



# Climate Stress Testing Data Management Framework

## Summary

This paper outlines a data management framework that improves climate related data collection and establishes the data reporting requirements for financial institutions. This framework will allow the BOJ to implement climate related financial risks stress testing and gradually integrate climate risks into supervision and macroprudential policy formulation.

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## Abbreviations

**ACPR:** French Prudential Supervisory Authority

**BIS:** Bank for International Settlements

**BoE:** Bank of England

**BOJ:** Bank of Jamaica

**CCCCC:** Caribbean Community Climate Change Centre

**CGS:** Cambium Global Solutions

**CRFRs:** Climate-Related Financial Risks

**DTI:** Deposit Taking Institution

**IAM:** Integrated Assessment Model

**ECB:** European Central Bank

**FSB:** Financial Stability Board

**FSC:** Financial Services Commission

**GFDRR:** Global Facility on Disaster Reduction and Recovery

**GFS:** Global Financial Crisis

**GHG:** Green House Gasses

**JSRAT:** Jamaica Systemic Risk Assessment Tool

**MSME:** Micro, Small and Medium Enterprise

**MtCO<sub>2e</sub>:** Metric tons of carbon dioxide equivalent

**NGFS:** Network of Central Banks and Supervisors for Greening the Financial System

**PCAF:** Partnership on Carbon Accounting Financials

**PIOJ:** Planning Institute of Jamaica

**UNEPFI:** United Nations Environmental Programme Finance Initiative

## Acknowledgements

This paper on Jamaica's Climate Stress Testing Data Management Framework outlines the **Supervisors** data management framework. The framework will support Bank of Jamaica's (BOJ's) and the Financial Services Commission's (FSC's) project to integrate climate risks into their supervisory and macroprudential policy formulation activities.

The authors extend their appreciation to the Agence Française de Développement (AFD) for their generous support and sponsorship of Jamaica's financial sector greening initiative. Their dedication to addressing climate change in different spheres and promoting sustainable development has been pivotal in enabling the successful completion of this paper.

This paper was drafted with the support of Cambium Global Solutions. Other organizations and groups that played a role in the preparation of this paper include:

- The NDC Partnership for their facilitation in accessing relevant resources and assistance in aligning this work with Jamaica's Nationally Determined Contributions.
- The Ministry of Economic Growth and Job Creation for their cooperation and provision of crucial information pertaining to Jamaica's climate commitments and progress.
- The Planning Institute of Jamaica for their assistance in meeting the data requirements for this paper.

Finally, the members of the project team comprising representatives from the Bank of Jamaica (BOJ), the Financial Services Commission (FSC), and the Jamaica Deposit Insurance Corporation (JDIC) who assisted in compiling the findings represented in the Report.

## Introduction

The timing, frequency and severity of climate-related events are characterized by substantial uncertainty. It is therefore imperative for Supervisors and financial institutions to employ forward-looking assessment methods to effectively address the unprecedented challenges posed by climate change. In this context, scenario analysis emerges as a pivotal instrument for evaluating the potential impact of climate change on the financial systems. Globally, a growing number of Supervisors have either conducted, are in the process of conducting or have announced plans to conduct, a climate stress test. An important ingredient in this process is the need to have - or the need to enhance – data collection and reporting mechanisms to include both traditional financial metrics and specific climate-related information.

This paper therefore outlines the data management framework of the Jamaican Supervisors for overseeing climate risks in the financial sector and for conducting climate risk stress testing. Read in conjunction with [BOJ/FSC's first paper](#) on Climate risk (December 2022), it provides a brief background on climate stress testing followed by an outline of the essential data requirements. The data collection and monitoring framework is then detailed, outlining the different owners of traditional financial data and climate data.

Lastly, the report outlines a timeline and implementation plan for the data management framework to ensure a systematic and phased integration of these elements. It outlines the process that will be undertaken to amend the reporting forms for financial institutions. It also discusses the process involving other relevant stakeholders and data scientists (non-financial corporates, meteorological services, government ministries, academic collaborators and the PIOJ) to develop and to formalize data and forecast sharing agreements.

The next two chapters of the paper cover the elements of climate stress tests including:

- Climate scenarios
- Modelling methodology and Coverage
- Use of the results from climate stress tests
- Data Requirements

The final sections of the paper focus on a gap analysis of the data needed to conduct climate related financial stress testing for Jamaica.

The appendix of the paper outlines timelines for an implementation plan for data collection as well as sample data collection templates.

# Climate Stress Testing

## 2.1 Elements of Climate Stress Tests

Climate stress tests are complex undertakings with a number of different components. Some of the key elements for their design and development include the objectives, the type of scenarios employed, the data that are used in the exercises, the coverage and the methodologies utilized.

### Key Considerations:

The design of a stress test also involves a deep understanding of the climate hazards and their potential impact.

Financial institutions' exposure to **physical risks** comprise those resulting directly from such events (e.g. damages to properties) and those ensuing indirectly from subsequent events (e.g. disruptions to global supply chains) (see chart below). Physical risks also have large effects on the value of companies and thus on financial institutions as markets price-in the effects of longer-term risks on business prospects. The risks banks face in this regard are closely linked to the geographical location of their lending activities which could, in some cases, lead to non-negligible losses.

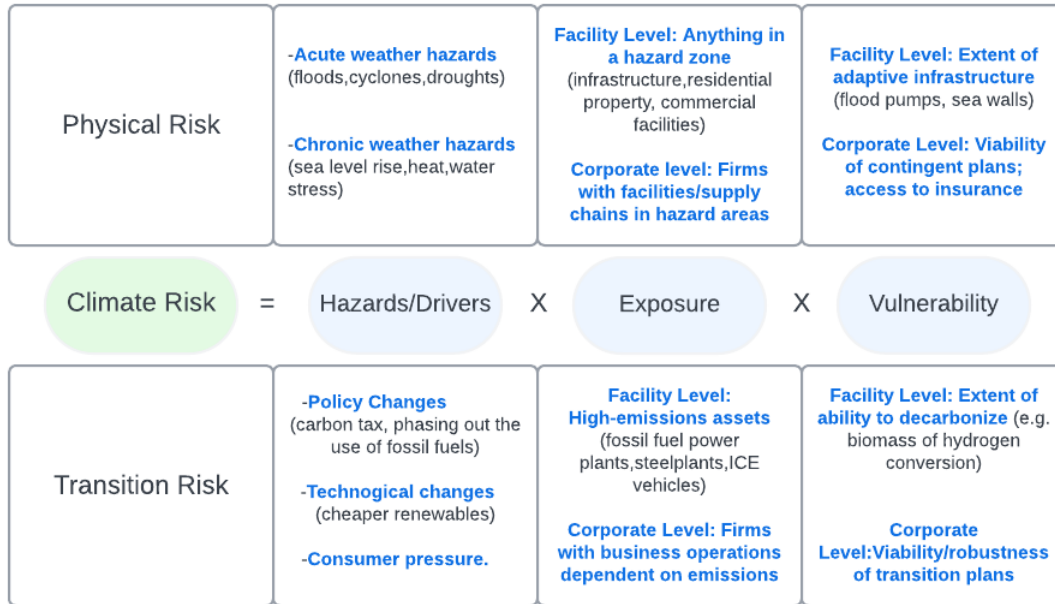
Given the significance of physical risk management, it is therefore important that the Supervisors conducts assessments with high-quality data and modern scenario assumptions that project the likelihood and impact of different hazards. By subjecting financial institution's portfolios to these tests, the central bank will be able to identify vulnerable assets and regions, assess potential losses and assess their risk management strategies accordingly.

**Transition risks** are also highly relevant to the work of the Supervisors because of their potential to impact on financial institution's long-term profitability and asset valuations. These risks are measured by, *inter-alia*, the shape and scope of domestic and international policy commitments and by emissions data. Emissions data plays a pivotal role in climate stress testing, offering insights into the current and potential future carbon footprints of counterparties and sectors. This data is instrumental in understanding transition risks, especially in scenarios where stringent climate policies and regulations are envisioned.

These transition risks tests are typically aimed at evaluating the impact on both credit and market risks. Current practices and capabilities for physical risk assessments are more developed than those for the assessment of transition risks.

Running climate stress tests are of great value to Supervisors in assessing financial stability. Globally, approximately thirty Supervisors have either already conducted their own climate stress test or plan to do so in the near future ([NGFS, 2021](#)). Other Supervisors have announced plans to conduct a climate stress test.

Figure 1: Elements of Climate Risk Assessment



Source: BOJ : Adopted from (Caldecott et al 2021).

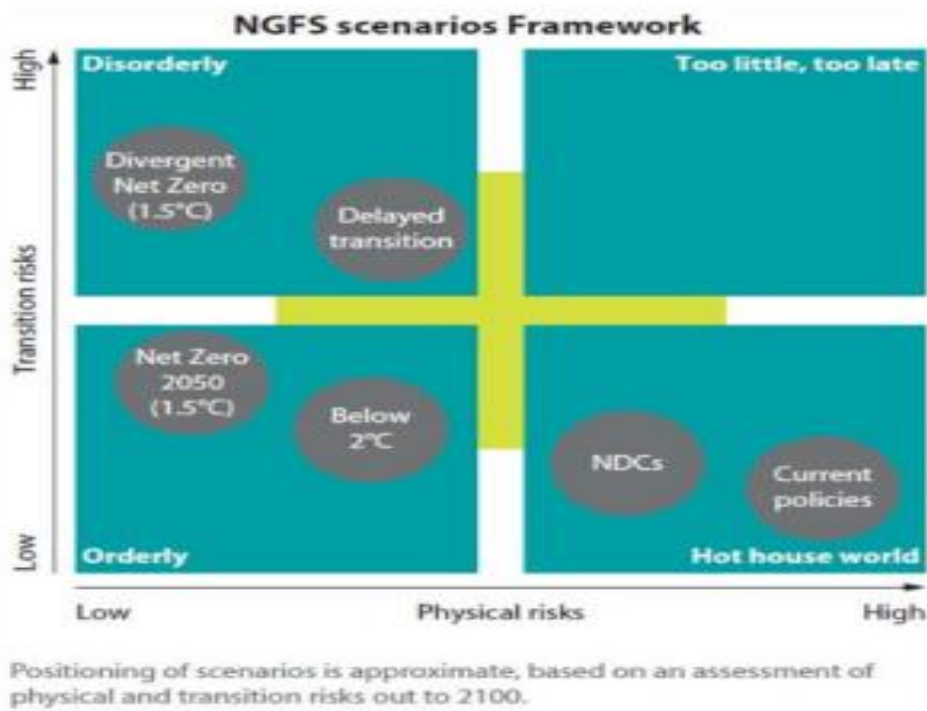
### 2.1.1 Climate Scenarios

Climate scenarios, defined as plausible representations of future climates corresponding to potential future realizations of climate change, are an important component of the physical climate risk assessment methodology. Climate scenario analyses typically use, or plan to use, the Network for Greening the Financial System (NGFS) scenarios. While NGFS scenarios remain the mainstream option for supervisors, some jurisdictions do not use them in their climate stress test exercises, usually because these exercises focus on specific risk actors.

