable results for the prescribed assumptions and scenarios. This analysis will include checks to ensure adherence to the instructions and will draw comparisons with peer benchmark data and challenger views as appropriate.

⁴ In conjunction with any technical clarifications issued via the official communication channels for this exercise (for example, the FAQ portal).

Banks will be requested to address quality assurance queries raised in relation to the information provided. The ECB may require banks to adjust their inputs, perform further analysis or provide supporting evidence to substantiate their results.

During this phase, the ECB will communicate closely with the banks to clarify any pending issues.

3 Instructions on how to fill in the templates

The climate risk stress test consists of three modules: Module 1 is a qualitative questionnaire and is described in Section 3.1; Module 2 requests banks to calculate climate metrics and is described in Section 3.2; Module 3 represents the bottom-up stress test projections, for which the methodology is presented in Section 3.3.

All significant institutions participating in the 2022 climate risk stress test exercise are subject to Module 1 and Module 2⁵.

The ECB identifies a subset of participating banks that it expects to conduct Module 3. However, in order to establish a starting point, **all banks participating in the 2022 climate risk stress test exercise are expected to submit the required information for Module 3.**

Given that all three modules constitute interrelated parts of a single stress test exercise, institutions are expected to submit the required information for Module 1, Module 2 and Module 3 (depending on applicability) simultaneously. The exercise will be conducted at the consolidated level of each institution.

3.1 Module 1: Qualitative questionnaire

3.1.1 Instructions

The purpose of this module is to gain an illustrative overview of the institution's internally available stress testing capability and capacity including its climate risk stress testing framework, management and modelling practices. The questions in this survey concern qualitative information on the institution's current practices, i.e. based on the bank's status quo at the point in time when this stress test is performed. Where a question refers to an institution's future plans, this is clearly indicated. Institutions must answer the questions in the template provided, largely through pre-defined drop-down menus. For the first submission cycle, banks are not asked to provide any supporting documentation. In case of need, occasional and tailored requests for supporting documentation may be requested from banks during the quality assurance process for Module 1.

The questionnaire comprises 11 blocks. Blocks 1 to 10 concern the **day-to-day** internal stress testing framework of the institution, while Block 11 concerns **the assumptions developed by the bank in the context of the 2022 climate risk stress test exercise.**

⁵ Not applicable to cases for which the Supervisory Board has granted exceptions.

Block 1. **General climate risk stress test**: General questions regarding the existence and use of climate risk stress testing within the institution.

Block 2. **Climate risk stress test governance and risk appetite**: Governance structure of the bank's climate risk stress test and the integration of the climate risk stress test results into the risk appetite framework of the bank.

Block 3. **Integration of the climate risk stress test into the institution's long-term business model strategy**: Use of the results from the climate risk stress test in the strategy, loan granting process and product pricing or capital requirements of the institution.

Block 4. **Stress test methodology**: Assumptions, transmission channels and portfolios used in the climate risk stress test.

Block 5. **Stress test scenarios**: Scenarios used by the bank in the climate risk stress test, for example for physical and/or transition risk.

Block 6. **Data**: The role of data (availability/sources) in the climate risk stress test framework of the institution.

Block 7. **ICAAP**: Integration of the climate risk stress test in the Internal Capital Adequacy Assessment Process (ICAAP) of the institution.

Block 8. **Future plans regarding climate risk stress testing and interaction with other priorities**: Plans to further improve climate risk stress test capabilities and the respective priorities.

Block 9. **Involvement of the internal audit function in the climate risk stress test**: Involvement of the third line of defence in the internal climate risk stress test.

Block 10. **Application of parent company climate risk stress test framework**: Applies to EU subsidiaries of non-EU institutions and explores their climate risk stress test framework.

Block 11. **Bottom-up stress test**: Assumptions applied by the institution when making the bottom-up climate risk stress test projections and some additional aspects of the projections under Module 3.

The questions in the first ten blocks of the survey as well as questions 55, 56, 57 and 78 of Block 11 are mandatory for all participating banks. **The remaining questions in Block 11 are only mandatory for banks that provide projections in the bottom-up stress test for Module 3.**

Questions related to the overall stress test framework applied by banks follow the EBA Guidelines on institutions' stress testing, Section 6.5 of the ECB Guide on climate-related and environmental risks and the EBA Report entitled "On management and supervision of ESG risks for credit institutions and investment firms".

Definitions: Where a term is not defined in this document and the meaning is unclear, please refer to the EBA Guidelines on institutions' stress testing and the EBA Report

on management and supervision ESG risks for credit institutions and investment firms. If in doubt, banks should contact the ECB's helpdesk.

Please note that the questionnaire was developed to address the needs of the 2022 climate risk stress test exercise and is not intended to bring forward any regulations.

Annex A.1 contains the list of questions.

3.2 Module 2: Climate risk metrics

3.2.1 General instructions

In the 2022 climate risk stress test exercise, all banks are requested to provide a set of common climate-related metrics, following the guidelines set out in the respective section (Section 3.2.2).

3.2.2 Detailed instructions and metric definition

Banks are requested to fill in the templates on Module 2, which focuses on two climate risk metrics. The metrics have been designed to shed light on banks' analytical and data capabilities regarding climate risk. More specifically, the metrics provide insights into the sensitivity of banks' income to transition risk, their exposure to carbon-intensive industries and, in that sense, the sustainability of the banks' business model. The designed metrics give banks the opportunity to start building their databases and collecting climate-related data that will help them meet future regulatory requirements.⁶

Banks are asked to **split their corporate exposures** between **22 industries** at the **NACE two-digit**.⁷ Annex A.5 provides an overview of the industries.⁸ Banks should map (the exposures to) the corporate counterparties to one single sector based on its principle activity, i.e. the activity that generates the highest share of the counterparty's revenue.

Institutions are further asked to provide information in an accompanying **explanatory note on actions the bank has taken in the past to finance the green transition**. This entails providing information on, for example, de-risking high climate risk portfolios or selling green products. The objective of the explanatory note is to give banks the opportunity to provide further information and put the information as provided for in this stress test into additional context. Banks are encouraged to map the above-mentioned actions by sector. In addition, banks can include forward-looking information on how their planning in the short to medium term contributes to financing

⁶ See, for example EBA proposal on technical standards on Pillar 3 disclosures of ESG risks.

⁷ For definitions of NACE industries, see [Statistical Classification of Economic Activities in the European Community, Rev. 2 \(2008\)](#), Eurostat.

⁸ The industries are also specified in the Excel template.

the green transition. These plans can go beyond “solely” balance sheet adjustments. Banks are asked to provide the information in a concise and meaningful way.

3.2.2.1 Metric 1: Interest, fee and commission income from greenhouse gas intensive industries

To measure the sensitivity of banks’ business models to greenhouse gas (GHG) intensive sectors, as a proxy for the implications of transition risk, banks are asked to map their income and expenses according to a pre-defined list of NACE sectors.⁹ The reported information will be used to construct various metrics to measure the bank’s reliance on income stemming from GHG intensive industries and provides a proxy for the sustainability of the bank’s business model.

The scope of this metric encompasses the interest, fee and commission income from non-financial corporations **domiciled in both EU and non-EU countries**. The definitions of interest income and fee and commission income should be in line with the financial reporting framework (FINREP) and relate solely to **non-financial corporations** (according to Commission Implementing Regulation (EU) No 680/2014).¹⁰

For these non-financial corporations, banks should provide the gross interest income and the gross fee and commission income for each sector listed in the data template (based on NACE Rev. 2). In addition, banks should provide the total volumes to non-financial corporations which generate the interest income and fee and commission income for each sector listed in the data template. These volumes are, inter alia, the underlying loans and advances that generate the interest and fee and commission income. Underlying exposures, as part of these volumes, must be reported on a gross carrying amount basis.

This metric is calculated only for the activities and related NACE sectors within the scope of this exercise as pre-defined in the data template. Income from EU corporates should be filled in separately for each EU country, while income from non-EU corporates can be aggregated as non-EU. The country of the counterparty refers to the country of incorporation of the obligor or, if different, the country of the underlying risk, i.e. on an ultimate-risk basis.

If the corporate counterparty is a (financial) holding company, banks must report the pro-rata income and the volume generating the income from the three major headings of the NACE sector allocation as described above (i.e. in the three respective sectors). The residual of the income/volume must be reported in the Other industries bucket. The Other industries bucket is solely to be used for providing information on financial holding companies. Banks are encouraged i) to consult the holding company’s financial statements, and/or ii) consult directly with the holding company.

⁹ For the list of industries, see Annex 5.

¹⁰ [Commission Implementing Regulation \(EU\) No 680/2014 of 16 April 2014 laying down implementing technical standards with regard to supervisory reporting of institutions according to Regulation \(EU\) No 575/2013 of the European Parliament and of the Council \(OJ L 191, 28.6.2014, p. 1\).](#)

Institutions should include as many countries as needed to cover at least 80% of gross interest income and gross fee and commission income. In order to limit the scope of the exercise and the required analysis, the maximum number of countries is limited to five if the 80% coverage threshold is not achieved with five countries. If exposures to an industry (as defined in Annex A.5) constitute less than 0.05% of the bank's total assets as reported in FINREP (F01.1), the bank is not required to report the information related to this industry.

The reference period for the income and expenses data collection is the sum of the time-weighted notional of instruments¹¹ that were on the bank balance sheet from 1 January 2021 to 31 December 2021 (quarterly average, Q1 2021 to Q4 2021).

3.2.2.2 Metric 2: Financed greenhouse gas emissions

To measure exposure to carbon-intensive industries, each bank is expected to provide the necessary data to calculate a weighted average GHG intensity metric. This will provide an indication of the climate-related risk in the bank's non-financial corporations portfolio. The metric will rely on Scope 1, 2 and 3 GHG emissions¹² of the counterparties within the scope of this metric. Scope 1, 2 and 3 GHG emissions provide important information for the mapping of direct and indirect emissions. The first part of the metric shows the extent to which the bank accounts for a portion of the corporate counterparty's annual emissions. The final calculation of the metric then provides an overview of the emissions financed by the bank via its corporate portfolio. Building upon these classifications, Metric 2 will provide an important proxy for the extent to which banks are financing emissions and how exposed they are to emission-intensive companies.

The metric encompasses corporate exposures to non-SME non-financial¹³ obligors, treated under both the internal ratings-based (IRB) approach and the standardised approach (STA). For the purpose of the exercise, banks need to report the top 15 largest counterparties by NACE sector in terms of the bank's exposure. Under both the IRB and the STA approaches, **non-SME corporate** exposures to non-financial corporations should be defined in line with the definitions of corporates (according to point (c) of Article 147(2) and point (g) of Article 112 of the Capital Requirements Regulation (CRR)¹⁴) excluding small and medium-sized enterprises (SMEs). If the bank does not have 15 exposures under a certain NACE sector, the bank will report up to the number of non-SME corporate counterparties to which the bank is exposed.

For the purpose of this metric, a counterparty shall be defined as the **direct counterparty** to which the bank has the exposure outstanding. If the required

¹¹ The time-weighted notional of an instrument is defined as the notional of the instrument times the fraction of the year in which the instrument was on the balance sheet.

¹² For a definition of Scope 1, 2 and 3 GHG emissions, see [Climate reporting along the value chain, EMAS Newsletter](#), Issue 3, European Commission, October 2016.

¹³ Financial and insurance activities (NACE 2 Codes 64 to 66) are outside the scope of this exercise.

¹⁴ [Regulation \(EU\) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation \(EU\) No 648/2012 \(OJ L 176, 27.6.2013, p. 1\)](#).

information is not available for the direct counterparty, the bank can take the information from the ultimate parent undertaking.¹⁵ The exposure to a counterparty shall then be the sum of exposures to the ultimate parent undertaking and all its subsidiaries. Banks must identify in their explanatory note the exposures and emissions reported under the parent company approach.

If the corporate counterparty is a **holding company**, banks must report the pro-rata emissions from the three major headings of the NACE sector allocation as described above. To facilitate banks' efforts, the residual headings (in excess of the three reported) in the holding company shall be disregarded in the context of this exercise. Banks are encouraged to: i) consult the holding company's financial statements; and/or ii) consult directly with the holding company.

If a sector contributes less than 0.05% to the bank's total assets reported in FINREP (F01.1), banks are not expected to report the information for this sector. In addition, within each sector a **materiality threshold of 1% of total non-SME corporate credit exposures by sector (i.e. by group of NACE codes as described in Annex A.5)** applies. Banks do not need to reach 15 counterparties if the next top counterparty displays an exposure below this threshold.

