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Integrating C&E risks in credit risks at banks

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Introduction & agenda

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1 **Background & introduction to ESG risk management**

2 **Risk Identification, Measurement and Monitoring**

3 **Enhancing ESG data quality through data imputation**

1

Background & introduction to ESG risk management

Banks might face significant ESG risks

ESG landscape is evolving rapidly also due to geopolitical circumstances

Environmental risks

- Environmental risks are the traditional focus area of ESG risks.
- Most banks have devoted attention to the management of environmental risks.
- Environmental risks can have significant financial impact as demonstrated in recent years.

Social & Governance risks

- Social & governance risks have gained attention in recent times as a topic of importance.
- Many banks have failed to properly consider S&G risks in their risk management practices thus far.
- There is growing public attention to social & governance matters, putting pressure on banks.

Recent ESG developments

- Geopolitical developments have led to the politicization of ESG in many countries.
- Consequently, some banks have scaled-back their sustainable ambition.
- In the EU, the CSRD requirements have been simplified, placing many companies out-of-scope of the regulation.

EU stress test forecasts €630bn bank losses from climate and macro shocks

ECB and EU supervisory authorities urge co-ordinated action as green transition poses financial risks

ING profiteert van catastrofale lening aan Tsjaad met olie als onderpand

EU adopts omnibus proposal, trims sustainability reporting requirements

Europe's interest rates increasingly reflect climate risks

Six big US banks quit net zero alliance before Trump inauguration

Valencia floods highlight climate vulnerabilities of Spanish banks

ABN Amro, ING facilitate tax avoidance via the Netherlands, claims Fair Bank Guide

Europe's banks rethink climate collaboration as alliances struggle ahead of Davos

Nationwide stops lending on some flood-risk properties

Veel geld voor megastallen, weinig voor duurzaamheid: Rabo's rol in de stikstofcrisis

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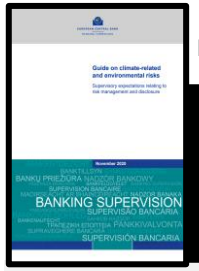
Understanding how ESG risk regulations interconnect is essential for successfully implementing ESG risk management



ECB Guide on Climate and Environmental risks

Integrating climate-related and environmental risks into the banks' governance, strategy and risk management framework

The guide outlines 13 expectations on integrating C&E risks into business strategies, governance and risk management frameworks. Key areas such as:

- **Materiality assessment:** Banks are required to perform a materiality assessment to identify and evaluate the significance of C&E risks. This involves understanding relevant risk drivers and assessing the impact on existing risk types.
- **Business models and strategy:** Institutions are expected to incorporate C&E consideration into their strategy and alignment with their business models.
- **Governance and risk appetite:** Institutions should ensure that the management bodies are actively involved in overseeing C&E risks and that these risks are reflected in their risk appetite frameworks.
- **Risk management:** The guide details expectations for integrating material C&E risks into various risk management processes, including credit, operational, market, and liquidity risk management.
- **Stress testing and scenario analysis:** Use stress testing and scenario analysis to evaluate the potential impact of CER on the institution's resilience.

EBA Guidelines on ESG risk management*

Enhancing ESG risk management frameworks for financial resilience

The EBA GLs provide a comprehensive framework for FIs to identify, measure, manage and monitor ESG risks. The GLs are an evolution of the ECB Guide on CER, new elements being:

- **Covers next to C&E risks also the S and the G in all components:** Social and governance risks should be fully integrated in all components incl. materiality assessment, strategy, risk appetite, governance and risk management.
- **More specific data requirements and measurement methodologies:** Specifies in more detail data points related to 'E' and 'S' topics banks need to collect for companies that fall within the scope of the CSRD. For companies that are not covered by the CSRD, the EBA GLs require banks to develop separate data collection procedures. Institutions must consider a combination of exposure-based, portfolio-based, and scenario-based methodologies to assess ESG risks.
- **Requires development of a CRD transition plan:** The GLs have introduced the requirements for a CRD transition plan, emphasizing the need for institutions to align their actions and strategies with predefined objectives and regulatory requirements. The GLs specify that institutions must develop structured plans with quantifiable targets and timelines, ensuring alignment with EU sustainability objectives, particularly the 2050 climate neutrality goal.