Broadly defined, there are six scenarios under the NGFS framework, with each of them been characterized by their implication for the physical and transition risks pathways. These scenarios explore three quadrants of the NGFS scenarios framework, namely “Hot house world”, “Orderly transition” and “Disorderly transition”. The “Current Policies” scenario is the most adverse in terms of physical risks, while the “Net Zero 2050” scenario reflects a relatively smooth transition to net zero emissions by 2050. In the “Delayed Transition scenario”, emissions are only reduced after 2030, and hence require more rapid adjustments to limit the most severe physical impacts.



Figure 2: NGFS scenarios for phase II and III



Source: NGFS

The "Current Policies" scenario is the most adverse in terms of physical risks, while the "Net Zero 2050" scenario reflects a relatively smooth transition to net zero emissions by 2050. In the "Delayed Transition scenario", emissions are only reduced after 2030, and hence require more rapid adjustments to limit the most severe physical impacts.<sup>1</sup>

<sup>1</sup> For the divergent net zero scenario, the world reaches net zero around 2050 but with higher costs due to divergent policies introduced across sectors leading to a quicker phase out of oil use; For delayed transition annual emissions do not start to fall until 2030.

Figure 3: Use of NGFS Scenario reported in the survey jointly conducted by FSB and NGFS

| Category        | Scenario                                   | Physical risk   |  | Transition risk    |                                     |  |
|-----------------|--|-----------------|--|--------------------|-------------------------------------|--|
|                 |  | Policy ambition | Policy reaction                        | Technology change  | Carbon dioxide removal <sup>-</sup> | Regional policy variation <sup>+</sup> |
| Orderly         | Net Zero 2050                              | 1.4°C           | Immediate and smooth                   | Fast change        | Medium-high use                     | Medium variation                       |
|                 | Below 2°C                                  | 1.6°C           | Immediate and smooth                   | Moderate change    | Medium-high use                     | Low variation                          |
| Disorderly      | Divergent Net Zero                         | 1.4°C           | Immediate but divergent across sectors | Fast change        | Low-medium use                      | Medium variation                       |
|                 | Delayed Transition                         | 1.6°C           | Delayed                                | Slow / Fast change | Low-medium use                      | High variation                         |
| Hot house world | Nationally Determined Contributions (NDCs) | 2.6°C           | NDCs                                   | Slow change        | Low-medium use                      | Medium variation                       |
|                 | Current Policies                           | 3°C +           | Non-current policies                   | Slow change        | Low use                             | Low variation                          |

Colour coding indicates whether the characteristic makes the scenario more or less severe from a macro-financial risk perspective<sup>2</sup>

- Lower risk
- Moderate risk
- Higher risk

The driving forces in each scenario include (a) policy ambition, (b) policy timing, (c) coordination and (d) technology levers (NGFS, 2022). Policy ambition is a key driver of physical risks in these scenarios since it frames the risk level over relevant time horizons. For example, stringent policy ambition is implicit in the Net Zero 2050 scenario and, therefore, physical risks are foreseen to be low. In contrast, the Current Policy scenario indicate a world with more frequent and more severe physical risks-related events.<sup>2</sup>

Jamaica faces significant physical risks from climate change, including rising temperatures, altered rainfall patterns, more intense tropical storms, and sea level rise. The Planning Institute of Jamaica’s (PIOJ) projections indicate not only a higher frequency of extreme weather events like heatwaves and heavy rainfall but also stronger hurricanes and increased coastal erosion under various climate scenarios (PIOJ, 2021). Additionally, these physical changes threaten to disrupt agriculture, decrease worker productivity, and strain both the energy infrastructure and healthcare systems, raising both direct and indirect costs for the island.

Additionally, transition risks scenarios, which relate to the effects on economic activity and financial outcomes of regulatory interventions in response to climate risk (e.g., carbon taxes and renewable energy subsidies) or from changes in technologies and preferences, are also implicit in the NGFS scenarios framework. These risks are relevant to the work of Jamaican Supervisors because of their potential to impact long-term profitability and asset valuations. Policies aimed at curbing emissions and facilitating the transition to a greener economy may create significant risks for carbon-intensive sectors such as mining or fossil fuel extraction (ECB, 2022).

<sup>2</sup> As an illustrative description, in the case of Current Policy scenario, since its policy ambition setting tolerates a 3°C + warming, the scenario has high implication on an induced severe physical risks outcome (such as significant sea level rise and heatwave-related natural disasters). For the Net Zero 2050 scenario, the warming level is targeted as ambitious as only 1.5°C above pre-industrial level, the physical risks probability are projected to be lower than the other scenario cases with earlier policy actions intervened in climate change mitigation measures and a higher demand on the investment and adoption of new technology.

While all scenarios under the NGFS's framework have implications for the severity of transition risks, two scenarios (Divergent Net Zero and Delayed transition) are particularly pertinent. As an illustration, under the Divergent Net Zero scenario, carbon prices may vary across sectors and regions, leading to a higher cost of carbon mitigation. The Delayed Transition scenario will also lead to a relatively high level of transition risks, since climate-related interventions under this scenario are assumed to be put in place late (in 2030).<sup>3</sup>

The majority of transition risks climate stress tests will be adopted from the NGFS but the Jamaican Supervisors may also choose to adopt self-developed scenarios for intermediary level transition pathways.<sup>4</sup> For example, the scenarios might not adequately address the higher exposure of small island developing states to sea-level rise, hurricanes, and other extreme weather events. Of note, the economic structures of small island developing states, often reliant on tourism, fisheries, and agriculture, are highly sensitive to climate impacts.

## 2.2 Stress Testing Methodologies and Coverage

Climate risk assessments can encompass a range of methodologies, including scenario analysis, sensitivity testing and forward-looking modelling. Scenario analysis involves constructing plausible climate-related projections that simulate potential impacts on financial portfolios under varying climate conditions. Sensitivity testing evaluates the sensitivity of financial positions to changes in key climate risk drivers, such as shifts in carbon pricing or extreme weather events. Forward-looking modelling employs predictive models to project the long-term financial implications of different climate pathways.

The modelling framework is complex as it involves combining different models that are not usually designed to work together. **Climate scenario models** are needed to project pathways for the selected physical and transition risk variables. **Macroeconomic models** are then required to translate variables from the climate model to selected macroeconomic variables. Climate stress testing also requires the use of **damage functions** that estimate the macroeconomic impact of different climate events and scenarios at the sector-level. Following this, **financial models** at an institution-level are used to calculate bank's exposures to climate risks. These models assess changes in metrics such as probabilities of default (PD) and loss given default (LGD).

### 2.2.1 Models

Integrated Assessment Models (IAMs) have recently gained popularity due to their ability to describe the interactions between economic activity, GHG emissions and climate system. These models generate emission pathways that can be integrated into climate models.<sup>5</sup>

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<sup>3</sup> While the plausible outcomes of transition risks are often analysed through a similar transition pathway design, different factors are taken into account by different Supervisors in different transition risks stress tests. Some of them look at mainly carbon policies or technological changes. For example, the Deutsche Bundesbank adopted the average global carbon price as a proxy for the intensity of policymakers' efforts to mitigate climate change and which was thus used to differentiate the scenarios (Net Zero 2050, Below 2°C and Current Policies) (DBB, 2021).

<sup>4</sup> Bank of Canada, for example, included two scenarios referred to as 'Below 2°C immediate' and 'Below 2° delayed' (BoC, 2022). Similarly, other than 'Current Policy' and 'Net Zero 2050' scenarios, the Deutsche Bundesbank employed a scenario referred to as 'Below 2°' (DBB, 2021).

<sup>5</sup> A 'suite' of IAMs have contributed to the generation of the NGFS scenarios' transition pathways, comprising three well-established IAMs: GCAM, MESSAGEix-GLOBIOM and REMIND-MAGPIE. REMIND and MESSAGE employ intertemporal optimization algorithms characterized by perfect foresight. Their forecasts encompass various factors, including escalating costs of exhaustible resources, diminishing costs associated with solar and wind technologies and the rising prevalence of carbon pricing. Moreover, these models facilitate the representation of endogenous shifts in

In terms of macroeconomic models, the NiGEM and G-cubed model are widely adopted.<sup>6</sup> Many financial institutions choose to use macroeconomic variables from NiGEM ([FSB, 2022](#)), which includes endogenous policy responses from both the fiscal and monetary authorities for each region and includes some macro-financial variables, such as long-term interest rates ([NGFS, 2021](#)). All ACPR (Prudential Supervision and Resolution Authority or Autorité de contrôle prudentiel et de résolution), BoE (Bank of England) and DNB (De Nederlandsche Bank) have used/are using the NiGEM model for their climate stress test exercises (BIS, 2021). The Climate Vulnerability Assessment (CVA) by the Australia Prudential Regulation Authority (APRA) in 2022 adopted the G-cubed model to help increase the sectoral granularity of the NGFS scenarios.