For exposures within the scope of this metric, banks should provide the following information for each counterparty within the industrial sectors listed in the data template (based on NACE Rev. 2):¹⁶

- the counterparty's identification code;¹⁷
- the bank's gross carrying amount¹⁸ to each counterparty;
- the counterparty's Scope 1 GHG emissions in tCO₂e;
- the counterparty's Scope 2 GHG emissions in tCO₂e;
- the counterparty's Scope 3 GHG emissions in tCO₂e;
- the counterparty's average revenue¹⁹ for the last three years (2018, 2019 and 2020).

In addition, banks are required to provide exposures to counterparties as a percentage of total exposure per NACE sector. The inclusion of Scope 1, 2 and 3 GHG emissions may lead to a potential double counting. As methods to exclude this are still evolving, banks are asked to report the requested data separately for Scope 1, 2 and 3 emissions.

¹⁵ Note that the purpose of the loan is not relevant for the metric, i.e. even if the bank provided an EU Taxonomy-compliant loan, the total emissions and revenues of the counterparty still need to be used.

¹⁶ For the list of industries, see Annex 5.

¹⁷ Banks should report the same identification code used in the reporting of Anacredit, making use of [the list of national identifiers](#).

¹⁸ The amount should be reported after credit risk mitigation substitution effects and accounting for conversion factors.

¹⁹ This refers to the total revenue of the counterparty.

For the purpose of this metric, the counterparty's Scope 1 GHG intensity is automatically calculated in the template according to the following definition:

$$\begin{aligned} & \text{Counterparty}_i \text{ S1 GHG intensity} \\ &= \frac{\text{Counterparty}'s_i \text{ Scope 1 GHG emissions}}{\text{Counterparty}'s_i \text{ average revenue for last three years}} \end{aligned}$$

With $i = 1, 2, 3, \dots, N$

And the targeted counterparties are:

$$\begin{aligned} & \text{S1 Targeted counterparties} \\ &= \text{Counterparties for which Scope 1 emissions are reported or available} \end{aligned}$$

$$\begin{aligned} & \text{S2 Targeted counterparties} \\ &= \text{Counterparties for which Scope 2 emissions are reported or available} \end{aligned}$$

$$\begin{aligned} & \text{S3 Targeted counterparties} \\ &= \text{Counterparties for which Scope 3 emissions are reported or available} \end{aligned}$$

The calculations for Scope 2 and Scope 3 follow the same approach.

Financed Scope 1 and Scope 2 GHG emissions are then defined as follows:

$$\sum_{\text{S1S2 Targeted counterparties}} \frac{\text{S1S2 GHG intensity} \times \text{Bank's exposure to counterparty}}{\text{Bank's total exposures to S1S2 Targeted counterparties}}$$

Where

$$\begin{aligned} & \text{Counterparty}_i \text{ S1S2 GHG intensity} \\ &= \sum_{i=1}^N \frac{\text{Counterparty}'s_i \text{ Scope 1 + 2 GHG emissions}}{\text{Counterparty}'s_i \text{ average revenue for last three years}} \end{aligned}$$

With $i = 1, 2, 3, \dots, N$

And the targeted counterparties are:

$$\begin{aligned} & \text{S1S2 Targeted counterparties} \\ &= \text{Counterparties for which Scope 1 and 2 emissions are reported or available} \end{aligned}$$

Including Scope 3 in the calculation, financed GHG emissions should be defined as follows:

$$\sum_{S1S2S3 \text{ Targeted counterparties}} \frac{S1S2S3 \text{ GHG intensity} \times \text{Bank's exposure to counterparty}}{\text{Bank's total exposures to S1S2S3 Targeted counterparties}}$$

Where

$$\begin{aligned} & \text{Counterparty}_i \text{ S1S2S3 GHG intensity} \\ &= \sum_{i=1}^N \frac{\text{Counterparty}'s_i \text{ Scope 1 + 2 + 3 GHG emissions}}{\text{Counterparty}'s_i \text{ average revenue for last three years}} \end{aligned}$$

With $i = 1, 2, 3, \dots, N$

And the targeted counterparties are:

$$\begin{aligned} & S1S2S3 \text{ Targeted counterparties} \\ &= \text{Counterparties for which Scope 1, 2 and 3 emissions are reported or available} \end{aligned}$$

In particular, the counterparty's revenue, as well as its Scope 1, 2 and 3 GHG emissions data, includes information from the counterparty's reporting, for example annual reports or sustainability reports. As an alternative, banks can use a data provider to obtain this information. As a fall-back option, if Scope 3 emissions data is not available, banks can use proxies to estimate Scope 3 emissions (see Box 1 on Scope 3 proxies). Banks are expected to be conservative in their use of proxies. In the event that Scope 1 and/ or Scope 2 data is not available at all for the corporate counterparty, the bank may exceptionally use estimations in this regard. The same holds true for counterparty's revenue data. Finally, banks must **submit an explanatory note** with details of their calculation approach (data sources used and, in the case of proxies, how these were derived). This also includes an explanation of why Scope 1, Scope 2 and/or revenue data is not available in the event that estimations are used.

The reference date for the required input parameter is 31 December 2020.

Box 1

Examples of Scope 3 GHG emission proxies

This box provides three examples of proxies that can be used to estimate Scope 3 GHG emission data for the individual corporate counterparties.* The following examples provide a non-exhaustive list and banks are encouraged to develop their own proxies.

Example 1: Average-sector based emissions. Scope 3 GHG emissions are estimated using industry average data. Data on the corporate's quantity, weight, or other unit of purchased goods and

services needs to be collected and multiplied with cradle-to-gate emission factors (e.g. tCO₂e per tonne of product) from industry average data.

Example 2: Physical activity-based emissions. Scope 3 GHG emissions are calculated using the primary physical activity data for the company's energy production or consumption and emission factors specific to that primary data. The Scope 3 emission factor can then be calculated using an appropriate calculation methodology or tool with verified emission factors expressed by physical activity (e.g. tCO₂e/MWh or tCO₂e/t of steel).

Example 3: Economic activity-based emissions. Scope 3 GHG emissions are based on the economic activity data (e.g. euro of revenue or euro of asset) from the counterparty. The emissions data can then be calculated using region or sector-specific average emission factors expressed by economic activity (e.g. tCO₂e/€ of revenue or tCO₂e/€ of asset).

* Examples are taken from the Global GHG Accounting and Reporting Standard for the Financial Industry.

3.3 Module 3: Bottom-up stress test projections

The purpose of this section is to describe the methodology and requirements for the starting point data and projections that banks must provide for the bottom-up stress test exercises targeting transition risk and physical risk. **All banks that are subject to Modules 1 and 2 also need to provide starting point information in the templates for Module 3.** For banks that have been granted a waiver of the requirement to submit their own bottom-up projections, the ECB will calculate the projections itself.

This exercise follows the definitions outlined in the ECB Guide on climate-related and environmental risks. **Climate-related and environmental risks are commonly understood to involve the following two main risk drivers:**

Transition risk refers to financial losses that an institution may incur, directly or indirectly, as a result of the process of adjustment towards a lower carbon and more environmentally sustainable economy. This could be triggered, for example, by a relatively abrupt adoption of climate and environmental policies, technological progress or changes in market sentiment and preferences.

Physical risk refers to the financial impact of a changing climate, including more frequent extreme weather events and gradual changes in climate, as well as environmental degradation, such as air, water and land pollution, water stress, biodiversity loss and deforestation. Physical risk is categorised as “acute” when it arises from extreme events, such as droughts, floods and storms, and “chronic” when it arises from progressive shifts, such as increasing temperatures, sea level rise, water stress, biodiversity loss, land use change, habitat destruction and resource scarcity. This can directly result in, for example, damage to property or reduced productivity, or indirectly lead to subsequent events, such as the disruption of supply chains.

The 2022 Single Supervisory Mechanism (SSM) climate risk stress test does not cover all the above-mentioned physical risk and transition risk channels.

Sections 3.3.1 and 3.3.2 outline the separate methodological approaches to assessing credit and market risks for transition and physical risk respectively, which are in scope of this stress test. Section 3.3.3 describes the methodology for assessing operational and reputational risks stemming from both transition and physical risk events.

3.3.1 Transition risk

This stress test covers banks' potential financial losses in both short-term and long-term transition risk scenarios. First, it assesses banks' **short-term vulnerabilities** in a **three-year disorderly transition scenario** triggered by a sharp increase in the price of carbon emissions. The objective of this analysis is to identify potential vulnerabilities connected to a disorderly transition that may materialise in the short term. The scenario should be considered as severe but plausible in order to detect tail risks.

Second, it assesses banks' **longer-term strategies** when confronted with **three different transition scenarios over a 30-year horizon**. The transition towards a more carbon-neutral economy can take different paths. The objective of this analysis is to shed light on banks' strategic choices in these different long-term scenarios. Specifically, different parts of banks' exposures may be vulnerable, depending on the scenario. The objective is to obtain better insights into the different long-term risks.

The stress test considers the impact of transition risk based on **credit risk** and **market risk**. A **static balance sheet** is assumed in assessing the short-term vulnerabilities, whereas a **dynamic balance sheet** is assumed for the long-term strategy.

While transition risk is expected to impact carbon-intensive exposure in the first place, banks are also encouraged to consider whether exposures to "green industries" carry an increased credit risk, as the respective industry sector may be subject to uncertainty in terms of future technology paths, increased competition or over-funding and hence too many players ("green bubble").

The purpose of this section is to provide (i) a general description of the transition risks covered, (ii) the transmission channels of the risks, (iii) guidance on the potential approach that banks may follow when developing the working assumptions, (iv) output variables, and (v) reference sources for the scenarios.

3.3.1.1 Vulnerabilities in a disorderly transition

While an orderly transition to a low-carbon economy is characterised by a predictable adjustment path, a disorderly transition might cause significant challenges for banks. Most notably, a **sharp and unexpected** increase in the price of carbon emissions or other non-price measures to curb emissions will hit carbon-intensive sectors directly and other parts of the economy indirectly through production chains and second-round effects. Such a shock affects banks through their credit and market risk exposures to

carbon-sensitive sectors. This exercise assesses banks' vulnerability to a **disorderly sharp increase in carbon prices, taking credit and market risk into account**.²⁰

The exercise is inspired by the **disorderly transition scenario** developed by the Network for Greening the Financial System (NGFS).²¹ Under this scenario, policy measures to reduce carbon emissions are delayed. For governments to still achieve the Paris Agreement targets, a sharp and unexpected increase in the price of carbon is needed. In the NGFS's disorderly scenario, this sharp increase takes place around 2030. **However, this exercise assumes that the increase in the carbon price occurs in 2022, along with the associated effects on the economy**. Importantly, this event needs to be considered as a tail risk analysis rather than a benchmark scenario. The aim of the hypothetical tail risk event is to **assess the sensitivity of banks' current balance sheets** to unexpected sharp measures to curb carbon emissions in the near term.

The exercise consists of **two key steps**. First, all participating banks are asked to provide **starting point values** for credit and market risk. Second, banks subject to Module 3 are asked to make **projections** for these two types of risk. Insofar as possible, the EBA's methodology for the 2021 EU-wide stress test²² is followed, with the deviations clearly described below. Module 1 contains several specific questions on the starting points and projections (see Annex A.1).

Credit risk exposure classification

The credit risk exposures in scope are an institution's **mortgage** and **corporate** exposures as defined below. Institutions should include as many countries as needed to cover at least 80% of their joint mortgage and corporate exposures. In order to limit the scope of the exercise and the required analysis, the maximum number of countries is limited to five if the 80% coverage threshold is not achieved with five countries.

When a bank's **exposures to an industry** (as defined in Annex A.5) constitute less than 0.05% of the bank's total assets reported in FINREP (F01.1), the bank is not required to report the information related to this sector.

Whenever reference is made to exposure value, this is the exposure that forms the basis for computation of the risk exposure amount (REA), according to common reporting framework (COREP) definitions, as set out in Article 111 of the CRR (for the STA portfolio) and Articles 166 to 168 of the CRR (for the IRB portfolio). For the purpose of all projections related to Module 3, IRB and STA portfolios are combined into a single portfolio. The exposure should be reported after credit risk mitigation substitution effects and accounting credit conversion factors, and should be allocated in line with COREP exposure classes. The principles outlined in paragraphs 97 and 98

²⁰ The methodology considers the carbon price as a summary variable which captures all costs (for example taxes and environmental standards) that increase the direct and indirect costs of production associated with carbon emissions.

²¹ For a high-level description, see [NGFS Climate Scenarios for central banks and supervisors](#), NGFS, June 2021.

²² See [2021 EU-Wide Stress Test – Methodological Note](#), EBA, 29 January 2021.

of the EBA's 2021 EU-wide stress test methodological note should be applied.²³ The country of the counterparty refers to the country of incorporation of the obligor or, if different, the country of the underlying risk, i.e. an ultimate-risk basis. This provision holds for the rest of the Module 3 projections.