## 2.3 Risk Metrics

The majority of scenario stress testing exercises focus on either credit or market risk but a few exercises also focus on reputational or operational risks. Credit risk analysis involves the calculation of credit default rates in financial institutions. Market risk assessments usually involve the calculation of risk premia on corporate bonds and losses on securities to reflect the impact on trading books of changes in the market value of stocks and corporate bonds ([DBB, 2021](#)). Climate-related and environmental occurrences may result in financial setbacks, whether through climate-related legal claims ("conduct risk") or the disruption of business operations caused by extreme weather.<sup>7</sup>

The most common risk metrics relate to credit quality and changes in market valuations. Examples of such metrics include the probability of default (PD) or loss given default (LGD) for credit exposures to given geographical regions or sectors, as well as losses on investment portfolios (see appendix). These risk metrics can be further customised to capture the impact of physical or transition risks. For instance, the ECB developed two intensity metrics to assess the climate-related vulnerabilities of euro area banks' loan exposures ([ECB/ESRB, 2022](#)).<sup>8</sup>

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consumption, GDP and energy demand which arise in response to the implementation of climate policies. A potential driving force for a majority of financial institutions to choose REMIND lie in the fact that it has more variables and involves a specific focus on the energy sector. It aims to find the optimal mix of investments in the economy and the energy sector, given a set of population and model region, which is a significant part of financial institutions' asset management and strategy building.

<sup>6</sup> The G-cubed model is a multi-country, multi-sector, intertemporal general equilibrium model developed by McKibbin and Wilcox (NGFS, 2022). G-Cubed is designed to bridge the gaps between econometric general-equilibrium modeling, international trade theory, and modern macroeconomics. Its main advantage lies in its detailed multi-sectoral model setting, which allows an enhanced granularity in understanding how the scenarios will play out within specific sectors of the economy or at the regional level. The NGFS ran a pilot project in 2022 to test the feasibility of integrating the G-Cubed model into NGFS scenarios, including "Net Zero 2050", "Delayed Transition" and "Current Policies". A comparison between the results from G-Cubed and those of the three IAMs from Phase II of NGFS allowed the exploration of the alignment between the two modelling frameworks. While there are persistent differences in the results that currently constrain the full integration of NGFS scenarios for the moment, the G-Cubed pilot project has showcased the value of collaboration and comparative exercises to better explore climate policy pathways modelling approaches.

<sup>7</sup> Other operational risks include compliance risk in a context where a firm's climate risk disclosure is inadequate when compared to regulatory expectations. Additionally, there is the risk of reputational damage if the public, counterparties, or investors link the institution to adverse environmental impacts. These reputational harms also may have financial implications both on the valuation of the institution, but also on their liquidity, if trust is lost in the institution.

<sup>8</sup> Both metrics were constructed using banks' loan exposures and borrower-level PDs; the TCI combines them with borrower-level emissions data, while the PCI combines them with borrower-level physical risk scores. By blending conventional financial data with climate-specific metrics, the ECB was able to better account for the interaction of climate risks with existing financial conditions. ([FSB, 2022](#)).

Table 1: Risk Types and associated metrics

| Risk Type                    | Metrics  |
|------------------------------|--|
| Operational Risk             | <ul style="list-style-type: none"> <li>• Proportion of facilities in risky areas</li> <li>• Level of company preparedness</li> </ul>                     |
| Credit Risk                  | <ul style="list-style-type: none"> <li>• Probability of Default (PD)</li> <li>• Loss Given Default (LGD)</li> <li>• Exposure at Default (EAD)</li> </ul> |
| Liquidity Risk               | <ul style="list-style-type: none"> <li>• Loans to Deposit Ratio (for banks)</li> <li>• Liquidity Ratios</li> <li>• Bid-ask-spread (markets)</li> </ul>   |
| Underwriting/ Insurance Risk | <ul style="list-style-type: none"> <li>• [Change in] insurance premiums</li> <li>• Availability of Insurance</li> </ul>                                  |
| Market Risk                  | <ul style="list-style-type: none"> <li>• [Weighted Average] Carbon Intensity</li> <li>• Portfolio Risk Scores</li> </ul>                                 |

Source: BOJ

### Credit Exposure Metrics

In a climate-related stress test, Probability of Default (PD), Loss Given Default (LGD), and Exposure at Default (EAD) are adjusted to reflect the impact of climate risks on a financial institution’s portfolio. PD increases for sectors heavily affected by climate change, such as fossil fuels and agriculture, due to higher default risks from physical and transition impacts. LGD may increase due to potential declines in collateral values, such as properties in flood-prone areas and disrupted recovery processes. EAD may rise as borrowers draw down credit lines more in response to climate stress. These adjusted metrics are applied to stress scenarios, like rapid transitions to a low-carbon economy or extreme weather events, to estimate potential financial losses. This comprehensive analysis helps institutions assess their resilience to climate risks, informs risk management strategies, and ensures regulatory compliance.

#### *Probability of Default (PD)*

PD is the likelihood that a borrower will default on their debt obligations within a given time period. PD is often estimated using historical data and statistical models. One common approach is the logistic regression model, where:

*Equation 1: Probability of Default (PD)*

$$PD = \frac{1}{1 + e^{-(\alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)}}$$

Where:  $\alpha$  is the intercept,  $\beta_i$  are the coefficients, and  $X_i$  are the risk factors.

#### *Loss Given Default (LGD)*

LGD is the portion of an exposure that is lost if a borrower defaults, usually expressed as a percentage of the total exposure. LGD can be calculated based on historical recovery rates or using models that account for collateral and recovery processes. A simplified formula is:

Equation 2: Loss Given Default (LGD)

$$LGD = 1 - \text{recovery rate}$$

Where the recovery rate is the amount recovered divided by the exposure at default.

Exposure at Default (EAD)

EAD is the total value a bank that is exposed to when borrowers default. It includes the outstanding loan balance and any undrawn committed amounts. EAD is calculated differently depending on the type of exposure. For credit lines and revolving facilities, it may include an estimation of future drawdowns. A common approach is:

Equation 3: Exposure at Default (EAD)

$$EAD = \text{Outstanding Balance} + \text{Credit Conversion Factor}$$

Where the Credit Conversion Factor (CCF) is an estimate of the portion of the undrawn amount that will be drawn down at the time of default.

Finally, to calculate the Expected Loss (EL) for a given loan, combine the previous components:

$$\begin{aligned} \text{Expected Loss (EL)} \\ &= \text{Probability of Default (PD)} \times \text{Loss Given Default (LGD)} \\ &\times \text{Exposure at Default (EAD)} \end{aligned}$$

This formula gives the expected monetary loss for the loan based on the probability of default, the loss given default, and the exposure at default. The Basel Committee on Banking Supervision, Basel Accords, particularly Basel II and Basel III, provide detailed guidelines on these risk parameters and their calculation methodologies ([BIS, 2017](#))

## Damage Functions

A critical component of macroeconomic modelling is the estimation of damage functions. A climate damage function is a simplified expression of economic damages (which theoretically can encompass both positive and negative effects) as a function of climate inputs. The representation of damages due to weather and climate in IAMs and Agent Based Models (ABMs) is a convex function that relate economic damages to global and regional mean temperature.

A typical form of a damage function is:

Equation 4: Damage Function

$$\text{Damage rate} = 1 - \frac{1}{(1 + \alpha T + \beta T^2)}$$

where  $T$  is the Global or regional Mean temperature and  $\alpha$  and  $\beta$  are two estimable parameters where the *Damage rate* is in percentage of GDP. Temperature used in these models is a proxy index for climate change. Climate change damage functions vary widely based on specific climate hazard or climate events

and geographic locations ([Franzke 2021](#)). As such, regression and econometric methods are mainly used to derive country specific, region specific and hazard specific damage functions.

When conducting climate scenario analysis, some jurisdictions adopt hazard specific damage functions from the academic literature.<sup>9</sup>

## 2.4 Qualitative Analysis

The assessments of reputation and operational climate related risks are often realized through a qualitative questionnaire. Inputs for these types of qualitative analyses are gathered via surveys which aim to

1. Understand the challenges to participants' business models from climate-related risks;
2. Gain information on operational and reputational risks management;
3. Understand and assess participants proposed management actions and how they intend to improve their management of climate-related risks (including as a result of lessons learnt from the exercise).

Qualitative assessments delve into various aspects of institution's approach to managing climate risks through transition plans and mitigation commitments. It enquires about strategies and policies along with their progress towards achieving associated targets. The assessment also explores the integration of climate considerations into investment strategies, the establishment of climate-related targets across different business units, the inclusion of climate change in the firm's strategy documents, the reporting provided to the board and the incorporation of climate risks into the organization's risk management framework.

## 2.5 Use of Climate Stress Test Results

The results of climate stress tests play a pivotal role in shaping effective macro prudential policies to enhance the resilience of - and to improve - bank's risk management practices. Firstly, these results offer the central bank broad insights into the systemic risks posed by climate change for the financial sector. Secondly, they facilitate the development of disclosure and reporting standards and, thirdly, they raise awareness to the risk and adaptation needs in the financial sector.

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<sup>9</sup> One example of hazard specific damage function relevant to Jamaica was developed using hurricane strikes in the Eastern Caribbean ([Brei et. al., 2019](#)). Equation 3 below, represents this damage function.

$$\text{Hurricane index}_{ijk} = \frac{v_{ijk}^3}{1 + v_{ijk}^3} \times 100$$

With

$$v_{ijk} = \frac{\text{MAX}[(V_{ijk} - V_{thresh}]^0}{V_{half} - V_{thresh}}$$

Where  $V_{ijk}$  is the maximum wind experienced at point  $i$  in country  $k$  due to storm  $j$ ,  $V_{thresh}$  is the threshold below which no damage occurs, and  $V_{half}$  is the threshold at which property is damaged.

The Supervisors will also establish guidelines for reporting, ensuring that institutions provide accurate and standardized information about their exposure and mitigation strategies. Top down climate stress test results can also be communicated directly by the Supervisors to financial institutions, detailing the assessment of their performance and level of preparedness for the implications of climate change. The ECB has provided its “good practice report” of the climate stress tests which shares its supervisory expectations ([ECB, 2022](#)).

Stress testing exercises can further help in the formulation of climate-related government policies, such as national emissions reduction strategies and regional adaptation measures.