The **mortgage portfolio** encompasses the IRB asset class Retail – Secured by real estate property – Non-SME portfolio and the STA asset class Secured by mortgages on immovable property – Non-SME.

Corporate exposures are split into three portfolios, namely 1) corporate exposures not secured by real estate property, 2) corporate exposures secured by real estate where the collateral is within the scope of the Energy Performance Certificate (EPC)²⁴, and 3) corporate exposures secured by real estate where the collateral is not within the scope of the EPC (Table 1).

²³ [2021 EU-Wide Stress Test – Methodological Note](#), EBA, 29 January 2021. Mortgages and corporate loans which are securitised through a structured entity in which the bank has a controlling interest are part of the consolidated balance sheet and should be included as well. Specifically, covered bonds issued by banks with residential or commercial real estate as collateral and with the bank bearing the credit risk are within the scope of mortgage and corporate exposures secured by real estate.

²⁴ Although EU legislation sets out broad definitions of real estate within the scope of the EPC, the detailed requirements can be determined at the national level. In general, commercial real estate consisting of, for example, office space, multi-family rentals and retail space would be in scope of the EPC.

Table 1

List of credit risk portfolios in the stress test and corresponding CRR portfolio definitions

Portfolios in template	CRR portfolio definitions
Mortgages	IRB – Retail – Secured by real estate property – Non-SME STA – Secured by mortgages on immovable property – Non-SME
Corporate exposures not secured by real estate	IRB – Corporates – Specialised lending – Not secured by real estate property IRB – Corporates – SME – Not secured by real estate property IRB – Corporates – Other – Not secured by real estate property IRB – Retail – Other retail – SME STA – Corporate – SME STA – Corporate – Non-SME STA – Retail – SME
Corporate – Secured by real estate – EPC	IRB – Corporates – Specialised lending – Secured by real estate property (the part with collateral within the scope of the EPC) IRB – Corporates – SME – Secured by real estate property (the part with collateral within the scope of the EPC) IRB – Corporates – Other – Secured by real estate property (the part with collateral within the scope of the EPC) IRB – Retail – Secured by real estate property – SME (the part with collateral within the scope of the EPC) STA – Secured by mortgages on immovable property – SME (the part with collateral within the scope of the EPC)
Corporate – Secured by real estate – non-EPC	IRB – Corporates – Specialised lending – Secured by real estate property (the part with collateral not within the scope of the EPC) IRB – Corporates – SME – Secured by real estate property (the part with collateral not within the scope of the EPC) IRB – Corporates – Other – Secured by real estate property (the part with collateral not within the scope of the EPC) IRB – Retail – Secured by real estate property – SME (the part with collateral not within the scope of the EPC) STA – Secured by mortgages on immovable property – SME (the part with collateral not within the scope of the EPC)

Banks are asked to **split their corporate exposures which are either not secured by real estate property or secured by real estate property not within the scope of the EPC** between **22 industries** at the **NACE two-digit** level.²⁵ Annex A.5 provides an overview of the industries.²⁶ A question in Annex A.1 asks banks to indicate what percentage of exposures they are able to allocate to industrial sectors at the NACE two-digit level.

With regards to the **mortgages and corporate exposures secured by real estate property within the scope of the EPC**, banks are asked to **break down their exposures by EPC rating**.²⁷ These ratings are categorised as A, B, C, D, E, F or G. Where an EPC rating is not available, banks may use an estimation approach to obtain the rating. If an EPC rating is still not available for a property, banks are

²⁵ For definitions of the NACE industries, see [Statistical Classification of Economic Activities in the European Community, Rev. 2 \(2008\)](#), Eurostat.

²⁶ The industries are also specified in the Excel template.

²⁷ For further information on EPCs, see, for instance, “Energy Performance Certificates”, [EU Buildings Factsheets](#), European Commission (click on Certification/Energy Performance Certificates).

requested to classify the corresponding mortgage in the “Unknown” category. Banks can use provisional EPC labels to classify their exposures if a final label is not yet available. If a label has a sign attached to it, the loan should be allocated to the letter label class (e.g. A+ should be allocated to A). When a label worse than G is observed (e.g. H or I), the loan should be allocated to the label category G.

For estimating the EPC rating, banks may have developed an internal methodology to determine the energy performance of the collateral used to secure mortgages and commercial real estate exposures. In this case, banks can classify loans that would otherwise be allocated to the “Unknown” category in the relevant EPC categories (A to G) based on their own methodology. The classification in EPC categories should be in line with national regulations. The methodology can be, for example, a model-based estimation of the EPC category based on collateral characteristics that determine energy use in kWh/m²/year, the use of proxies (see Box 1) or a representative sampling technique. Banks are encouraged to apply this approach in order to obtain a better understanding of the transition risks for mortgages without an official energy label. Banks must describe the approach taken (actual data, estimated data or combination) for the reporting of the EPC rating data in an accompanying explanatory note (maximum five pages). For each EPC-rating bucket, banks must indicate the percentage based on actual data and the percentage based on estimates.

The use of EPCs is mandatory within the EU,²⁸ but banks may also have mortgages or corporate loans secured by real estate property outside of the EU that falls within the scope of the EPC. In some countries such as the United Kingdom a similar system of EPC ratings is applied. In this case, banks can allocate the loans to the relevant label categories based on these classification systems. All exposures in countries without a similar system to that of the EU must be allocated to the “Unknown” category.

Box 2

Examples of EPC rating proxies

This box provides three examples of proxies that can be used to estimate the EPC rating for mortgages and corporate exposures secured by real estate property.

Example 1: Building period of the property. Banks can use the year the property was built to proxy the EPC rating, the assumption being that older buildings often have lower EPC-ratings. Banks can compare building years of buildings without an EPC rating with those for which the ratings are available to obtain an estimation of the EPC rating.

Example 2: Size of the property. Banks can use the size of the property (e.g. square metres) to proxy the EPC rating, the assumption being that larger buildings often use more energy. Banks can compare the size of buildings without an EPC rating with those for which the ratings are available to obtain an estimation of the EPC rating.

²⁸ Please note that EPCs are mandatory for new construction and for property transactions, but the implementation dates and precise requirements differ across EU countries.

Example 3: Energy costs of the property. Banks can use information on energy costs (e.g. costs in euro per square metre) to proxy the EPC rating, the assumption being that higher costs would lead to lower EPC ratings. Banks can compare the energy costs of buildings without an EPC rating with those for which the ratings are available to obtain an estimation of the EPC rating.

The scope of credit risk exposures covers all counterparties as defined above and all positions (including both on-balance-sheet and off-balance-sheet positions) exposed to risks stemming from the default of a counterparty, except for fair value positions, i.e. fair value through other comprehensive income (FVOCI) or fair value through profit or loss (FVPL). For the avoidance of doubt, FVOCI and FVPL positions are excluded from the estimation of credit risk losses.

Market risk exposure classification

The market risk exposures within the scope of the revaluation calculation are all **corporate bonds and stocks in the trading book (FVPL)**. The scope of the market risk stress methodology covers all equity and non-financial corporate bond positions under full or partial fair value measurement which are held with a trading intent, i.e. positions at FVPL. Associated hedging positions also fall within the scope of the analysis (for further details, see the section on fair value revaluation calculation).

Banks are asked to classify their bond and stock holdings by the same **22 NACE industries** as outlined above. The industrial sector of the bond or stock should be determined by the ultimate parent company. For example, a bond issued by a captive finance subsidiary of a car manufacturer should not be classified as a bond issued by a financial institution but as an exposure to a manufacturer of motor vehicles.

Similarly to the EBA methodology for the 2021 EU-wide stress test, banks can request the **trading exemption** provided that neither of the following conditions hold: the institution has at least one VaR model in place, approved by the competent authority under the CRR; the bank's total market risk capital requirement is greater than 5% of the total capital requirement.

Starting point values

For the credit risk component, banks are requested to provide the following starting point values broken down by country and portfolio as at **31 December 2021**: REA, Stage 1 exposure, Stage 2 exposure, Stage 3 exposure, Stage 1 provision stock, Stage 2 provision stock and Stage 3 provision stock. For loans secured by real estate property, the appropriate Stage 1 LTV, Stage 2 LTV and Stage 3 LTV²⁹ need to be provided along with the Stage 1 funded collateral, Stage 2 funded collateral and Stage

²⁹ Banks are required to report the loan-to-value (LTV) ratio for selected real estate-related exposure classes (IRB "Secured by real estate property" and STA "Secured by mortgages on immovable property").

3 funded collateral.³⁰ Please use the same scope of exposures for the calculation of the REA, i.e. FVOCI and FVPL positions are to be excluded when calculating the REA.

Banks need to provide the following within-year flows and parameters during 2021: Transition rates (TR) S1-S2, TR S1-S3, TR S2-S1, TR S2-S3, Loss given default (LGD) S1-S3, LGD S2-S3, Lifetime expected loss rate (LRLT) S1-S2, LRLT S2-S2, LRLT S3-S3, Cure rate S1-S3 and Cure rate S2-S3.

These starting point parameter values are estimates from banks' models, with the estimation based on the line-by-line decomposition of the portfolio as at the beginning of 2022 and using the most up-to-date information available on observed macroeconomic variables for 2021 (i.e. not considering stress test macroeconomic scenarios). The observed 2021 end-of-year macroeconomic data should be gathered from an official source. Whenever the actual values are still not available, the most up-to-date projected values for the end of 2021 should be used. In calculating the starting point parameters, the 2021 macroeconomic variables shall be assumed to remain flat, except for GDP. For example, consumer price indices shall be assumed flat at 2021 levels for every subsequent year (i.e. 0% inflation is assumed), and the same stands for nominal interest rates (i.e. they remain unchanged). To account for the current economic environment, banks are required to consider the GDP growth rate in the regular ECB/Eurosystem macroeconomic projections (or equivalent official source for other regions) for the forward-looking path in the estimation of the starting point parameters that are relevant for lifetime losses, with an appropriate adjustment to allow for a margin of conservatism.³¹ Paragraph 111 of the 2021 EU-wide stress test methodological note provides further guidance in case of ambiguity.

For the market risk exposures, the total equity and corporate bond holdings disaggregated in accordance with the 22 NACE sectors need to be reported. In addition, potential hedges (derivatives) directly connected to the equity and corporate bond positions split into accounting hedges and economic hedges need to be reported. Please report both the fair value and the notional value of the holdings and derivative positions as at **31 December 2021**. For corporate bond exposures, banks also need to report the exposure-weighted residual maturity.

To avoid any doubt, the above-mentioned values should be reported as produced by the internal systems of the banks to meet their regulatory and accounting obligations.

³⁰ Banks should follow paragraph 66 of the 2021 EU-wide stress test methodological note to determine the funded collateral values. "Funded collateral covers all funded collateral, including real estate property, that is available to cover [Stage 1, Stage 2 or Stage 3 exposures]. Only CRR/CRD-eligible collateral and only the bank's share of collateral (if collateral is assigned to several debtors) is to be reported. No regulatory haircuts should be applied, but the value of collateral should be adjusted by haircuts applied for accounting purposes in the banks' internal calculation of provisions (if any). Collateral must be capped at the exposure level, which means that, at the exposure level, collateral cannot be higher than the corresponding exposure. All CRR/CRD-eligible collateral is to be reported regardless of the credit risk mitigation approach or regulatory own funds requirement calculation approach. Banks are required to provide in the explanatory note detailed information on how the collateral values have been determined and how often appraisals are refreshed. Provisions on IFRS 9 exposures should be calculated based on internal definitions of the collateral available while REA should be calculated considering the regulatory treatment of collateral."

³¹ The approach to lessening an already stressed economic environment for the starting point calculation might be subject to change, depending on economic developments in 2021.

Methodological approach: short-term tail risk

The scenario calibration will be provided at a later stage. This section outlines key elements of the scenario.

For the purpose of this exercise, the stress test scenario takes the **NGFS disorderly transition scenario** as a starting point, assuming the disorderly transition to take place as of 2022. While carbon prices increase by about USD 100 over a three-year period in the period 2030-32 in the NGFS disorderly scenario, the stress test scenario assumes that this increase takes place in the period 2022-24. A disorderly transition taking place in 2022 can be considered to be a tail risk, but has the advantage of testing the vulnerability of current exposures to such a disorderly transition.

The carbon price is applicable for all GHG emissions and scaled by the relevant CO₂-equivalence factors (the same principle applies throughout the following paragraphs, where relevant). While carbon prices increase by about USD 100 over a three-year period in the NGFS disorderly scenario, the stress test scenario assumes that the carbon price shock is **frontloaded** to simplify the market risk calculations.

The ECB will provide banks with information on GDP, the inflation rate, the unemployment rate and housing prices for all EU countries, which will be complemented by information on selected non-EU countries. In addition, the scenario provides details on stock price and bond price shocks disaggregated by industrial sector and, in the case of bonds, also disaggregated by credit rating. Exchange rates remain fixed at their 31 December 2021 values over the full scenario horizon. A full list of scenario variables is provided in Annex A.4.

Expected credit loss projections

Banks are required to forecast credit impairments resulting from the materialisation of two separate scenarios (baseline and adverse) based on IFRS 9 as prescribed in the methodology laid down in this section unless they are subject to nGAAP. For specific guidelines for nGAAP banks, see Annex A.3. The same principle is applied throughout all relevant paragraphs of the document unless stated otherwise.

For the credit loss projections, banks are expected to provide the following projections of within-year flows and parameters: TR S1-S2, TR S1-S3, TR S2-S1, TR S2-S3, LGD S1-S3, LGD S2-S3, LRLT S1-S2, LRLT S2-S2, LRLT S3-S3, Cure rate S1-S3 and Cure rate S2-S3 as defined in the credit risk section of the 2021 EU-wide stress test methodological note and stock of provisions. In order to calculate lifetime credit risk parameters banks should assume perfect foresight. Paragraph 131 of the 2021 EU-wide stress test methodological note sets out the main pillars of the approach. In particular, the adverse scenario credit risk parameters (i.e. stage transition probabilities and the corresponding loss rates across stages) for S1 and S2 exposures are assumed to revert to the baseline parameters after the stress period.

The Excel sheet will automatically calculate the end-of-year stocks and the next year's starting values. As in the EBA stress test, banks should assume no recoveries from

Stage 3, i.e. S3-S1 and S3-S2 are equal to zero. Projecting REAs for the stress test horizon is not within the scope of the exercise.

Banks are asked to provide projections **for both the disorderly transition scenario and the baseline scenario** and to fill in the results in the respective cells in the Excel template. For the baseline scenario, banks should use the projections from the **December 2021 Eurosystem Broad Macroeconomic Projection Exercise (BMPE)** to the extent that their internal models require these variables as input. Where the BMPE projections do not cover the relevant country, institutions should use the projections from the country's central bank or other official sources. Since a projection of the carbon price is not available in the BMPE projections, for simplicity a flat carbon price at the level of 31 December 2021 should be assumed over the projection horizon. Banks should assume a **static balance sheet**, i.e. replacing maturing loans with loans and collateral of similar credit quality and maturity over the three-year projection horizon **2022-24**.

Banks can use their internal models to assess how their credit risk parameters are affected by the scenario. For example, this can be captured via an appropriate profitability/cost function for the counterparty and the historical GHG emissions with which the direct impact of the CO₂ price increase could be modelled. The fundamentals of how the bank's models capture the relevant scenario transmission channels should be outlined in the explanatory note. Specifically, the credit risk parameters will be affected by the stressed profitability and/or deterioration of creditworthiness of counterparties. For example, the increase in carbon prices pushes up the probability of default (PD) of companies that rely heavily on GHG emissions for their operations. Furthermore, the LGD will be affected if the value of a firm's assets is directly or indirectly affected by the increased costs of GHG emissions (e.g. petrol-powered cars, dairy farms, oil pipelines, etc.). For the projections of the credit risk parameters, banks are asked to consider both (i) the direct impact of the shock on their counterparties (e.g. rising costs due to the increasing carbon price), and (ii) the impact from the changes in the macro variables that accompany the carbon price shock (e.g. lower aggregate demand), which are given as part of the scenario.

Institutions are encouraged to conduct counterparty-level analysis insofar as possible in their projections. For example, available firm-level data and cash-flow analysis can be used as well as engaging directly with counterparties. Banks should indicate in their explanatory note the extent to which they used counterparty-level analysis for their credit risk projections.

In order to cover the entire portfolio, banks can apply some extrapolation and portfolio-level analysis. Specifically, exposures can be split into segments of corporates facing similar risks, and banks can extrapolate their assessment to the rest of the segment. Similar extrapolation techniques can be applied to cover exposures to SMEs.

Fair value revaluation calculation

Banks are asked to calculate how the **fair value of market risk exposures** in the scope of the exercise (see section above on market risk exposure classification) is affected by the carbon price shock. This change in fair value needs to be broken down by risk driver (equity, credit spread, interest rates, commodities, FX movements and other). Banks can use their internal models to assess how bonds and equities are affected, considering the variables provided in the scenario. To this end, banks should assume full transmission of the carbon price shock to their bond and equity portfolio by **1 January 2022** based on starting point values as at 31 December 2021. Bank are requested to perform fair value revaluation of associated hedging positions separately.

Associated hedging positions include all hedge-accounting portfolios designated to hedge positions measured at fair value (i.e. FVPL and FVOCI) or at amortised cost, with the exception of currency (FX) hedges. This includes fair value hedges and cash flow hedges (as set out in Paragraph 200 of the EBA's 2021 EU-wide stress test methodological note).

Specifically:

- (a) Hedge-accounting portfolios are defined in line with FINREP. Only the fair value changes of hedging instruments (cash flow hedges and fair value hedges) that qualify as hedge-accounting instruments under the relevant accounting framework (e.g. IAS 39 or IFRS 9) as of year-end 2021 are recognised as hedging effects from hedge-accounting instruments (as set out in Paragraph 210 the EBA's 2021 EU-wide stress test methodological note).
- (b) Fair value hedging instruments are items that are recognised as hedging instruments in a fair value hedge-accounting relationship under either IFRS 9 or IAS 39 (as set out in Paragraph 217 of the 2021 EU-wide stress test methodological note).
- (c) Cash flow hedging instruments are items that are recognised as hedging instruments in a cash flow hedge-accounting relationship under either IFRS 9 or IAS 39 (as set out in Paragraph 215 of the EBA's 2021 EU-wide stress test methodological note).

Hedges, including hedges measured at amortised cost which are not registered under the hedge accounting framework but economically related to bond and equity positions subject to the carbon price shocks can be included in the calculations. These positions should be reported on a best effort basis separately from positions related to hedge-accounting portfolios. Banks are requested to describe hedging strategies linked with positions vulnerable to carbon price shocks in their explanatory note and to report this information in a concise and meaningful way.

For the portfolio items (bonds and stocks) held for trading and related accounting and economic hedges, the revaluation has to be performed under the market risk factor shocks for both the hedged position and the hedging instrument separately (i.e.

positions cannot be netted prior to calculating the impact of the stress), as set out in Paragraph 201 of the EBA's 2021 EU-wide stress test methodological note).

3.3.1.2 Long-term strategic response

Climate change risks can pose significant long-term challenges for the European banking sector. A disorderly transition could affect a bank's credit exposure to vulnerable sectors and might result in significant revaluations of the bank's bond and equity holdings. However, a delayed transition might lead to increasing materialisation of physical risks, thereby weighing on long-term economic growth. While a near-term materialisation of transitional risks might hit banks that are ill-prepared, banks are able to adapt their business strategies to these challenges over the long term.

The objective of this part of the exercise is twofold: i) to encourage banks to develop capabilities in projecting risk parameters over the long run under transition scenarios; and ii) to understand the strategic thinking of banks regarding the evolution of their business mix over the full transition cycle assuming a dynamic balance-sheet. The proposed analysis is consistent with the ECB Guide which expects institutions "to consider adopting a longer time horizon for climate-related and environmental risks given the likelihood that they will mostly materialise in the medium to long term."

The ECB recognises the novel features of such an exercise. In particular, the ECB is aware that the dynamic balance sheet assumption may result in heterogeneities across banks. For example, they may not make the same strategic decision in the face of the trade-off between supporting a counterparty in transitioning or reducing exposures. This is therefore an expected feature of the exercise and the ECB will focus accordingly on the ability of banks to substantiate strategic choices and develop approaches to perform long-term assessments.

More specifically, the exercise considers **three long-term scenarios** based on the high-level **NGFS scenarios**. Each scenario spans a horizon from **the present day up to 2050**. The **first** scenario assumes an orderly transition with a **smooth reduction** in CO₂ emissions to achieve the carbon emission goals by 2050. The **second** scenario assumes a **disorderly transition** in which CO₂ **emissions do not decrease quickly enough until 2030**. This triggers a disorderly transition in the years thereafter in order to still achieve the emission targets by 2050. Finally, the **third** scenario **assumes a hot house world** in which CO₂ emissions are not reduced and the economy is confronted with the materialisation of increasing physical risks, resulting in GDP losses.

Banks are asked to outline their strategies under these three scenarios. More specifically, banks are asked to project their mortgages disaggregated by EPC and corporate exposures disaggregated by industry for reference dates at **ten-year intervals (2030, 2040 and 2050)**. The key differences from the previous short-term projections are twofold. **First, banks can change the dynamics of their balance sheet, thereby allowing them to adjust their portfolio to changing circumstances**. This portfolio adjustment needs to be aligned with the internal projected business strategy of the bank at least for the horizon covered by the bank's

business strategy. **Second, the credit risk projections will be less detailed.** The focus of these long-term projections is therefore less on obtaining precise estimates of credit risk parameters, and more on obtaining detailed insights into the resilience of banks' business models and their adaptability in different long-term transition scenarios. The questionnaire contains several specific questions on the starting points and projections (see Annex A.1).

Scope, exposure classification and starting point values

Recognising the novel features of this exercise, banks are asked to concentrate their efforts on their primary country of loan activity as determined under the short-term transition analysis. Since the same credit risk exposures are in scope as outlined in Section 3.3.1.1 and the same starting point values will be used as in Section 3.3.1.1, it is not necessary to report these again. The Excel sheet automatically links the relevant starting point values. Market risk is not within the scope of the long-run exercise.

Methodological approach: long-term transition pathways

The three transition risk scenarios are based on the NGFS' three representative scenarios. The first "Orderly" scenario assumes early, ambitious action to transition to a net zero CO₂ emissions economy. The second "Disorderly" scenario assumes action that is late, disruptive, sudden and/or unanticipated. The third "Hot house world" scenario assumes that limited action leads to a hot house world with significant global warming and, as a result, strongly increased exposure to physical risks.

Annex A.4 contains a list of scenario variables that will be provided by the ECB to perform the projections. These scenario variables are in line with the scenario calibrations provided by the NGFS, accompanied by some further details on sectoral developments.

Dynamic balance sheet development

Given the purpose of this exercise, a static balance sheet is not appropriate for long-term projections covering almost 30 years. Therefore, banks are asked to project how their balance sheet will change in each of the three scenarios until 2050. The bank's exposures, restricted to the credit risk exposure classes mentioned in Section 3.1.1.1, need to be reported as at 2030, 2040 and 2050. Banks are asked to split their exposures into **performing** and **non-performing exposures**. To ensure consistency, in the context of this exercise **S1** and **S2** should be considered to be **performing** and **S3** to be **non-performing**.

When making their balance sheet projections, banks are invited to consider relevant criteria to ensure their plausibility. These criteria could be regrouped into two complementary categories: bank-specific strategy on the one hand and the bank's business environment linked to the scenarios on the other hand.

- Bank-specific strategy. Against the background set in the scenarios and public policies, banks can integrate their strategic approach in their reallocation decisions. Banks may consider the following non-exhaustive aspects for a given NACE code:
 - ability of the existing mix of clients to withstand transition costs and adapt to a low-carbon economy;
 - willingness to maintain a long-term relationship with existing clients and support their transition;
 - publicly announced commitments in exiting both certain economic activities and documented sectoral policies;
 - reputational risk concerns;
 - market position of the banks within the economic sector (for instance, if a bank is a key financing actor of a given economic activity, its ability to exit this sector could be limited).
- Business environment. When performing the reallocation of exposures by industry within the corporate portfolios, banks can consider sectoral developments (magnitude and time evolution) as described in the scenarios (such as the evolution of the value added by NACE code). Regarding portfolios secured by immovable properties, banks can account for the path of GHG emissions linked to buildings compatible with the relevant scenarios as well as government building energy efficiency policies (for instance renovation policies described in a national low-carbon strategy) to infer reallocation across EPC levels.

To focus on the reallocation of exposures across sectors and EPC segments, **banks should base their projection of the total size of the submitted balance sheet on the nominal GDP growth** provided in the scenarios.

Banks should specify whether their change in exposure to a specific industrial sector or EPC label is due to balance sheet growth or reallocation. Specifically, the amount specified as due to balance sheet growth is the expected exposure change without any reallocation, i.e. if total exposures to the portfolio “Corporate exposures not secured by real estate property” grow by 10% between 2021 and 2030, this growth is to be expected for exposures to all industrial sectors within this portfolio.

Banks are asked to report some of the main parameters summarising their balance sheet projections in each scenario and for each timestep. This information includes the number of sectors where banks increase/decrease their exposures (in proportion to the corporate portfolio), the average growth of associated exposures, and in relation to exposures secured by real estate EPC (corporate and mortgages), the average EPC of reallocated exposures. Finally, to capture the main strategic thinking behind reallocation decisions for each economic activity in the corporate portfolio, banks are requested to answer **qualitative questions in a dedicated worksheet**.