### **Supervisory Review and Evaluation Process (SREP)**

Climate stress test results also feed qualitatively into broader Supervisory Review and Evaluation Process (SREP) assessments, complementing findings from thematic reviews of climate-related and environmental risks.<sup>10</sup> The outcomes of SREPs may influence Basel Pillar 2 requirements (which are bank-specific capital requirements designed to address any additional risks not covered by the minimum capital requirements under Basel Pillar 1). If stress tests indicate that a bank is particularly vulnerable to climate-related risks, Bank of Jamaica may decide that additional capital buffers are necessary to mitigate these risks. They (climate stress tests) can also inform the central bank’s assessment of financial institution’s business models and strategic planning. Finally, the disclosure of the results of financial institution’s internal climate stress tests can improve market discipline and incentivize them to enhance their climate risk management practices. This aligns with the broader objectives of the SREP by promoting transparency and sound risk management.

On the part of financial institutions, the results serve as a critical strategic resource. Firstly, they will enable institutions to bolster risk management practices by identifying vulnerabilities within their portfolios. Armed with this knowledge, institutions can reduce exposures to climate-related risks. Secondly, these results empower institutions to align their operational and business strategies with sustainability objectives. With data on climate risk, they can favour products and activities that are more resilient to environmental challenges and better position themselves to benefit from the transition to a low-carbon economy. This not only mitigates risks but also seizes opportunities for long-term financial stability and growth.

### **Monitoring Framework for Jamaica’s Supervisors’ Climate Risk Assessments**

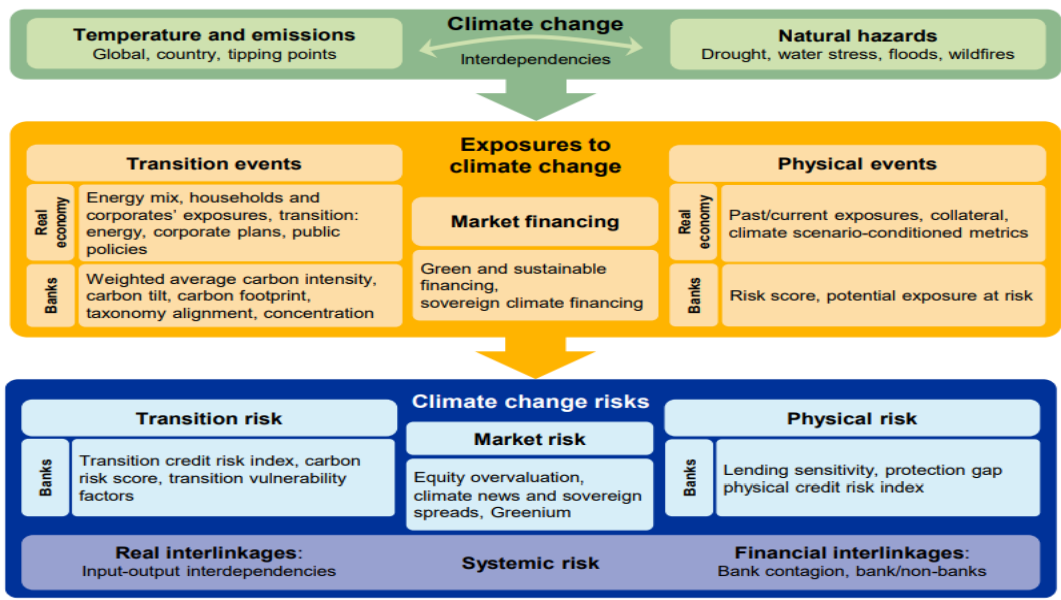
Both the inputs to – and the output of – climate stress tests form an important dataset for monitoring climate-related financial risks and potential financial stability concerns. The proposed financial stability surveillance framework requires the Supervisors to measure not only financial sector exposures to transition and physical risks, but also their transmission and potential amplification within the real economy and the financial system, ultimately leading to systemic risk. The European Central Bank (ECB) and the European Systemic Risk Board (ESRB) has offered guidance on the monitoring frameworks for climate-related risks ([ECB & ESRB, 2023](#)) (see Figure 3 below).

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<sup>10</sup> The SREP is a framework used by banking supervisors to assess the risks banks face and to determine the adequacy of their capital and liquidity positions. It is a comprehensive evaluation that includes reviewing the bank’s strategies, processes, risk exposure, risk management practices, and capital and liquidity adequacy.



Figure 4: Monitoring framework for climate-related financial stability risks



Source: ECB/ESRB Project Team

The proposed framework covers climate risk, economic sectors, and the financial system with various financial instruments (loans, debt securities and equities). The first section (in green) encapsulates climatic indicators, ranging from temperature developments to physical hazards such as floods, droughts and water and heat stress. The section also covers greenhouse gas (GHG) emissions from households and firms, as well as their exposure to flood and other hazards.

These indicators are essentially the foundational layer, providing a snapshot of the current and projected states of climate factors that could pose risks to economic and financial stability. Global and Jamaica-specific temperature patterns will be shown and monitored with respect to theoretical warming thresholds associated with global tipping points. High-resolution data from different sources will be employed to construct maps and visualisations in order to show the historical trend as well as forward-looking projections of water stress, river flooding, sea level rise and droughts.

The second section (in papaya) delves into the exposures to climate-related factors of the real economy and, indirectly, the financial system. Monitoring these exposures across individual agents, sectors and regions will offer valuable insights into the vulnerabilities present within the financial system and will allow the central bank and financial institutions to adopt more targeted risk management strategies.

The third section (purple) moves from exposure mapping to climate-related risks and vulnerabilities in the financial system and provides information on the vulnerabilities and systemic risk present within the system. It includes forward-looking metrics, localised risk metrics to assess vulnerabilities among banks, and insights into the effect of climate risks on public finances and insurance premiums. Moreover, the section will explore how climate change can generate systemic risk, whereby direct climate-related events trigger cascading feedbacks through the economy and the financial system, with the aim of identifying potential amplification effects that could turn localised risks into systemic threats for the economic and financial system.

The following section outlines a surveillance framework and its constituent metrics for monitoring climate-related risks to the financial system.

An effective monitoring framework incorporates all or most of the metrics described above but will also have a number of other important features. These include roles and responsibilities for the monitoring and the frequency of the monitoring exercise.

## Data

Reliable and comparable data for climate stress testing is crucial for financial institutions (including central banks and supervisors), investors, and policymakers to assess financial stability risks as well as effectively manage and mitigate the financial impacts of climate change. The progress in climate stress testing has however been hindered by the lack of standardized data with the necessary quality to effectively assess and model climate-related risks. Recognising these potential limitations, this paper therefore provides a detailed breakdown of the data needs as well as illustrative templates to guide financial institutions' reporting.

### 3.1 Key data types required

The data required for climate stress testing fits into two categories: *traditional financial data* and *climate data*. Macro-financial data (macroeconomic as well as financial) are already used to conduct traditional stress tests and evaluate portfolio and client risks. This data includes a variety of financial information that enables the evaluation of portfolio-level (and sometimes counterparty-level) risk models.

Climate data are typically less well-integrated into institutional processes. A large amount of information at a very granular level is typically required. In particular, there is a growing need for detailed geographical data on asset locations to assess physical risks and for more details on emissions along the value chains across sectors ([NGFS, 2021](#)). Some climate-related data also come directly from scenarios and offer high-level details on physical risks and transition pathways.

### 3.2 Climate Data

The various data types used in climate risk assessments include the following:

#### 3.2.1 Locational data

- Location-specific data on land cover, elevation, soil composition as well as satellite data that identify physical hazards
- Location of the client's physical assets (*e.g.* location of headquarters/main operating facilities)
- Regional-based historical catastrophe data

#### 3.2.2 Physical risk data

**Physical risk data comprises historical data as well as projections of this data, including their severity and frequency.** Forecasts for hazards like coastal flooding, wildfires and hurricanes provide the probability distributions for hazard events.

### 3.2.3 Transition risk data

Emissions data refers to information on greenhouse gas emissions, primarily carbon dioxide (CO<sub>2</sub>) and other greenhouse gases (GHGs) due to human activities.<sup>11,12</sup>

### 3.2.4 Transition Plans and Commitment Data

Transition plans encompass a strategic roadmap detailing how organizations intend to shift their operations, investments, and practices toward climate-resilient pathways. These plans include timelines, resource allocations, and adaptive strategies to ensure a transition to a low-carbon or climate-resilient future.

### 3.2.5 Transition Risk Related Macroeconomic Data

The data and metrics discussed below provide relevant reference points for transition scenarios:

- **Carbon Pricing and Policy Actions:** Carbon pricing has implications for sectoral costs and the economic performance of different companies. In addition, policy incentives and government funding can accelerate or hinder climate transition.
- **GDP and GVA:** Evaluating both broad and specific economic implications of transition policies will be fundamental to assessing the financial stress experienced by different sectors, companies, and the overall economy. Faster growth in one sector might result in a smoother transition for that sector, while falling demand may indicate business challenges.
- **Commodity price variables:** Identifying how prices may change for key inputs such as oil, steel, and others has major implications for the financial performance of the companies that produce these goods. It also has knock on effects for other variables like consumption and inflation that may influence overall economic health.
- **Asset Valuations:** These include market indices, overall market and sector-specific, and are commonly used within risk models to evaluate the potential level of stress that an industry or the overall economy may be facing in the transition.

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<sup>11</sup> Scope 1, Scope 2, and Scope 3 emissions are categories used to classify the different sources of greenhouse gas emissions. Scope 1 emissions are direct emissions from sources that are owned or controlled by a company, such as emissions from company vehicles or on-site fuel combustion. Scope 2 emissions are indirect emissions from the generation of purchased electricity, steam, heating, and cooling consumed by the company, occurring at the facility where the energy is produced. Scope 3 emissions encompass all other indirect emissions that occur in a company's value chain, including both upstream and downstream activities. This category includes emissions from business travel, employee commuting, waste disposal, and the production and transportation of purchased goods and services. Together, these scopes provide a comprehensive view of a company's total carbon footprint.

<sup>12</sup> These emissions come from various sources, including industrial processes, transportation, energy production, deforestation and agriculture.