Banks are asked to provide projections for point-in-time PD, point-in-time LGD, and the stock of provisions for performing and non-performing exposures for the years 2030, 2040 and 2050. For this purpose, they may use their internal models, bearing in mind the connection between the scenario storylines and the risks they see in different sectors. Considering the challenges and the high degree of uncertainty of long-term estimates, banks will be asked to provide conservative credit risk parameters reflecting a view on expected long-term losses, while keeping these parameters aligned with their dynamic balance sheet assumptions.

To the extent that banks hold substantiated documentation on the adaptation plans of a given large corporate, they can include this information in their assessment of credit risk parameters. Banks are asked to provide this information and approach in their explanatory note how they integrated **without providing** the names of the respective corporates.

3.3.2 Physical risk

For the purpose of the 2022 climate risk stress test exercise, the assessment of physical risk will focus on two extreme weather events representing key climate risks in Europe: (1) **a large flood** and (2) **a severe drought and heatwave**. River flooding has historically been a major source of physical risk in Europe and, with an expected rise in precipitation, this risk is expected to increase. On the other hand, many Europeans are also being confronted with more frequent, more severe and longer-lasting droughts. These droughts often affect several areas in the economy, for example the transport infrastructure, agriculture and the availability of water for cooling.

With a view to keeping the exercise manageable, the scenarios will focus on the **direct impact of the physical risks on credit risk**. As such, banks are not requested to consider second-round effects linked, for instance, to losses borne by insurance companies. Broader macroeconomic implications beyond those described in this methodological note and risks beyond credit risk are outside the scope of the exercise. The analyses of physical risk will focus on a one-year projection horizon.

The objective of the exercise is to assess banks' vulnerabilities to two key physical risks in Europe. However, the exercise also provides banks with analytical frameworks that can be used for their internal stress test exercise if other physical risks or bank exposures are relevant beyond the purpose of the 2022 SSM climate risk stress test. The methodologies can be expanded to include a longer time horizon or to incorporate physical risk probabilities in a more distant future. However, to keep the current exercise manageable, these extensions are not within the scope of the 2022 SSM climate risk stress test. Furthermore, the current set-up allows both banks and the ECB to assess the vulnerabilities of banks' current balance sheets.

The purpose of this section is to provide: (i) a description of the physical risks covered; (ii) information on the risk transmission channels; (iii) guidance on the internal approach that banks may follow when developing the working assumptions; (iv) output variables; and (v) reference sources for the scenarios.

3.3.2.1 Drought and heat risk

Extended periods of hot weather and low rainfall can lead to sizeable output losses across several industrial sectors, for example the agricultural, manufacturing and construction sectors. Through their exposure to these vulnerable industries, banks might suffer relevant losses if drought and heat stress scenarios materialise. This exercise therefore aims to assess the vulnerability of banks to a scenario consisting of a severe drought and heatwave in Europe. It focuses on **credit exposure to firms**, as the associated losses on this part of banks' balance sheets appear to be the main transmission channel through which banks are affected by droughts and heat stress.

All participating banks are asked to provide starting point values for the part of their exposure that is classified as being prone to drought and heat risk. This gives a rough picture of the potential relevance of drought and heat risk across institutions. Next, banks subject to Module 3 are asked to project credit risk parameters for the drought and heat risk scenario to assess expected losses. The questionnaire contains several specific questions on the starting points and projections (see Annex A.1).

Exposure classification

Exposures in the STA and IRB exposure classes "Corporates" regrouped into a single portfolio are within the scope of the exercise. This also includes the exposure classes Retail – SME in the STA and IRB credit risk regimes. Unlike in the transition risk exercises, **only EU counterparties are in scope for drought and heat risk**. Institutions should include as many countries as needed to cover at least 80% of the corporate exposures to EU counterparties. In order to limit the scope of the exercise and the required analysis, the maximum number of countries is limited to five EU countries if the 80% coverage threshold is not achieved with five countries.

Table 2

List of credit risk portfolios in scope for drought and heat risk and corresponding CRR portfolio definitions

Portfolios in template	CRR portfolio definitions
Corporate exposures not secured by real estate	IRB – Corporates – Specialised lending – Not secured by real estate property
	IRB – Corporates – SME – Not secured by real estate property
	IRB – Corporates – Other – Not secured by real estate property
	IRB – Retail – Other retail – SME
	STA – Corporate – SME
	STA – Corporate – Non-SME
	STA – Retail – SME

Banks are asked to classify their credit exposure to counterparties broken down by NACE sector at the two-digit level.³² Annex A.5 lists the industries by NACE sector. In

³² For further information on NACE codes, see [Statistical Classification of Economic Activities in the European Community, Rev. 2 \(2008\)](#), Eurostat.

the event that **exposures to an industry** (as defined in Annex A.5) constitute less than 0.05% of the bank's total assets reported in FINREP (F01.1), the bank is not required to report the information for this sector.

Starting point values

Banks are asked to provide starting point values for their credit risk exposures and credit risk parameters as at 31 December 2021: REA, Stage 1 exposure, Stage 2 exposure, Stage 3 exposure, Stage 1 provision stock, Stage 2 provision stock and Stage 3 provision stock.

The following within-year flows and parameters during 2021 need to be provided: TR S1-S2, TR S1-S3, TR S2-S1, TR S2-S3, LGD S1-S3, LGD S2-S3, LRLT S1-S2, LRLT S2-S2, LRLT S3-S3, Cure rate S1-S3 and Cure rate S2-S3.

Methodological approach

In the drought and heat scenario, the entire EU is hit by a heatwave in 2022 which hampers economic activity and results in output losses for vulnerable industries.

For example, in this scenario farming industries are affected by crop failure and construction work is delayed as a result of extreme heat. The tourism sector is also negatively affected by the heat. In addition, energy producers suffer from the lack of available water for cooling; water transport is disrupted by low water levels in rivers, and forestry output declines due to heat and wildfires.

Based on this narrative, banks are provided with the value added³³ losses at the sectoral level for each EU country using the NACE sectors defined in Annex A.5. The calibration considers production chains in the economy to also capture the potential impact on industries which are indirectly affected. Annex A.4 contains a table with the variables to be provided.

For simplicity and manageability, the scenario assumes that the heatwave hits Europe on 1 January 2022. While this is arguably not a realistic date for a heatwave to occur, it has the advantage that end-of-year data can be used and the projection horizon can be limited to one year ahead.

In order to limit the scope of the scenario, only information for EU countries is provided. If banks need additional scenario information on macroeconomic variables, the December 2021 Eurosystem BMPE should be used to fill any gaps. The only exception is GDP growth in 2022, for which scenario-consistent figures are provided.

³³ "Value added" is a measure of the contribution of the industry to overall GDP. It is equal to the difference between an industry's gross output (consisting of sales or receipts and other operating income, commodity taxes and inventory change) and the cost of its intermediate inputs (including energy, raw materials, semi-finished goods and services purchased from all sources).

Expected credit loss projections

Using the information from the previous section, banks are asked to provide one-year-ahead projections for exposures, credit risk parameters (TR S1-S2, TR S1-S3, TR S2-S1, TR S2-S3, LGD S1-S3, LGD S2-S3, LRLT S1-S2, LRLT S2-S2, LRLT S3-S3, Cure rate S1-S3 and Cure rate S2-S3 as defined in the credit risk section of the EBA's 2021 EU-wide stress test methodological note) and the stock of provisions as at the end of 2022. The Excel sheet will automatically calculate the end-of-year stocks. As in the EBA stress test, banks should assume no recoveries from Stage 3, i.e. S3-S1 and S3-S2 are equal to zero.

Banks should assume a **static balance** sheet over this horizon, i.e. with maturing loans being replaced with loans and collateral of similar quality. Furthermore, banks should assume that exchange rates remain fixed at their 31 December 2021 values.

Importantly, banks should outline their assumptions on the role of insurance companies and public natural disaster relief schemes. Specifically, the insurance coverage needs to be clearly linked to the hazard outlined in the scenario above. Furthermore, the insurance/guarantee can be added after the date the loan was granted, but needs to be in place on 31 December 2021. Changes in coverage after this date are not permitted.

To account for the effect of insurance, banks can study the impact of past similar events on credit risk parameters of relevant samples of loans.³⁴ This impact will reflect the existing insurance coverage of related exposures, helping banks to infer assumptions for the projections requested in the exercise.

Banks should take into account public natural disaster relief schemes and private insurance cover when they project credit losses under heat/drought and flood events, as such support constitutes unfunded credit risk mitigation subject to compliance with the provisions of the CRR.³⁵

In general, banks are not expected include second-round effects in their projections. When projecting losses over the scenario horizon, banks should not include losses borne by the insurance company or government in their calculation. Specifically, where banks cross-sell insurance products and/or have an insurance entity at the holding level, losses should only be calculated for the consolidated banking entity.

In order to identify the additional losses generated by the drought and heatwave, banks are asked to calculate both **baseline projections** (i.e. **without the drought and heatwave**) and **stressed projections incorporating the drought and heatwave scenario**. In order to calculate the baseline projections, banks can use the macroeconomic projections from the **December 2021 Eurosystem BMPE** to the extent needed for their models. When calculating lifetime losses, banks should assume that current climate change trends are not affected by the heatwave in 2022.

³⁴ The paragraph to be further specified via FAQs; amendments may occur.

³⁵ As amended by Regulation (EU) 2019/876 (CRR2).

3.3.2.2 Flood risk

Floods can cause severe damage to buildings, thereby reducing the value of properties that banks use as collateral for loans. Through their exposure to flood-prone areas, banks might suffer significant losses if flood stress scenarios materialise. This exercise assesses banks' vulnerability to the hypothetical scenario of a severe flood in Europe. As the main transmission channel works through changes in the value of the underlying collateral, the exercise focuses on mortgage exposure to households and the part of a bank's exposure to firms that is secured by real estate.

All participating banks are asked to classify their exposure according to the associated flood risk and provide respective starting point values. This gives a rough picture of the potential relevance of flood risk across supervised banks. Banks subject to Module 3 are then asked to project expected credit losses on these specific portfolios under a flood scenario. The questionnaire contains several specific questions on the starting points and projections (see Annex A.1).

Exposure classification

All STA and IRB credit exposures with EU counterparties that are secured by real estate are within the scope of the exercise, meaning that only loans with real estate collateral are in scope. The portfolio **Corporate – Secured by real estate** encompasses the following IRB exposures “Corporates – Specialised lending – Secured by real estate property”, “Corporates – SME – Secured by real estate property” and “Corporates – Others – Secured by real estate property” in the corporate category and “Retail – Secured by real estate property – SME”. Under the STA, the portfolio includes “Secured by mortgages on immovable property – SME”. The **mortgages** portfolio includes the IRB exposures “Retail – Secured by real estate property – Non-SME” and STA exposures “Secured by mortgages on immovable property – Non-SME”. Table 3 provides an overview of the portfolios in scope. Institutions should include as many countries as needed to cover at least 80% of the mortgage and corporate exposures to EU counterparties secured by real estate. In order to limit the scope of the exercise and the required analysis, the maximum number of countries is limited to five EU countries if the 80% coverage threshold is not achieved with five countries.

Table 3

List of credit risk portfolios in scope for flood risk and corresponding CRR portfolio definitions

Portfolios in template	CRR portfolio definitions
Mortgages	IRB – Retail – Secured by real estate property – Non-SME
	STA – Secured by mortgages on immovable property – Non-SME
Corporate – Secured by real estate	IRB – Corporates – Specialised lending – Secured by real estate property
	IRB – Corporates – SME – Secured by real estate property
	IRB – Corporates – Other – Secured by real estate property
	IRB – Retail – Secured by real estate property – SME
	STA – Secured by mortgages on immovable property – SME

Banks are asked to classify their credit exposures to these counterparties in accordance with the **flood stress map** provided. The map disaggregates regions at the NUTS3³⁶ level into **no risk, low risk, medium risk and high-risk areas**.³⁷ The cells in the Excel template have two dimensions: (i) **country**, (ii) **flood risk category**. The match between the collateral and flood risk needs to be performed as precisely as possible. If a property is located at the intersection of two flood risk categories, banks should assign the loan to the **higher risk category**. Banks should use **the location of the collateral** as the relevant address for the flood risk. In the case of multiple-collateral loans, the loan exposures should be split according to the value of each collateral. **Uncollateralised exposures are not in scope**. In addition, exposures to EU counterparties where the underlying collateral is not located in the EU are **not in scope**. Moreover, exposures to non-EU counterparties are generally not in scope, even if the underlying collateral is located within the EU. For the classification, banks should follow Article 147 of the CRR.