- Scope 1, 2 and 3 and financed emissions
- Energy and carbon mix of counterparties
- Published or estimated GHG emissions produced by portfolios and assets of clients
- GHG emissions data by region, sector or industry;
- Energy efficiency data, for example, real estate ratings like the Energy Performance Certificate Rating
- Data on carbon pricing by jurisdiction

### 3.3 Traditional Financial Data

Traditional macro-financial data comprise firm-level financial information provided by dataset providers like Orbis, Eikon, Bloomberg, and iBACH, who are the main data sources of the general datasets in the case of the ECB's economy-wide climate stress test in 2021 ([ECB, 2021](#)). However, in the case of Jamaica, in the absence of current providers of these datasets, this type of information would need to be collected via surveys.

#### 3.3.1 Financial and macroeconomic data

To translate estimated damages from climate risk models into estimates of financial or macroeconomic losses, macroeconomic data such as national accounts, labour/unemployment, trade flow, and productivity data is also required. Other data sets that can support the analysis include government spending and revenue, consumer price index, interest rate, policy rate, informal sector, and regional and sectoral GDP/gross value added (GVA) data ([NGFS, 2022](#)). The table below illustrates the detailed types of traditional macro-financial data.

Table 2: Types of traditional macro-financial data required for climate stress testing ([UNEP FI, 2021](#))

|                                      |   |
|--------------------------------------|---|
| <b>Finance-related Data</b>          | <ul style="list-style-type: none"><li>• Portfolio composition by sector and geography.</li><li>• External and internal credit and valuation criteria.</li></ul> |
| <b>Macroeconomic Data</b>            | <ul style="list-style-type: none"><li>• Domestic and global GDP, unemployment, population growth, inflation, interest rates and exchange rates.</li></ul>       |
| <b>Borrower/Asset Financial Data</b> | <ul style="list-style-type: none"><li>• Costs and revenues.</li><li>• Forward-looking metrics, such as OPEX and CapEx.</li></ul>                                |

### 3.4 Data quality and uncertainties

Highly standardized but granular (asset-class level) data across institutions are indispensable for conducting regulatory climate stress tests. In practice, a granular approach that reflects the structure of different banks' balance sheets is needed to understand how risk realizations affect each assessed entity. This approach requires detailed exposure information and other data from the banks to be used to project losses in the event of a macroeconomic shock. Despite ongoing efforts to bridge the data gap in climate stress testing, the lack of high-quality data remains a significant obstacle for central banks, supervisors, and participants in the financial sector. In order to effectively manage and mitigate the financial impacts of climate change, a comprehensive framework for data collection is essential. This framework must encompass a detailed analysis data related to both physical and transition risks.

## Data Gap Analysis

The Jamaican Supervisors conducted a data gap analysis for their climate stress testing data needs, which revealed several key areas where improvements are necessary to fully assess the climate change risk facing financial institutions. The gap analysis covers the entirety of the data needs for climate stress testing to effectively manage climate-related financial risks.

## 4.1 Highlights of the Data Gap Analysis

*Counterparty Data:* Financial institutions have good data at the sector level, but lack granularity especially in the insurance and Securities Dealers sectors. The analysis indicates that while supervisors have access to overall portfolio data from Deposit Taking Institutions (DTIs), there is a notable gap in company-specific financial and production data. This information is crucial for assessing the resilience of individual counterparties to climate risks.

*Sector-Specific Data:* There's an evident gap in sector-specific data that accounts for varying vulnerabilities to climate risks, such as the energy sector's exposure to transition risks compared to the agricultural sector's exposure to physical risks. Current market data is primarily macroeconomic and does not sufficiently cover all the sectoral data desired for comprehensive climate stress testing.

*Property Attributes:* For financial institutions with significant real estate exposures, the analysis highlights a lack of detailed locational and physical attribute data. This data is essential for assessing the vulnerability of properties to physical risks.

*Emissions Data:* Currently, there is a significant lack of emissions data in Jamaica. This gap is critical for assessing transition risks. The BOJ will be taking step to encourage the reporting on Scope 1, Scope 2, and financed emissions.

The table below provides a detailed list of the data required for the climate stress test, along with an evaluation of their status.

Table 3: Data Gap Analysis for Climate Stress Testing in Jamaica

| Category   | Description   | Source<br>(Actual/Potential) | Status  |                                  | Comments   |
|--|---|------------------------------|---|----------------------------------|--|
|  |   |                              | Have  | Not Have                         |  |
| <b>Financial Data</b>  | <p>This data encompasses</p> <ol style="list-style-type: none"> <li>1. on and off-balance sheet exposures (including loans, securities, derivatives and other financial instruments)</li> <li>2. by sector</li> <li>3. by location</li> <li>4. by maturity profiles</li> <li>5. Exposure by collateral types                             <ol style="list-style-type: none"> <li>a. Cash</li> <li>b. Real Estate</li> <li>c. Other Asset</li> </ol> </li> <li>6. Current quality of exposures</li> </ol> | <i>DTIs/Non-DTFIs</i>        | <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>(DTIs only)</p> <p>✓<br/>(DTIs only)</p> | <p>✓</p> <p>✓</p> <p>(NDTIs)</p> | <p>Loan quality ratios and investment ratings are available for the loan and securities portfolio for DTIs, respectively.</p>                                  |
| <b>Specific property attributes</b>                                      | <p>location of properties (proximity to water or flood zones)</p> <p>Type of construction materials and roof design</p> <p>Age of properties</p>  | <i>DTI/Non-DTFIs</i>         |   | <p>✓</p> <p>✓</p> <p>✓</p>       |  |
| <b>Non-Financial Corporation's (NFC) financial &amp; production data</b> | <p>Counterparties financial health and production activities and their susceptibility to transition risks. This includes</p> <ul style="list-style-type: none"> <li>• Balance Sheet Information,</li> </ul>   | <i>NFC</i>                   |   | <p>✓</p>                         | <p>Granular financial data on counterparties is needed by both the Supervisors and financial institutions for this type of analysis. BOJ will work towards</p> |

| Category                   | Description  | Source<br>(Actual/Potential) | Status |   | Comments  |
|----------------------------|--|------------------------------|--------|---|---|
|                            |  |                              | Have   | Not Have  |   |
|                            | <ul style="list-style-type: none"> <li>Income Statements,</li> <li>cash flow and key financial ratios.</li> <li>Production Processes</li> <li>Supply chains, and carbon footprints (including the adoption rate of green technologies, energy efficiency improvements).</li> </ul>                         |                              |        | <ul style="list-style-type: none"> <li>✓</li> <li>✓</li> <li>✓</li> <li>✓</li> </ul>            | collecting this data over the medium term.  |
| NFC's Sector specific data | <p>Sectoral reliance on non-renewable resources<br/>Exposure to climate-sensitive regions<br/>Regulatory landscapes.</p> <p>Company level current and potential future carbon footprints of firms and sectors.</p> <p>Historical Emissions Data by sectors</p> <p>Sectoral and Geographical Breakdown:</p> |                              |        | <ul style="list-style-type: none"> <li>✓</li> <li>✓</li> <li>✓</li> <li>✓</li> <li>✓</li> </ul> | <p>Jamaica is a service-based economy so transition risks relating to emissions may not be material.</p> <p>The Supervisors will begin encouraging supervised entities to collect and report on their scope 1, scope 2 and scope 3 emissions.</p> <p>Encourage data collection for financed emissions through engagement between financial institutions and clients. Reporting on this data can be provided in line with guidance from the Partnership on Carbon Accounting Financials (PCAF)</p> <p>Encourage data collection for financed emissions through</p> |

| Category                          | Description  | Source<br>(Actual/Potential) | Status |                   | Comments   |
|-----------------------------------|--|------------------------------|--------|-------------------|--|
|                                   |  |                              | Have   | Not Have          |  |
|                                   |  |                              |        |                   | <p>engagement between financial institutions and clients. Reporting on this data can be provided in line with guidance from the Partnership on Carbon Accounting Financials (PCAF).</p> <p>However, given, the global shift toward decarbonization exposure to transition risks could affect local energy prices and undermine the competitiveness of industries reliant on high-carbon processes.</p> |
| <b>Climate scenario variables</b> | <p>These variables include:</p> <p>Emission Pathways - the trajectory of global greenhouse gas emissions over time.</p> <p>Climate Projections: derived from climate models and includes:<br/> temperature rises,<br/> precipitation patterns,<br/> sea-level changes.</p> | NGFS, IPCC, World Bank       |        | <p>✓</p> <p>✓</p> |  |



| Category                   | Description  | Source<br>(Actual/Potential)   | Status |          | Comments |
|----------------------------|--|--|--------|----------|----------|
|                            |  |  | Have   | Not Have |          |
|                            | Jamaica Specific Climate Pathways (RCPS and possibly SSPs)   | Caribbean Community Climate Change Centre (CCCCC); University of the West Indies (UWI) Climate Studies Group |        | ✓        |          |
|                            | Historical data on acute Climate events such as floods and hurricanes to include:<br>Frequency<br>Severity<br>Economic impacts<br>Other climate and weather-related data for example: temperature, rainfall, land cover. | Meteorological Services of Jamaica   |        | ✓        |          |
| <b>Physical peril data</b> | Geospatial Data: including high-resolution maps and satellite imagery that can pinpoint areas vulnerable to specific climate events.   |  |        | ✓        |          |
| <b>Policy Responses</b>    | Global policy measures, such as carbon pricing, emission caps, and renewable energy mandates.  |  |        | ✓        |          |
|                            | Adaptation and Mitigation Efforts  | Ministry of Economic Growth and Job Creation (MEGJC)   | ✓      |          |          |
|                            | Updates of Transition Plans and NDCs   | Planning Institute of Jamaica (PIOJ)   | ✓      |          |          |
|                            | Population growth  | BOJ  | ✓      |          |          |

| Category                 | Description                     | Source<br>(Actual/Potential) | Status |          | Comments |
|--------------------------|---------------------------------|------------------------------|--------|----------|----------|
|                          |                                 |                              | Have   | Not Have |          |
| Socioeconomic<br>Factors | GDP Growth                      |                              |        |          |          |
|                          | Changes in consumption patterns |                              |        |          |          |

## Monitoring Framework

### 5.1.1 Data Collection Mechanisms

The granularity required for climate risk bank solvency stress testing and scenario analysis will involve amendments to current prudential reporting forms to include specific fields for climate-related data, as detailed in the Appendix of this report. These amendments will capture a wider array of data points, such as carbon emissions metrics, exposure to climate-sensitive sectors, and geographic locations. For the other data, this process will involve further interactions with the relevant stakeholders and data scientists (non-financial corporates, meteorological services, government ministries, academic collaborators and the PIOJ) to develop and to formalize data sharing agreements such as Memoranda of understanding, where necessary.

### 5.1.2 Illustrative Templates

This section introduces illustrative data templates, designed to streamline the process of capturing, analyzing, and reporting crucial information related to climate risks from deposit taking institutions (DTIs) and non-deposit taking Financial institutions (NDTFIs) (see Appendix for Details). These templates follow guidance from the Basel committee on Banking supervision ([BIS 2023](#)) and are both quantitative and qualitative in nature, focusing on both physical and transition risk exposures. By standardizing data collection across the industry, these templates aim to enhance the accuracy and comparability of information, facilitating the development of Top-Down climate risk stress tests.

In addition to the quantitative data submissions regarding climate risks, supervised entities will be asked to provide comprehensive qualitative supplements to regulators, detailing how they manage their climate-related risks. Specifically, entities will be asked to detail their Risk Assessment Policies, explaining the integration of climate risks into their credit risk assessments and overall valuation processes. This includes discussing the methodologies and criteria used to incorporate climate-related factors into risk evaluations. Moreover, entities will be asked to report on any Valuation Adjustments they have implemented to reflect increased climate risks. This could involve adjustments to asset valuations based on their vulnerability to climate impacts such as extreme weather events or transition risks stemming from policy changes.

The templates presented in this framework are illustrative in nature, designed to facilitate a consultative development process. This approach will allow the BOJ and the Financial Services Commission (FSC) to implement modifications to existing reporting forms on a phased approach to implementation. This will help in managing the transition more smoothly, allowing both regulators and institutions to adapt to the changes without disruption.

### 5.1.3 Consultation and Sensitization

A consultative process will be implemented to refine the data requirements. For the illustrative templates this process will involve engaging with financial institutions. This process is aligned with the existing data reporting structures and aims to thoroughly sensitize financial institutions to the evolving data needs. The goal is to ensure that there is a clear understanding and alignment regarding the

available data and reporting expectations, facilitating a seamless transition to the enhanced climate risk reporting standards. This method not only builds consensus but also ensures that the final templates are practical and effective for diverse financial entities.

To complement the updated templates and ensure consistent and accurate data reporting, a key component of the framework will be the development of detailed climate risk guidance notes and standards. These documents will provide clear instructions on how to complete the new forms, the types of data required, and the methodologies for calculating or estimating climate-related metrics.

Standards will be set for data quality, ensuring that the information gathered is reliable and robust enough to support effective climate risk analysis.

## 5.2 Alignment with Existing Regulation

BOJ and the FSC will utilize their existing legislative powers to mandate the inclusion of climate-related data in the reporting requirements for financial institutions. These powers are enshrined in the Banking Services Act, 2014 for the BOJ, and the Financial Services Commission Act, 2001 for the FSC, which grant both bodies the authority to monitor financial institutions and collect a wide array of operational data essential for ensuring the safety and soundness of financial system.

For DTIs, which comprises commercial banks, merchant banks, and building societies, Articles 64 and 65 of the [Banking Services Act, 2014](#), Article 64 enables the BOJ to conduct ongoing monitoring, while Article 65 mandates these entities to submit any operational data required by the BOJ, including data relevant to the effective supervision of the licensee and any financial groups they belong to. Similarly, the FSC is equipped under the [Financial Services Commission Act, 2001](#), to collect necessary data from prescribed financial institutions.

## 5.3 Implementation Plan

To ensure the successful rollout of this framework, a detailed implementation plan has been developed. This plan employs a phased approach, encompassing a six-month consultation period to refine reporting requirements, and sets specific milestones and deadlines to maintain progress and ensure accountability.

The process for integrating climate-related data into the existing reporting framework will be systematic and involve several stages: -

**Development of New Forms and Establishing Data Needs:** Initially, the BOJ and FSC will develop new reporting forms designed specifically to capture detailed climate-related data. This will include information on exposures to climate-sensitive sectors, carbon footprint and counterparty exposures. At the same time, the BOJ will seek a deeper understanding of the methods available to collect historical weather data, data on adaptation and mitigation efforts, and transition plans

**Consultation Period:** Before the introduction of these forms, there will be a 6-month engagement period involving multiple consultations and feedback sessions between the regulatory bodies and

stakeholders. This collaborative approach ensures that the forms meet the needs of effective supervision while being feasible for institutions to complete.

**Finalization and Implementation:** Following these consultations, the final versions of the forms will be agreed upon and disseminated to the institutions. Regular data submission will then commence at intervals agreed upon by all stakeholders.

**Data Compilation and Validation:** A team from the BOJ will work with stakeholders to compile, review, and validate the collected data. This team will ensure that the data is accurate, comprehensive, and suitable for analysis.

**Dissemination to Stakeholders:** Finally, the validated data will be prepared for dissemination to relevant stakeholders, including policy makers and financial analysts to inform the climate resilience of the financial sector.

This consultative phase will also serve as a sensitization campaign, helping institutions understand the critical role their data plays in assessing climate risks and the broader implications for the financial sector. By involving all relevant stakeholders in the development process, the framework will ensure that the final templates are both practical and effective in capturing the necessary data.

## References

- Bank of England. “Results of the 2021 Climate Biennial Exploratory Scenario (CBES).” *Bank of England*, 2021, [www.bankofengland.co.uk/stress-testing/2022/results-of-the-2021-climate-biennial-exploratory-scenario](http://www.bankofengland.co.uk/stress-testing/2022/results-of-the-2021-climate-biennial-exploratory-scenario).
- Bank of Jamaica. *Climate-Related Financial Risks in Jamaica*, Dec. 2023, [boj.org.jm/boj-publications/research-papers](http://boj.org.jm/boj-publications/research-papers).
- Brei, Michael, et al. “The impact of natural disasters on the banking sector: Evidence from Hurricane Strikes in the Caribbean.” *The Quarterly Review of Economics and Finance*, vol. 72, May 2019, pp. 232–239, <https://doi.org/10.1016/j.qref.2018.12.004>.
- Caldecott, Ben, et al. “Stranded Assets: Environmental Drivers, Societal Challenges, and Supervisory Responses.” *Annual Review of Environment and Resources*, Annual Reviews, 18 Oct. 2021, [www.annualreviews.org/content/journals/10.1146/annurev-environ-012220-101430;jsessionid=m\\_ph-0eBHM1V7wiBOzccG4NlhtvgC5FeHJQOmQ94.annurevlive-10-241-10-91](http://www.annualreviews.org/content/journals/10.1146/annurev-environ-012220-101430;jsessionid=m_ph-0eBHM1V7wiBOzccG4NlhtvgC5FeHJQOmQ94.annurevlive-10-241-10-91).
- Carlin, David. “Climate Stress Testing Is Here: 4 Ways Your Firm Can Prepare.” *Forbes*, Forbes Magazine, 11 Jan. 2022, [www.forbes.com/sites/davidcarlin/2022/01/09/climate-stress-testing-is-here-4-ways-your-firm-can-prepare/?sh=8bb591996054](http://www.forbes.com/sites/davidcarlin/2022/01/09/climate-stress-testing-is-here-4-ways-your-firm-can-prepare/?sh=8bb591996054).
- Climate-Related Financial Risks in Jamaica*, Bank of Jamaica, Dec. 2023, [e2gobqetsqs.exactdn.com/wp-content/uploads/2023/12/Climate-Risks-Report.pdf](http://e2gobqetsqs.exactdn.com/wp-content/uploads/2023/12/Climate-Risks-Report.pdf).
- Deutsche Bundesbank. *Sensitivity Analysis of Climate-Related Transition Risks in The ...*, 2021, [www.bundesbank.de/resource/blob/846100/fb86cfe515ff7d1c10c8f9fe19b297cf/mL/2021-13-technical-paper-data.pdf](http://www.bundesbank.de/resource/blob/846100/fb86cfe515ff7d1c10c8f9fe19b297cf/mL/2021-13-technical-paper-data.pdf).
- European Central Bank. “ECB Report on Good Practices for Climate Stress Testing.” *European Central Bank*, Dec. 2022, [www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202212\\_ECBreport\\_on\\_good\\_practices\\_for\\_CST~539227e0c1.en.pdf](http://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202212_ECBreport_on_good_practices_for_CST~539227e0c1.en.pdf).

European Systemic Risk Board. “The Macroprudential Challenge of Climate Change.” *European Central Bank/European Systemic Risk Board*, July 2022, [www.esrb.europa.eu/pub/pdf/reports/esrb.ecb.climate\\_report202207~622b791878.en.pdf](http://www.esrb.europa.eu/pub/pdf/reports/esrb.ecb.climate_report202207~622b791878.en.pdf).

Federal Reserve Bank of New York. “Climate Stress Testing.” *Federal Reserve Bank of New York*, [www.newyorkfed.org/medialibrary/media/research/staff\\_reports/sr1059.pdf](http://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr1059.pdf). Accessed 31 May 2024.

Financial Stability Board. “Climate Scenario Analysis by Jurisdictions.” *Financial Stability Board*, 15 Nov. 2022, [www.fsb.org/wp-content/uploads/P151122.pdf](http://www.fsb.org/wp-content/uploads/P151122.pdf).

Network For Greening the Financial System. *Physical Climate Risk Assessment: Practical Lessons for the Development of Climate Scenarios with Extreme Weather Events from Emerging Markets and Developing Economies*, Sept. 2022, [www.ngfs.net/sites/default/files/media/2022/09/02/ngfs\\_physical\\_climate\\_risk\\_assessment.pdf](http://www.ngfs.net/sites/default/files/media/2022/09/02/ngfs_physical_climate_risk_assessment.pdf).