Starting point values

Banks are asked to provide starting point values for their credit risk exposures and credit risk parameters as at 31 December 2021: REA, Stage 1 exposure, Stage 2 exposure, Stage 3 exposure, Stage 1 provision stock, Stage 2 provision stock and Stage 3 provision stock. For loans secured by real estate, the appropriate Stage 1 LTV, Stage 2 LTV and Stage 3 LTV need to be provided in addition to the Stage 1 funded collateral, Stage 2 funded collateral and Stage 3 funded collateral.

The following within-year flows and parameters during 2021 need to be provided: TR S1-S2, TR S1-S3, TR S2-S1, TR S2-S3, LGD S1-S3, LGD S2-S3, LRLT S1-S2, LRLT S2-S2, LRLT S3-S3, Cure rate S1-S3 and Cure rate S2-S3.

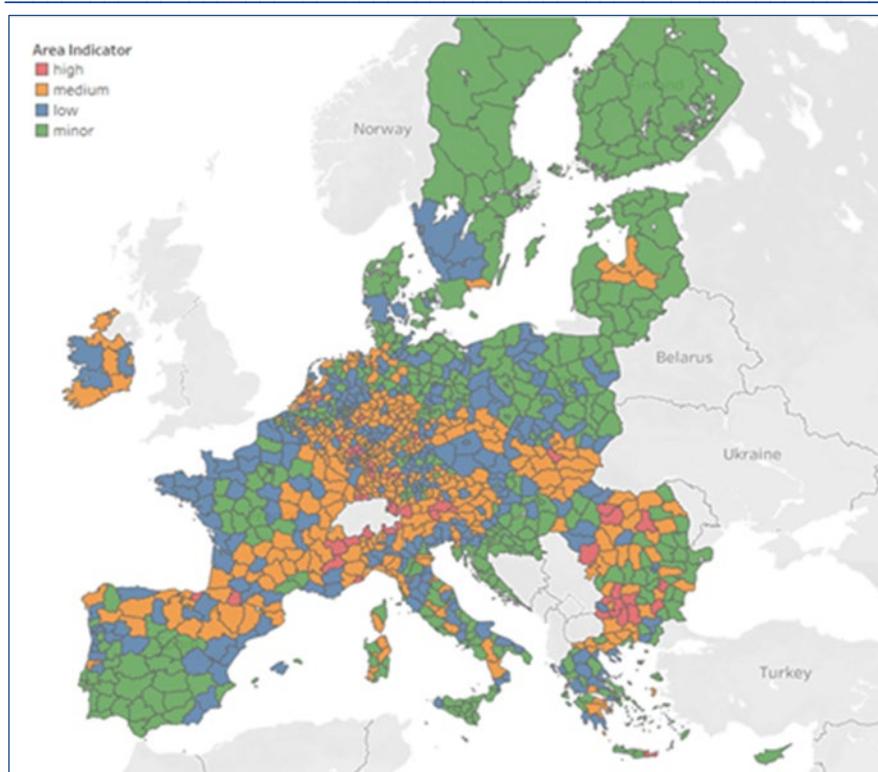
³⁶ For more detailed information on the regional classification system NUTS (Nomenclature of territorial units for statistics), see [NUTS MAPS](#) on Eurostat's website.

³⁷ If banks do not have NUTS3 location information directly available in their systems, they can use, for example, the postal code of the collateral to assign loans to a NUTS3 region using relevant postal code lists.

Methodological approach

In the flood scenario, the EU is hit by a severe flood which causes damage in a certain fraction of the areas at risk. For the purpose of this stress test, the ECB provides banks with a flood risk map³⁸ to calibrate a flood risk scenario. The risk map should only be used for this stress test and no rights can be derived from it. The flood risk map defines which regions are considered no risk, low risk, medium risk and high risk. The map disaggregates the regions at the NUTS3 regional level. For each NUTS3 region, the ECB provides the real estate price shocks that banks need to apply to the collateral value of properties in that region. Annex A.4 contains the variables which will be provided by the ECB.

Figure 1



In order to keep the exercise manageable, banks should assume that, in terms of **average PD, LGD and other risk characteristics**, the affected properties are similar to the average in the respective NUTS3 region.

For simplicity, banks can assume that other economic variables, such as GDP growth, the unemployment rate and interest rates, will be unaffected by the flood. In order to ensure a uniform economic scenario, banks should use the projections from the **December 2021 Eurosystem BMPE**. The economic trends in the four regions (no risk, low risk, medium risk and high risk) will all follow the aggregate national economic trends.

³⁸ Associated information at NUTS3 level will be provided to banks in a dedicated Excel file.

Expected credit loss projections

Using the information from the previous section, banks are asked to provide one-year-ahead projections for exposures, credit risk parameters (TR S1-S2, TR S1-S3, TR S2-S1, TR S2-S3, LGD S1-S3, LGD S2-S3, LRLT S1-S2, LRLT S2-S2, LRLT S3-S3, Cure rate S1-S3 and Cure rate S2-S3 as defined in the credit risk section of the EBA's 2021 EU-wide stress test methodological note) and the stock of provisions as at the end of 2022.

The Excel sheet will automatically calculate the end-of-year stocks. As in the EBA's 2021 EU-wide stress test, banks should assume no recoveries from Stage 3, i.e. S3-S1 and S3-S2 are equal to zero. In order to calculate lifetime credit risk parameters, banks can assume that the house price decrease is permanent, but that all other economic variables, except for GDP growth, remain constant. For GDP growth, the same assumptions as those described above for transition risk should be applied.

The calculations need to be made for the **baseline scenario (i.e. without a flood) and the flood scenario**. If banks require macroeconomic variables to calculate the baseline values, they can use the projections from the **December 2021 Eurosystem BMPE** as a baseline scenario. For simplicity and to focus the exercise on the direct flood losses, banks need to assume that the macroeconomic projections remain the same, except for the house price shocks indicated by the ECB.

Banks should assume a **static balance** sheet for the **one-year horizon**, i.e. with maturing loans being replaced with loans and collateral of similar quality. Furthermore, banks should assume that exchange rates remain fixed at their 31 December 2021 values.

For the calculation of the expected losses, banks should clarify their assumptions on the role of insurance companies and government guarantees in mitigating losses. Specifically, the insurance coverage needs to be clearly linked to the hazard outlined in the scenario above. The flood risk insurance needs to be linked to recovery of the losses from damage to the collateral. Furthermore, the insurance/guarantee can be added after the date on which the loan was granted but needs to be in place at the latest on 31 December 2021. No changes to the coverage are permitted after this date.

To account for the effect of insurance, banks can study the impact of past similar events on the credit risk parameters of relevant samples of loans.³⁹ This impact will reflect the existing insurance coverage of related exposures, helping banks to infer assumptions for projections requested in the exercise.

Banks should take into account public natural disaster relief schemes and private insurance cover when they project credit losses under heat/drought and flood events,

³⁹ The paragraph to be further specified via FAQs; amendments may occur.

as such support constitutes unfunded credit risk mitigation subject to compliance with the provisions of the CRR.⁴⁰

In general, banks are not expected include second-round effects in their projections. When projecting losses over the scenario horizon, banks should not include losses borne by the insurance company or government in their calculation. Specifically, if banks cross-sell insurance products and/or have an insurance entity at the holding level, losses should only be calculated for the consolidated banking entity.

In order to identify the additional losses generated by the flood, banks are asked to calculate both **baseline projections** (i.e. **without the flood**) and **stressed projections incorporating the flood scenario**. In order to calculate the baseline projections, banks can use the macroeconomic projections from the **December 2021 Eurosystem BMPE** to the extent needed for their models. When calculating lifetime losses, banks should assume that current climate change trends are not affected by the flood in 2022.

3.3.3 Operational and reputational risk stemming from climate-related and environmental events

Climate-related and environmental events could increase operational and/or reputational risks.⁴¹ Financial losses can stem directly or indirectly from climate-related legal claims (“conduct risk”), impaired business continuity due to extreme weather events such as droughts, floods and storms (“physical risk”) and reputational loss as a result of the public, counterparties and/or investors associating the institution with adverse environmental impacts (“reputational risk”).⁴² More specifically, the location and nature of the activities in which banks are involved can affect the risk of a negative financial impact arising from future reputational damage, physical damage and/or legal claims.

A negative financial impact can arise, for instance, when there is controversy about products owing to underlying investments with an adverse environmental impact. Furthermore, if an institution’s physical assets and/or critical infrastructure are located in an area which is prone to extreme weather events, direct losses from damage to physical assets and indirect losses from the disruption of services may occur. Moreover, providing finance to companies with significant polluting activities can be a driver of reputational risk for institutions. Finally, as rules and standards on sustainability may change over time, institutions may increasingly face compliance-related risks, such as reputational risks, stemming from climate-related and environmental issues.

⁴⁰ As amended by Regulation (EU) 2019/876 (CRR2).

⁴¹ For definitions of climate-related and environmental risks, see the ECB Guide on climate-related and environmental risks.

⁴² See Expectations 9, 9.1 and 9.2 in the ECB Guide on climate-related and environmental risks.

Although the ECB acknowledges the importance of the quantitative incorporation of operational/reputational risk into the climate risk stress test framework, for the purpose of this exercise, the ECB examines the topic via a qualitative questionnaire as described in tab “M3_Op_Rep_Assessment” of the climate stress test template.

Annexes

Annex A.1: Module 1 questionnaire (to be provided to banks in Excel format)

General climate risk stress test

1. Is climate risk currently included in the institution's stress test framework?
 - Yes
 - No
 - If Yes: [multiple answers possible]
 - Yes, as a portfolio-level stress test
 - Yes, as a sensitivity analysis
 - Yes, as a scenario analysis
 - If you answered "No" to Question 1:
2. Is the institution planning to include climate risk in its stress test framework?
 - Inclusion of transition risk in the stress test framework:
 - Yes, expected to be operational within 0-1 year
 - Yes, expected to be operational within 1-3 years
 - Yes, expected to be operational within 3-5 years
 - Yes, expected to be operational in more than 5 years
 - No
 - Inclusion of physical risk in the stress test framework:
 - Yes, expected to be operational within 0-1 year
 - Yes, expected to be operational within 1-3 years
 - Yes, expected to be operational within 3-5 years
 - Yes, expected to be operational in more than 5 years
 - No
3. What is the main reason why the institution does not include climate risk in its stress test framework?
 - Staffing
 - Insufficient knowledge
 - Data availability
 - Bank focused in previous years on the development of the climate risk management framework; a climate risk stress test framework is the next step
 - Lack of IT tools (financial, stress test-related)
 - Other reason, please specify [...]

4. If you answered “Data availability” to Question 3, in what part of the functioning of the institution’s climate risk stress test framework is data availability a limiting factor?
 - Designing scenarios
 - Mapping the institution’s assets
 - Other, please specify [...]

5. What steps will the institution take to respond to the data availability challenges identified in Question 3? [multiple answers possible]
 - Staff recruitment
 - Internal training and data enhancement activities
 - Improve data collection from counterparties
 - Engage with data providers
 - Other, please specify [...]

6. Does the institution take into account climate-related factors in other processes? [multiple answers possible]
 - Yes, for pricing
 - Yes, for credit approval
 - Yes, others, please specify [...]
 - No

7. Does the institution have a reverse climate risk stress test framework in line with the definition set out in the EBA Guidelines on institutions’ stress testing?
 - Yes
 - No
 - If Yes: [multiple answers possible]
 - Yes, including a total GHG emission target
 - Yes, including a CO₂ emission target
 - Yes, including a Paris Agreement target
 - Other, please specify [...]
 - If No:
 - No, but expected to be operational within 0-1 year
 - No, but expected to be operational within 1-3 years
 - No, but expected to be operational within 3-5 years
 - No, but expected to be operational in more than 5 years
 - No, and no date planned at this point in time

Climate risk stress test governance and risk appetite

8. Which business unit has developed or plans to develop the climate risk stress test framework?
 - Risk department
 - Dedicated stress test business unit
 - Other, please specify [...]

9. Which business unit within the institution runs or will run the climate risk stress test?
- Risk department
 - Dedicated stress test business unit
 - Other, please specify [...]
10. Which business unit validates the climate risk stress test framework?
- Onsite compliance unit
 - Risk department
 - Other, please specify [...]
11. Which other business units, in addition to the business units identified in Question 8, contribute to the climate risk stress test? [multiple answers possible]
- Research department
 - Business centres
 - Finance department
 - Trading desk
 - Another business area within the risk department
 - Other, please specify [...]
 - No interaction with other business units
12. Are the results of the climate risk stress test communicated across business lines and management levels? [multiple answers possible]
- Yes, communicated to the management body of the institution (“management body” as defined in point (7) of Article 3(1) of the Capital Requirements Directive (CRD V))⁴³
 - Yes, to other business lines, please select from drop-down list:
 - First line of defence
 - Second line of defence
 - Third line of defence
 - No
13. If you answered “Yes, communicated to the management body of the institution” to Question 12, please describe the composition of the management body within your institution (“management body” as defined in point (7) of Article 3(1) of CRD V)
- Free text answer
14. Does the institution disclose or intend to disclose any results of the climate risk stress test under Pillar III?
- Yes
 - No

⁴³ Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms (OJ L 176, 27.6.2013, p. 338).