Network For Greening the Financial System. *Progress Report on Bridging Data Gaps*, Network for Greening Financial System, 2021, [www.ngfs.net/sites/default/files/medias/documents/progress\\_report\\_on\\_bridging\\_data\\_gaps.pdf](http://www.ngfs.net/sites/default/files/medias/documents/progress_report_on_bridging_data_gaps.pdf).

Network For Greening the Financial System. “Scenarios in Action: A Progress Report on Global Supervisory and Central Bank Climate Scenario Exercises.” *Network For Greening the Financial System*, Oct. 2021, [www.ngfs.net/sites/default/files/medias/documents/scenarios-in-action-a-progress-report-on-global-supervisory-and-central-bank-climate-scenario-exercises.pdf](http://www.ngfs.net/sites/default/files/medias/documents/scenarios-in-action-a-progress-report-on-global-supervisory-and-central-bank-climate-scenario-exercises.pdf).

The Planning Institute of Jamaica. “The State of the Jamaican Climate 2019: Historical and Future Climate Changes for Jamaica.” *The Planning Institute of Jamaica*, 2019, [www.pioj.gov.jm/product/the-state-of-the-jamaican-climate-2019-historical-and-future-climate-changes-for-jamaica/](http://www.pioj.gov.jm/product/the-state-of-the-jamaican-climate-2019-historical-and-future-climate-changes-for-jamaica/).

UNEPFI. “Good Practice Guide to Climate Stress Testing.” *UN Environment Programme Finance Initiative*, Dec. 2021, [www.unepfi.org/themes/climate-change/good-practice-guide-to-climate-stress-testing/](http://www.unepfi.org/themes/climate-change/good-practice-guide-to-climate-stress-testing/).



## Appendix

Table 4: Timelines for Implementation Plan

| Activity                                    | Timeline | Objective   | Key Milestone  |
|---|----------|---|--|
| Develop new forms and expand existing forms | Mar-25   | Lay the groundwork for framework deployment.                  | <ul style="list-style-type: none"> <li>• Develop initial drafts of reporting forms</li> <li>• Set up initial consultation between supervisors and supervised entities.</li> <li>• Continue consultation CCCCC and UWI Climate Studies Group</li> </ul> |
| Consultation and Refinement                 | Mar-25   | Refine framework through stakeholder engagement.              | <ul style="list-style-type: none"> <li>• Conduct consultation sessions.</li> <li>• Adjust reporting forms based on feedback.</li> <li>• Develop and refine guidance notes and standards.</li> <li>• Earliest access to JSRAT</li> </ul>                |
| Finalization and Training                   | Jun-25   | Finalize framework and prepare institutions.                  | <ul style="list-style-type: none"> <li>• Finalize climate risk standards and reporting forms.</li> <li>• Roll out training programs for new reporting requirements.</li> <li>• Training of BOJ and FSC Staff to use JSTRAT tool</li> </ul>             |
| Implementation and Launch                   | Sep-25   | Officially launch the framework and commence data collection. | <ul style="list-style-type: none"> <li>• Begin the first cycle of data submission.</li> </ul>  |

|                               |        |  |  |
|-------------------------------|--------|--|--|
| Ongoing Review and Adjustment | Dec-25 | Ensure the framework remains effective and relevant. | <ul style="list-style-type: none"> <li>• Establish continuous feedback mechanisms.</li> <li>• Implement periodic reviews and adjustments.</li> </ul> |
| Climate Risk Dashboard        | Mar-26 | Enhance transparency and accountability              | <ul style="list-style-type: none"> <li>• Launch Dashboard on Bank's website</li> </ul>   |

### Template T 1: Exposure to physical risks

**Purpose:** Provides an overview of Banks exposures and vulnerabilities to chronic and acute climate events

**Scope of Application:** DTIs and NDTFIs

**Content:** Quantitative information

**Frequency:** Annually

**Accompanying Narrative:** This template may be supplemented with a narrative commentary to explain:

- details of the methodology used to determine which exposures are subject to the impact of climate change physical risk
- any significant change over the reporting period and the key drivers of such changes.

|      | Columns   | a                     | b | c              | d          | e              | f          | g                     | h                      | i          | j                               |
|------|---|-----------------------|---|----------------|------------|----------------|------------|-----------------------|------------------------|------------|---------------------------------|
|      |   | Gross Carrying Amount |   |                | Allowances |                | Maturity   |                       |                        |            |                                 |
|      |   | Amount                | % | Non-Performing | Total      | Non-Performing | <=5<br>Yrs | >5 yrs<br><=10<br>yrs | >10 yrs<br><=20<br>yrs | >20<br>yrs | Average<br>Weighted<br>maturity |
| 1    | Geographic location subject to climate change physical risk                     |                       |   |                |            |                |            |                       |                        |            |                                 |
| 2    | Of which corporates   |                       |   |                |            |                |            |                       |                        |            |                                 |
| 3    | Of which loans collateralized with residential or commercial immovable property |                       |   |                |            |                |            |                       |                        |            |                                 |
| 4    | Sector  |                       |   |                |            |                |            |                       |                        |            |                                 |
| .... |   |                       |   |                |            |                |            |                       |                        |            |                                 |
| x    | Total Geographical regions or locations   |                       |   |                |            |                |            |                       |                        |            |                                 |

|   | Columns  | a                     | b   | c              | d          | e              | f          | g                     | h                      | i          | j                               |
|---|--|-----------------------|-----|----------------|------------|----------------|------------|-----------------------|------------------------|------------|---------------------------------|
|   |  | Gross Carrying Amount |     |                | Allowances |                | Maturity   |                       |                        |            |                                 |
|   |  | Amount                | %   | Non-Performing | Total      | Non-Performing | <=5<br>Yrs | >5 yrs<br><=10<br>yrs | >10 yrs<br><=20<br>yrs | >20<br>yrs | Average<br>Weighted<br>maturity |
|   | subject to climate change physical risks   |                       |     |                |            |                |            |                       |                        |            |                                 |
| y | Total geographical regions or locations not subject to climate change physical risks   |                       |     |                |            |                |            |                       |                        |            |                                 |
| z | Total geographical regions or locations where the bank is unable to judge whether they are subject to climate change physical risks. |                       |     |                |            |                |            |                       |                        |            |                                 |
|   | Total  |                       | 100 |                |            |                |            |                       |                        |            |                                 |

Entities will provide data on their exposures as follows:

- a. Both NDTFI and DTIS will provide exposures to non-financial corporates and MSMEs including loans, debt securities and equity instruments on their books.
- b. DTIs will provide information on loans collateralized by immovable property.

**Rows:**

1. **Geographical region or location subject to climate change physical risk:** Town or Parish with material climate exposures as defined by the Bank of Jamaica's assessment of climate related risks([BOJ,2023.](#))
2. **Of which: corporates:** exposures towards corporates located in Parish or town subject to climate change physical risk based on the geographical location of activity of the counterparty with the exception of exposures towards corporates that are collateralized with immovable property that should be allocated to row 3 loans collateralized with residential or commercial immovable property.
3. **Of which: loans collateralized with residential or commercial immovable property:** loans collateralized by residential or commercial immovable property and exposures towards corporates that are collateralized with immovable property located in a Parish or town subject to climate change physical risks.
4. **Sector:** In this section firms should report on the following sectors<sup>13</sup>
  - Agriculture
  - Tourism
  - Real estate (including mortgages)
  - Mining and manufacturing (industrials)
  - Distribution
  - Energy (power production, generation, and transmission)
  - Transportation

(X). **Total geographical regions or locations subject to climate change physical risks:** the aggregated amounts on the banks' exposures that are subject to climate change physical risks.

(Y). **Total geographical regions or locations not subject to climate change physical risks:** the aggregate amounts of a bank's exposure towards corporates and loans collateralized by residential and commercial immovable property that are not subject to climate change physical risks. Note that the tis

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<sup>13</sup> During the consultation process, efforts should be made to ensure that the sectoral decomposition for climate reporting is aligned with the already existing sectoral decomposition in routine prudential reporting for both DTIs and NDTFIs.

is a total row and banks are not expected to breakdown exposures not subject to climate change physical risks by location.

(Z). **Total geographical regions or locations where the bank is unable to judge whether or not they are subject to climate change physical risks:** Aggregated amounts on the banks' exposures towards corporates (including those to real estate investment trusts or similar) and loans collateralized by residential or commercial immovable property where the bank is unable to judge whether or not these exposures are subject to climate change physical risks. Please note this is a total row and banks are not expected to break down exposures where the bank is unable to judge whether or not they are subject to climate change physical risks by virtue of location.

**Columns:**

- a) **Gross carrying amount - Amount:** carrying amount of loans, debt securities and equity before subtracting the loss allowances, when applicable, expressed in the presentation currency of the Firm's financial statements prepared in accordance with IFRS Accounting Standards. For non-banks, the gross carrying amount refers to the original cost of an asset as recorded on the balance sheet before accounting for depreciation, amortization, or impairment losses. This applies to a wide range of assets such as: Property, plant, and equipment intangible assets and Investments.
- b) **Gross carrying amount – %:** column (a) expressed as a percentage of the total row of column a (sum of rows X, Y and Z).
- c) **Of which: non-performing exposures:** gross carrying amount of non-performing exposures using the bank's own definition of non-performing exposures
- d) **Allowances:** total on-balance accumulated impairment amount recognized under the applicable accounting framework.
- e) **Of which:** non-performing exposures: accumulated impairment amount of non-performing exposures.
- f) **Maturity:** Firms shall allocate the exposures to the relevant bucket depending on the remaining maturity of the financial instrument, taking into account the following: (i) where the amount is repaid in instalments, the exposure shall be allocated in the maturity bucket corresponding to the last instalment; and (ii) where an exposure has no stated maturity, or in the case of equity holdings the amount of this exposure, shall be disclosed in the largest maturity bucket "> 20 years".
- g) **Average weighted maturity:** the maturity of each exposure is weighed by the gross carrying amount of the exposure.

## Template T 2: Exposures to Transition risks and financed emissions by sector

**Purpose:** Provides an overview of Banks exposures by sector along with associated financed emissions

**Scope of Application:** DTIs and NDTFIs

**Content:** Quantitative

**Frequency:** Annually

### **Accompanying Narrative:**

Firms are expected to supplement the template with a narrative commentary to:

- sectors: provide qualitative information on the materiality assessment of the sector exposures.
- non-performing exposures: explain if they are using a definition consistent with routine prudential reporting
- financed emissions: provide qualitative information on the methodology and sources used for the calculation of financed emissions; and
- explain any significant change, inter alia, in scope, sector classifications or calculation methods over the reporting period and the key drivers of such changes



| Columns |                 | a                      | b   | c                     | d                       | e                     | f          | g                        | h                         | i          | j  | k                                      | l                                       | m  | n  | o                                    |  |
|---------|-----------------|------------------------|-----|-----------------------|-------------------------|-----------------------|------------|--------------------------|---------------------------|------------|--|--|---|--|--|--------------------------------------|--|
|         |                 | On Balance Sheet items |     |                       |                         |                       |            |                          |                           |            |  |  |   |  |  | Off<br>Balanc<br>e<br>Sheet<br>Items |  |
|         |                 | Gross carrying amount  |     |                       | Allowance               |                       | Maturity   |                          |                           |            |  |  |   |  |  |                                      |  |
|         |                 | Amo<br>unt             | %   | Non-<br>Perfomi<br>ng | Total<br>Allowanc<br>es | Non-<br>Perfomi<br>ng | <=5<br>Yrs | >5<br>yrs<br><=10<br>yrs | >10<br>yrs<br><=20<br>yrs | >20<br>yrs | Average<br>weighte<br>d<br>Maturii<br>ty | Scopes<br>1,2 and<br>3<br>(MtCO2<br>e) | Of<br>which:<br>Scope 3<br>(MtCO2<br>e) | GHG<br>Forecast<br>- Scope<br>1,2 and<br>3<br>(MtCO2<br>e) | GHG<br>Forecas<br>t-<br>referen<br>ce year | Amou<br>nt                           |  |
| 1       | Sector          |                        |     |                       |                         |                       |            |                          |                           |            |  |  |   |  |  |                                      |  |
| 2       | Other<br>sector |                        |     |                       |                         |                       |            |                          |                           |            |  |  |   |  |  |                                      |  |
| ....    |                 |                        |     |                       |                         |                       |            |                          |                           |            |  |  |   |  |  |                                      |  |
|         | Total           |                        | 100 |                       |                         |                       |            |                          |                           |            |  |  |   |  |  |                                      |  |

### Rows:

Firms will report on their exposures towards non-financial corporates MSMEs including loans, debt securities and equity instruments, classified by sector of economic activity as defined by the Bank of Jamaica's Assessment on CRFR ([BOJ,2023](#)). When Firms have exposures that are immaterial in any sector, these exposures may be aggregated under "other sectors".

Columns (m) and (n) related to GHG forecast – Scope 1, 2 and 3 (MtCO<sub>2</sub>e) and the reference year (n), should be disclosed only for those sectors where the bank is setting forecasts based on sector-specific policies.

### Columns:

(k) to (l) **Greenhouse gas financed emissions – Scope 1, 2 and 3:** aggregated counterparties' Scope 1, 2 and 3 financed emissions associated with institution's lending and investment exposures reported in column (a) and could include counterparty-reported emissions and proxy measures (based on physical activity-based emissions or economic activity-based emissions). The absolute gross greenhouse gas emissions (GHG) generated during the reporting period, shall be measured in accordance with the Greenhouse Gas Protocol activities in column (k) and separately counterparties' Scope 3 financed emissions under column (l). These financed emissions should relate exclusively to the on-balance sheet Corporate Standard and should be expressed as metric tonnes of CO<sub>2</sub> equivalent. Banks are expected to disclose greenhouse gas financed emissions for all material sectors.

(m) **GHG forecast–Scope1,2and3(MtCO<sub>2</sub>e):** institutions should disclose forward-looking GHG absolute emission forecasts (Scope1,Scope2 and Scope3) only for those sectors where the bank is setting forecasts based on sector-specific policies.

(n) **GHG forecast – reference year:** reference year being the year in which the bank has committed to achieve its forecast (forward-looking) for the forecast disclosed in column (m).

(o) **Off-balance sheet items:** full amount of the commitment expressed in the presentation currency of the bank's financial statement

## Banking service Act- Article 64 and 65

**64.—(1)** In addition to his functions under this Act or any other enactment, the Supervisor shall—

- (a) monitor licensees on an on-going basis, by means of off-site and on-site examinations, to assess—
  - (i) compliance by individual licensees with the provisions of this Act, any regulations made under this Act or any other enactment;
  - (ii) the safety and soundness of individual licensees and the deposit taking system; and
  - (iii) risks across the group pursuant to the consolidated supervision of the financial group;
- (b) require, or recommend to the Supervisory Committee, timely and appropriate corrective action to be taken by licensees when deficiencies or breaches are identified;
- (c) impose or, as the case may require, recommend to the Supervisory Committee the imposition of, sanctions for identified breaches of the provisions of this Act, any regulations made under this Act or any directions issued by the Supervisor under this Act;
- (d) provide, at least on an annual basis, a comprehensive report to the board and management of each licensee on the results and findings from on-going monitoring of that licensee, including requirements for remedial action to be taken within given timelines;
- (e) advise the Supervisory Committee and the Minister on risks across the supervised system and on the supervisory response to emerging risks across the system;
- (f) publish financial information on individual licensees and the supervised system in such format and frequency as he may determine.
- (g) publish on an annual basis—
  - (i) statistics on customer complaints;
  - (ii) information reported by licensees on fees and charges;
  - (iii) complaints referred to the Supervisor in relation to a code conduct,

so, however, that no information in respect of the affairs of a particular customer of a deposit taking institution shall be published.

(2) In undertaking any of the functions under subsection (1) (a), the Supervisor may determine the frequency and scope of the examinations according to the risk profile and systemic importance of the licensee and any matters that may be unique to the licensee.

**65.—(1)** The Supervisor may require any company which is a member of a group of which the licensee is a member to submit to the Supervisor, such information relating to the operations of that company, as the Supervisor considers necessary for the effective supervision of the licensee or the financial group of which the licensee is a member.

(2) The information referred to in subsection (1) may be required for the purpose of determining—

- (a) the effect of the group's or those entities' operations on the licensee;
- (b) whether a member of the group is obtaining financing or other benefit, whether directly or indirectly from the licensee;
- (c) the general risks posed to the licensee from operations of the members of the group;
- (d) the risk management capabilities of the group as a whole;
- (e) whether the internal audit facilities within the group have the capability to scrutinize transactions undertaken or proposed to be undertaken by the management of the group or a company within the group so as to determine whether there are associated risks; or
- (f) the adequacy of the corporate governance arrangements for the group.

(3) The Supervisor may summon any director, officer, key employee or substantial shareholder of the licensee or member of the financial group for the purpose of obtaining information; and the director, officer, key employee or substantial shareholder of the licensee or member of the financial group shall comply therewith.

(4) A company who refuses to furnish information required under subsection (1) commits an offence.

(5) A director, officer, key employee or substantial shareholder of a licensee who refuses to obey a summons under subsection (3) commits an offence.

(6) Where the Supervisor proposes to exercise power under this section in relation to a company that is regulated by another regulator, the Supervisor shall consult with that regulator before exercising those powers.

## Financial Services Commission Act- Section 6

### *General Duties and Powers*

6.—(1) For the purpose of protecting customers of financial services, the Commission shall—

- (a) supervise and regulate prescribed financial institutions;
- (b) promote the adoption of procedures designed to control and manage risk, for use by the management, boards of directors and trustees of such institutions;
- (c) promote stability and public confidence in the operations of such institutions;
- (d) promote public understanding of the operation of prescribed financial institutions;
- (e) promote the modernization of financial services with a view to the adoption and maintenance of international standards of competence, efficiency and competitiveness.

(2) For the purpose of the discharge of its duty under subsection (1), the Commission shall—

- (a) take such steps as are necessary to ensure that appropriate standards of conduct and performance are maintained in prescribed financial institutions in accordance with this Act, any rules or regulations made hereunder or any relevant Act;
- (b) at such times as it may determine but at least once in each year—
  - (i) examine, in such manner as it thinks fit, the affairs or business of every prescribed financial institution carrying on business in Jamaica or elsewhere for the purpose of being satisfied that the provisions of this and any relevant Act are being complied with and that the institution is in a sound financial condition; and
  - (ii) within ninety days after the completion of the examination, report to the Minister the results of every such examination and any such report may contain such recommendations as the Commission considers necessary or desirable to correct any malpractices or deficiencies discovered in the examination;
- (c) in accordance with the provisions of any relevant Act—

- (i) consider applications for licences or registration and grant or refuse to grant any such licence or registration; or

- (ii) suspend, cancel or revoke any such licence or registration;

- (d) appoint authorized officers for the purposes of paragraph (b);

- (e) subject to such provisions as may be prescribed, summon the auditor or actuary, or any former auditor or actuary of a prescribed financial institution for the purpose of making enquiries into the operations and financial position of that institution;

- (f) implement measures designed to reduce the possibility of a prescribed financial institution being used for any purpose connected with an offence involving fraud, theft or money laundering;

- (g) collect at such times as may be prescribed such statistics in relation to financial services as may be prescribed;

- (h) perform such other duties as may be prescribed by or pursuant to this Act.

(3) In the performance of his duties under this section an authorized officer shall be entitled at all reasonable times—

- (a) to have access to all books, records and documents in the possession or control of any director, manager, officer or employee of any prescribed financial institution;

- (b) to require any director, manager, officer, auditor, former auditor or employee of any prescribed financial institution to furnish such information or to produce such books, records or documents as are in his possession or control, that relate to the operations of the prescribed financial institution and may be reasonably required for the performance of those duties.

(4) Any person who—

- (a) fails to comply with a requirement made pursuant to subsection (3)(b); or

- (b) wilfully attempts to mislead or makes any false statement with intent to mislead or attempts to mislead any person in the execution of his duties under this section; or

- (c) without lawful justification or excuse, obstructs or hinders any person in the execution of such duties,

shall be guilty of an offence.