15. Apart from internal reporting, to whom are the results of climate risk stress tests reported/published as part of the public disclosure under Article 449a of the CRR?⁴⁴ [multiple answers possible]

- Publicly, within any report
- Stakeholders
- Credit analysts
- Credit investors
- Rating agencies
- No public reporting
- Other, please specify [...]

Integration of climate risk stress test into institution's strategy

16. Are the results of the climate risk stress test framework considered when implementing the institution's business strategy?

- Yes, included in the decision-making process on pricing, granting loans or investing in certain business areas
- Yes, included in the risk limits or metrics (e.g. value at risk (VaR), exposure at default and expected loss) specified for business areas
- Yes, other please specify [...]
- No

17. Are the results of the climate risk stress test framework included in the loan granting process of the institution?

- Yes
- No

18. If you answered "Yes" to Question 17, how is this applied? [multiple answers possible]

- Applied to lending in certain sectors
- Applied to lending to certain clients
- Applied to holdings of bonds and/or equity
- Other, please specify [...]

Stress test methodology

19. Which risk types represent a transmission channel for climate risk within the climate risk stress test framework? [multiple answers possible]

- Credit and counterparty risks
- Securitisations
- Market risk
- Operational risk
- Conduct-related risk and associated litigation costs
- Liquidity risk
- Interest rate risk from non-trading activities
- Concentration risk
- Foreign exchange risk

⁴⁴ As amended by Regulation (EU) 2019/876 (CRR2).

- Strategic/business model risk
- Reputational risk
- Other, please specify [...]

20. Which portfolios are included in the climate risk stress test framework? [multiple answers possible]

- Corporate loans
- Retail household loans
- Retail SME loans
- Government exposures
- Derivatives
- Bonds and equity
- Commodities
- Securitisations
- Other, please specify [...]

21. Which mitigating actions does the institution include in its internal climate risk stress testing framework? [multiple answers possible]

- Hedging of positions with financial derivatives
- Insurance policies covering immovable property
- Insurance policies covering losses stemming from physical risk
- Insurance policies covering losses stemming from transition risk
- National schemes
- Other, please specify [...]
- None

22. For the modelling of climate risk, does the institution apply (or consider in the case of development) a static or dynamic balance sheet approach? [multiple answers possible]

- Static, both physical and transition risk
- Dynamic, transition risk
- Dynamic, physical risk
- Dynamic, both transition and physical risk
- No

23. If a dynamic balance sheet approach is used in modelling climate risk, at which level is the dynamic approach applied?

- Exposure class
- Sector level
- Other, please specify [...]

24. If reputational risk is part of your stress test framework, how is this being modelled and assessed?

- Via another transition risk channel, please specify [...]
- Operational risk
- Conduct risk
- Other, please specify [...]

Stress test scenarios

25. What kind of scenarios does the institution use in its climate risk stress test framework? [multiple answers possible]
- Publicly available scenarios, please specify [...]
 - Internally produced scenarios, please specify [...]
 - Third-party scenarios, please specify [...]
 - Combination, please specify [...]
 - No scenarios in place
26. Does the institution have baseline, medium and/or adverse climate risk scenarios in the climate risk stress test framework? [multiple answers possible]
- Baseline, specify number of scenarios [...]
 - Medium for physical risk, specify number of scenarios [...]
 - Medium for transition risk, specify number of scenarios [...]
 - Adverse for physical risk, specify number of scenarios [...]
 - Adverse for transition risk, specify number of scenarios [...]
 - No
27. What types of risk are included in the scenarios of the institution's climate risk stress test framework? [multiple answers possible]
- Physical risk
 - Transition risk
 - Liability and reputational risk
 - None
28. If you answered "Physical risk" to Question 27, which weather events are included in the physical risk scenarios? [multiple answers possible]
- Heat
 - Drought
 - Flood
 - Earthquake
 - Storm
 - Sea level rise
 - Chronic water stress
 - Extreme temperatures
 - Other, please specify [...]
29. What is the forecast horizon of the stress test projections for each extreme weather event identified in Question 28?
- Heat
 - 0-5 years
 - 5-10 years
 - 10-20 years
 - More than 20 years

- Drought
 - 0-5 years
 - 5-10 years
 - 10-20 years
 - More than 20 years
- Flood
 - 0-5 years
 - 5-10 years
 - 10-20 years
 - More than 20 years
- Earthquake
 - 0-5 years
 - 5-10 years
 - 10-20 years
 - More than 20 years
- Storm
 - 0-5 years
 - 5-10 years
 - 10-20 years
 - More than 20 years
- Sea level rise
 - 0-5 years
 - 5-10 years
 - 10-20 years
 - More than 20 years
- Chronic water stress
 - 0-5 years
 - 5-10 years
 - 10-20 years
 - More than 20 years
- Extreme temperatures
 - 0-5 years
 - 5-10 years
 - 10-20 years
 - More than 20 years
- Other, as specified in the answer to Question 28
 - 0-5 years
 - 5-10 years
 - 10-20 years
 - More than 20 years

30. If you answered “Transition risk” to Question 27, which sources of external risk are included in the institution’s climate risk stress test framework? [multiple answers possible]
- Policy risk
 - Technological innovation
 - Change in market sentiment
 - Other, please specify [...]
31. What is the forecast horizon of the stress test projections for each source of external risk identified in Question 30?
- Policy risk
 - 0-10 years
 - 10-20 years
 - More than 20 years
 - Technological innovation
 - 0-10 years
 - 10-20 years
 - More than 20 years
 - Change in market sentiment
 - 0-10 years
 - 10-20 years
 - More than 20 years
 - Other, as specified in the answer to Question 30
 - 0-10 years
 - 10-20 years
 - More than 20 years
32. If you answered “Transition risk” to Question 27, what type of variable is modelled in the climate risk stress test framework? [multiple answers possible]
- CO₂ emissions
 - Total GHG emissions
 - Translation of all risk factors into CO₂ emission equivalents
 - Energy certificate labels
 - Carbon (CO₂) price
 - Other, please specify [...]

Data

33. With regard to climate data availability for the institution’s climate risk stress test framework, what climate risk-relevant information on the bank’s counterparties is internally available to the relevant business areas of the institution? [multiple answers possible]
- Emissions data for corporate counterparties
 - Climate strategies and targets for corporate counterparties

- Energy label classification for real estate
- Likelihood of potential physical risk events (e.g. natural disasters)
- Estimates of the severity of potential physical risk events (e.g. natural disasters)
- Granular location data (not only location of headquarters but also of main manufacturing facilities)
- None
- Other, please specify [...]

34. What data can be observed directly from your counterparties (e.g. via dedicated questionnaires)? [multiple answers possible]

- Emissions data for corporate counterparties
- Climate strategies and targets for corporate counterparties
- Energy label classification for retail real estate
- None

35. What data need to be purchased from external data providers? [multiple answers possible]

- Emissions data for corporate counterparties
- Climate strategies and targets for corporate counterparties
- Energy label classification for retail real estate
- Likelihood of potential physical risk events (e.g. natural disasters)
- Estimates of the severity of potential physical risk events (e.g. natural disasters)
- None

36. Is the institution making use of any specific external data providers for the development of climate risk stress test models?

- Yes, please specify names of external data providers [...]
- No, but it is planning to do so
- No

37. In order to calibrate the climate risk stress test model, what data sources are used by the institution? [multiple answers possible]

- For physical risk, internally available historic data, please specify the time period [...]
- For transition risk, internally available historic data, please specify the time period [...]
- For physical risk, data (tools) from third parties, please specify [...]
- For transition risk, data (tools) from third parties, please specify [...]
- Other, please specify [...]

38. If you identify green exposures, are these based on the EU Taxonomy?

- Yes, using an internal taxonomy
- Yes, using a publicly available taxonomy, please specify [...]
- Yes, using a third-party taxonomy, please specify [...]
- No

ICAAP

39. Is the climate risk stress test framework included in the ICAAP of the institution as stated in the EBA Guidelines on institutions' stress testing?
- Yes, in a dedicated climate and/or environmental risk section
 - Yes, embedded in credit risk
 - Yes, embedded in operational and/or reputational risk
 - Yes, embedded in business and/or strategic risk
 - Yes, embedded in the liquidity operations
 - Yes, embedded in the market operations
 - Yes, embedded in business model analysis
 - Other, please specify [...]
 - No
40. Are the results obtained from the climate risk stress test framework included in the normative perspective and/or the economic perspective in ICAAP?
- Yes, normative perspective
 - Yes, economic perspective
 - Yes, both normative and economic perspective
 - No

Future plans regarding climate risk stress testing and interaction with other priorities

41. What steps will the institution take to enhance its climate risk stress test framework? [multiple answers possible]
- Staff recruitment
 - Improve data collection from counterparties
 - Engage with data providers
 - Other, please specify [...]
42. Has the turmoil related to the coronavirus (COVID-19) pandemic affected the institution's strategy regarding its climate risk stress test framework?
- Yes, moved focus to specific sectors
 - Yes, extended the considered time horizon
 - Yes, demonstrated the need to consider extreme events
 - Yes, other, please specify [...]
 - No
43. Did other issues affect the development and implementation of the climate risk stress test framework?
- Yes, turmoil related to the COVID-19 pandemic
 - Yes, other supervisory tasks, please specify [...]
 - Yes, other, please specify [...]
 - No

44. Has the turmoil related to the COVID-19 pandemic affected the prioritisation of the development of a climate risk stress test framework in the institution?
- Yes, it slowed down the development of a climate risk stress test framework
 - Yes, it accelerated the development of a climate risk stress test framework
 - No
45. Have climate-related regulatory developments promoted or influenced the development of a climate risk stress test framework in the institution?
- Yes
 - No

If **Yes**:

- ECB Guide on climate-related and environmental risks?
 - Yes
 - No
 - EBA Report entitled “On management and supervision of ESG risks for credit institutions and investment firms”?
 - Yes
 - No
 - Implementation of the EU Taxonomy?
 - Yes
 - No
 - Others?
 - Yes, please specify [...]
 - No
46. Do you envisage challenges to applying the new climate-related regulations in areas related to the development of the climate risk stress test framework?
- Yes, please specify [...]
 - No

Internal audit function and the climate risk stress test

47. Is the internal audit function involved in the review of the institution's internal climate risks stress test framework?
- Yes
 - No

If **No**:

- Is the internal audit function involved in the implementation of the internal climate risks stress test framework?
 - Yes
 - No

If **Yes**:

- Does the internal audit function issue an opinion on the internal climate risk stress test framework as a whole?
 - Yes, the opinion is issued or expected to be issued during 2021
 - Yes, the opinion is issued or expected to be issued during 2022
 - Yes, the opinion is issued or expected to be issued from 2023
 - No
- 48. If you answered “Yes” to Question 47, does the internal audit function review the selected transmission risks of the climate risk stress test risks map included in the internal framework?
 - Yes
 - No
- 49. Does the internal audit function review the internal climate scenarios?
 - Yes
 - No
- 50. If you answered “Yes” to Question 47, does the internal audit function review the methodology (including assumptions and models used) of the internal climate risk stress test?
 - Yes
 - No
- 51. Does the internal audit function review the data infrastructure used to feed the internal climate risk stress test exercise (e.g. via additional training or additional resources)?
 - Yes
 - No
- 52. Is the bank planning to enhance the resources of the internal audit function with staff specialised in climate risk?
 - Yes
 - No

Application of parent company climate risk stress test framework

This section is only applicable for EU subsidiaries of non-EU institutions.

53. Does the bank have its own climate risk stress test framework?

- Yes
- No

If **No**:

- Is the bank included in the group (parent company) climate risk stress test framework?
 - Yes
 - No

If **Yes**:

- For which elements does the bank not have internal development capacity and has to rely on the parent company?
 - Data
 - Scenarios
 - Methodology
 - IT tools/systems

If **Yes**:

- Has the bank participated in the group (parent company) climate risk stress test framework building process?
 - Yes
 - No
- 54. Has the parent company considered all material aspects and particularities of the climate risks of the subsidiary?
 - Yes, please add a brief description [...]
 - No

Institution's assumptions for bottom-up climate risk stress test and metrics

Vulnerabilities in a disorderly transition (short-term transition risk)

55. What proportion of current mortgage exposures (retail portfolio) is the institution able to allocate based on internally available information or via access to a public register of energy performance certificates?

- 0% to 5%
- 5% to 10%
- 10% to 25%
- More than 25%

56. What proportion of current corporate exposures secured by real estate within the scope of the energy performance certificate is the institution able to allocate based on internally available information or via access to a public register of energy performance certificates?
- 0% to 5%
 - 5% to 10%
 - 10% to 25%
 - More than 25%
57. What proportion of current corporate exposures is the institution able to classify based on the NACE two-digit classification?
- Less than 75%
 - 75% to 80%
 - 80% to 90%
 - 90% to 99%
 - More than 99%
58. If the institution did not report 80% of their corporate exposure in Module 3: Why could only less than 80% of corporate exposure in scope be allocated to NACE digit 2 buckets although the overall coverage of NACE digit 2 is above 80%?
- No information on NACE digit 2 in the sectors of scope
 - NACE digit 2 exposure in scope of exercise is in other countries than those reported
 - Other, please specify
59. What was your biggest challenge when projecting the effects of a disorderly transition on your banks' credit risk parameters for the period 2022-2024?
- Correct and complete classification of existing exposures by industry/energy efficiency rating
 - The ability of the internal stress test model to produce credit risk parameters at the required granularity (i.e. disaggregated by industrial sector/energy efficiency rating)
 - Connecting scenario assumptions to credit risk parameters (e.g. PD, LGD)
 - Other, please specify [...]

Transition risk strategy (long-term transition risk)

60. What is the main factor responsible for your institution's balance sheet adjustment of credit exposures across industries, if any, in the orderly transition scenario?
- The scenario does not trigger a portfolio reallocation
 - The institution's current long-term strategy
 - Increased riskiness of lending to firms in specific industrial sectors
 - Growth opportunities in specific industrial sectors
 - Reputational risk concerns
 - Other, please specify [...]

61. What is the main factor responsible for your institution's balance sheet adjustment of credit exposures across industries, if any, in the disorderly transition scenario?
- The scenario does not trigger a portfolio reallocation
 - The institution's current long-term strategy
 - Increased riskiness of lending to firms in specific industrial sectors
 - Growth opportunities in specific industrial sectors
 - Reputational risk concerns
 - Other, please specify [...]
62. What is the main factor responsible for your institution's balance sheet adjustment of credit exposures across industries, if any, in the hot house world scenario?
- The scenario does not trigger a portfolio reallocation
 - The institution's current long-term strategy
 - Increased riskiness of lending to firms in specific industrial sectors
 - Growth opportunities in specific industrial sectors
 - Reputational risk concerns
 - Other, please specify [...]
63. What was your biggest challenge when projecting the credit risk parameters for 2030, 2040 and 2050 in the three long-term transition scenarios?
- Producing long-term projections under a dynamic balance sheet assumption
 - Connecting scenario assumptions to credit risk parameters (e.g. PD, LGD)
 - Other, please specify [...]

Drought and heat risk

64. Does the institution incorporate private insurance coverage in its projections in the drought and heat scenario?
- Yes
 - No
65. If you answered "Yes" to Question 64, what fraction of the counterparties' exposures is assumed to be covered by private insurance in the drought and heat scenario? Please answer on a best effort basis.
- <25%
 - 25-50%
 - 50-75%
 - >75%

66. If you answered “Yes” to Question 64, to what extent does private insurance coverage reduce the projected impairments in the drought and heat scenario, i.e. as a percentage of projected impairments without any form of private or public insurance coverage? Please answer on a best effort basis.

- <25%
- 25-50%
- 50-75%
- >75%

67. Does the institution incorporate public insurance schemes and guarantees in its projections in the drought and heat scenario?

- Yes
- No

68. If you answered “Yes” to Question 67, what fraction of the counterparties’ exposures is assumed to be covered by public insurance schemes in the drought and heat scenario? Please answer on a best effort basis.

- <25%
- 25-50%
- 50-75%
- >75%

69. If you answered “Yes” to Question 67, to what extent do public insurance schemes reduce the projected impairments in the drought and heat scenario, i.e. as a percentage of projected impairments without any form of private or public insurance coverage? Please answer on a best effort basis.

- <25%
- 25-50%
- 50-75%
- >75%

70. What was your biggest challenge when projecting the effects of drought and heat on your banks’ credit risk parameters?

- Correct and complete classification of existing exposures by industry and drought and heat risk category
- The ability of the internal stress test model to produce credit risk parameters at the required granularity (i.e. disaggregated by industrial sector/drought and heat risk category)
- Connecting scenario assumptions to credit risk parameters (e.g. PD, LGD)
- Other, please specify [...]

Flood risk

71. Does the institution incorporate private insurance coverage in its projections in the flood scenario?
- Yes
 - No
72. If you answered “Yes” to Question 71, what fraction of the exposures’ collateral, with each counterparty’s collateral capped by the institution’s exposure to the respective counterparty, is assumed to be covered by private insurance in the flood scenario? Please answer on a best effort basis.
- <25%
 - 25-50%
 - 50-75%
 - >75%
73. If you answered “Yes” to Question 71, to what extent does private insurance coverage reduce the projected impairments in the flood scenario, i.e. as a percentage of projected impairments without any form of private or public insurance coverage? Please answer on a best effort basis.
- <25%
 - 25-50%
 - 50-75%
 - >75%
74. Does the institution incorporate public insurance schemes and guarantees in its projections in the flood scenario?
- Yes
 - No
75. If you answered “Yes” to Question 74, what fraction of the exposures’ collateral, with each counterparty’s collateral capped by the institution’s exposure to the respective counterparty, is assumed to be covered by public insurance schemes in the flood scenario? Please answer on a best effort basis.
- <25%
 - 25-50%
 - 50-75%
 - >75%
76. If you answered “Yes” to Question 74, to what extent do public insurance schemes reduce the projected impairments in the flood scenario, i.e. as a percentage of projected impairments without any form of private or public insurance coverage? Please answer on a best effort basis.
- <25%
 - 25-50%
 - 50-75%
 - >75%

77. What was your biggest challenge when projecting the effects of flood on your banks' credit risk parameters?

- Correct and complete classification of existing exposures by flood risk category
- The ability of the internal stress test model to produce credit risk parameters at the required granularity (i.e. disaggregated by flood risk category and by buildings affected/unaffected by the flood)
- Connecting scenario assumptions to credit risk parameters (e.g. PD, LGD)
- Other, please specify [...]

78. For what proportion of the exposures in scope did the institution need to use the address of the lender instead of the address of the collateral to match the location?

- 0%
- 0% to 5%
- 5% to 10%
- More than 10%

Annex A.2: -

Empty.

Annex A.3: Guidance for nGAAP banks

Banks which are subject to nGAAP are expected to comply with the requirements of this methodological note as it applies to S1 and S3 exposures. All performing exposures and associated provisions should be mapped to S1 equivalent fields, and all non-performing exposures and associated provisions should be mapped to S3. Thus, no stocks and flows of S2 exposures have to be reported by nGAAP banks.

Provisions for equivalent stages should be calculated using forward-looking information to ensure comparability and consistency among banks. Notwithstanding this, parameters in combination with the respective formulas prescribed by the methodological note and the templates should lead to accurate stocks of provisions given this information.

Table A.1

Variables: Fields in credit risk templates to be populated by banks applying nGAAPs

Beginning-of-year stocks	Performing exposure (Exp) Of which: S1 (Exp S1)
	Non-performing exposure (Exp S3)
	LTV – S1
	Funded Collateral (capped) — S1
	LTV – Non-performing exposure
	Funded Collateral (capped) — Non-performing exposure
	Stock of provisions (Prov Stock) Of which: S1 (Prov Stock S1)
	Stock of provisions (Prov Stock) Of which: non-performing assets (Prov Stock S3)
Within year — flows and parameters	TR1-3
	S3 flow (S3 flow)
	LGD1-3
	Cure rate stage 1 to stage 3 assets (Cure1-3)
	LR3-3
End-of-year stocks	Performing exposure (Exp) of which: S1 (Exp S1)
	Non-performing exposure (Exp S3)

Annex A.4: Provisional set of scenario variables

Annex A.4 contains the list of variables the ECB plans to provide for the four different bottom-up stress test calculations. Please note that the final list of variables may be change when the scenarios are released.

Table A.2

Variables: short-term transition risk

Variable	Level of country disaggregation	Level of sector disaggregation
Carbon price	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Output: GDP (and gross value added)	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	by sector (see Annex A.5)
Inflation	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Unemployment rate	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Residential real estate prices	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	distinguished by energy performance certificate class
Commercial real estate prices	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	distinguished by energy performance certificate class
Government expenditure	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Household income	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	TBD
Exchange rates	n/a	aggregate
Short-term interest rates	by euro area + non-euro area EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Government bond yields	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Corporate bond yields or spreads	global	by sector (see Annex A.5)
Equity indices	global	by sector (see Annex A.5)
Commodity prices	TBD	aggregate

Table A.3

Variables: long-term transition risk

Variable	Level of country disaggregation	Level of sector disaggregation
Emission pathways	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	possible breakdown depending on NGFS availability
Temperature pathways	global	n/a
Carbon price	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Energy prices	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	by energy source
Energy mix	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	by energy source
Output: GDP (and gross value added)	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	by sector (as specified in Annex A.5)
Inflation	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Unemployment rate	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Residential real estate prices	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	distinguished by Energy Performance Certificate class
Commercial real estate prices	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	distinguished by Energy Performance Certificate class
Government expenditure	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Household income	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Exchange rates	n/a	aggregate
Short-term interest rates	Euro area	aggregate
Government bond yields	by EU countries + United Kingdom + United States + China + Japan + regional blocks (or RoW)	aggregate
Corporate bond yields or spreads	global	by sector (see Annex A.5)
Equity indices	global	by sector (see Annex A.5)
Commodity prices	global	aggregate

Table A.4

Variables: drought and heat risk

Variable	Level of locational disaggregation	Level of sector disaggregation
Value-added growth	EU country level	See Annex A.5

Table A.5

Variables: flood risk

Variable	Level of locational disaggregation
Housing price shocks	Flood risk region
Commercial real estate price shocks	Flood risk region

Annex A.5: List of industries

NACE industrial sectors	NACE industrial sector description
A01	Crop and animal production, hunting and related service activities
A02-A03	Forestry and logging; Fishing and aquaculture
B	Mining and quarrying
C10-C12	Manufacture of food products, beverages and tobacco products
C13-C18	Manufacture of textiles; Manufacture of wearing apparel; Manufacture of leather and related products; Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; Manufacture of paper and paper products; Printing and reproduction of recorded media
C19	Manufacture of coke and refined petroleum products
C20	Manufacture of chemicals and chemical products
C21-C22	Manufacture of basic pharmaceutical products and pharmaceutical preparations; Manufacture of rubber and plastic products
C23	Manufacture of other non-metallic mineral products
C24-C25	Manufacture of basic metals; Manufacture of fabricated metal products, except machinery and equipment
C26-C28	Manufacture of computer, electronic and optical products; Manufacture of electrical equipment; Manufacture of machinery and equipment not elsewhere classified
C29-C30	Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of other transport equipment
C31-C33	Manufacture of furniture; Other manufacturing; Repair and installation of machinery and equipment
D	Electricity, gas, steam and air conditioning supply
E36-E39	Water collection, treatment and supply; Sewerage; Waste collection, treatment and disposal activities; Materials recovery; Remediation activities and other waste management services
F	Construction
G45-47	Wholesale and retail trade and repair of motor vehicles and motorcycles; Wholesale trade, except of motor vehicles and motorcycles; Retail trade, except of motor vehicles and motorcycles
H49	Land transport and transport via pipelines
H50	Water transport
H51	Air transport
H52-H53	Warehousing and support activities for transportation; Postal and courier activities
L	Real estate activities

Annex A.6: Examples of climate-related and environmental events relevant for conduct and physical risk

Conduct risk

- Greenwashing (clients, products and business practices): Liability claims resulting from green products sold with underlying assets that do not match the promoted level of greenness/sustainability.

Physical risk

- Direct losses due to extreme weather events (damage to physical assets): Extreme weather events, such as floods, may damage physical assets (for example buildings, cash machines) owned by the bank and lead to losses, for example when buildings need to be repaired or customers are unable to make payments.
- Damage to crucial infrastructure (business disruption and systems failure): Extreme weather events may damage crucial infrastructure that is not necessarily owned by the bank but is essential for providing services to customers (for example, rented buildings, external service providers like “server farms”, energy supply), leading to indirect losses.

© **European Central Bank, 2022**

Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.bankingsupervision.europa.eu

All rights reserved. Reproduction for educational and non-commercial purposes is permitted provided that the source is acknowledged.

For specific terminology please refer to the [SSM glossary](#) (available in English only).