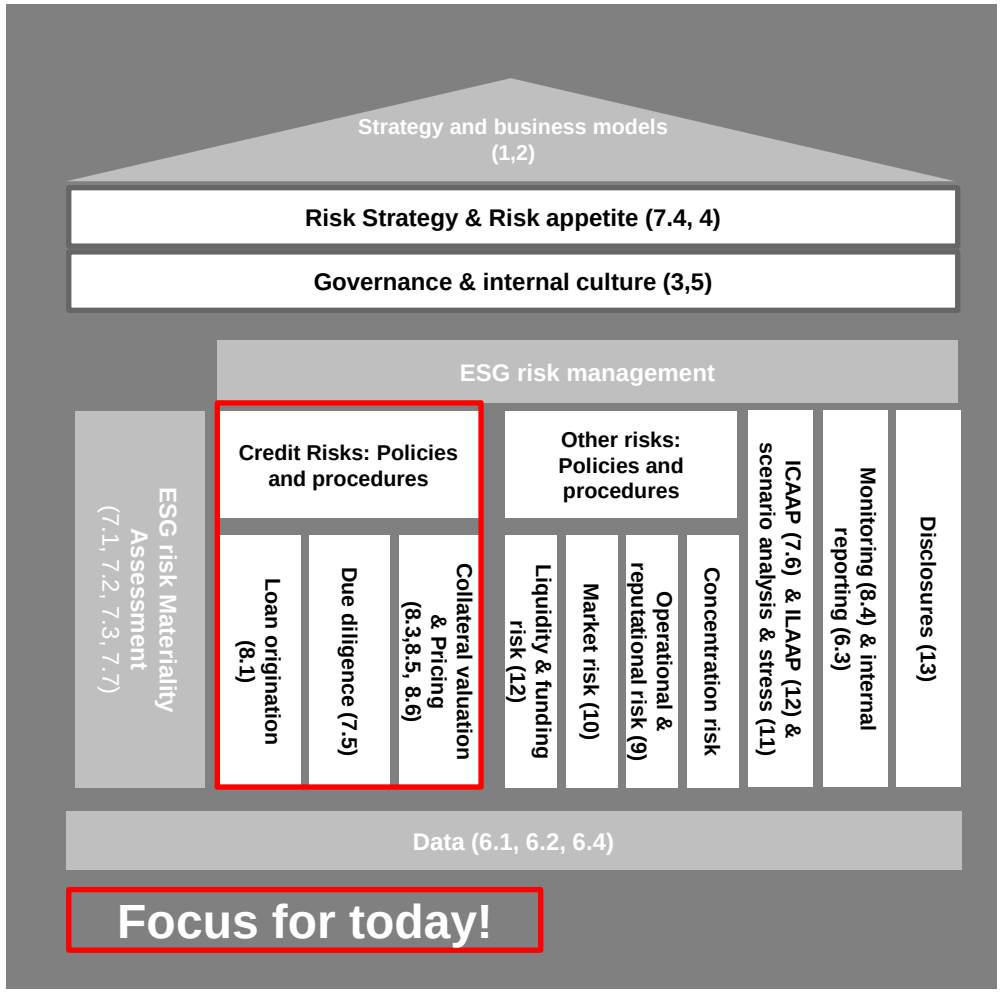
EBA Consultation Paper on ESG scenarios**

Improving banks' strategic planning and risk management through ESG scenario analysis

The consultation paper establishes a structured approach to ESG scenario analysis, clarifying its objectives, scope, and integration into risk management. Key new elements include:

- **Clearer purpose and requirements for scenario analysis:** The GLs define two primary applications:
  - **Climate Stress Testing (CST):** Assesses **financial resilience** by integrating material ESG risks into stress testing models (complementing the EBA GLs on stress testing 2018). Results should inform **ICAAP and ILAAP**, using short- to medium-term time horizons with both baseline and adverse scenarios.
  - **Climate Resilience Analysis (CRA):** A new forward-looking tool evaluating the long-term (10+ years) impact of plausible climate scenarios on **viability and resilience of an institution's business model**. CRA should inform the strategy development and transition planning process.
- **Governance of ESG scenarios**: Emphasizes the need for **robust processes** to maintain, validate, and regularly update ESG scenarios to ensure their relevance and reliability

A holistic view on ESG risk management enables effective implementation



Key concepts

The **ECB guide on CER** forms the foundation and consists of the following key concepts:

- An **annual C&E materiality assessment** is essential, serving as the cornerstone for deeper integration of C&E risks in the core or your bank;
- The identified material C&E risks must be integrated in the **overall strategy and risk appetite** through KPIs and KRIs;
- The material C&E risks that impact existing risk types must be included in the **existing risk management framework** (e.g. Risk Management Policies, RAS Notes);
- The introduced **limits (key risk indicators) and targets (KPI's)** must be monitored and used for steering and escalation purposes. The management information is part of the internal risk reports that reflect the exposure to risks;
- The material C&E risks must be included in the existing risk management practices. The business lines need to include these risks into **due diligence** and **loan origination processes** (e.g. acceptance criteria), implement procedures for **credit risk classification** (e.g. which clients have increased credit risk due to ESG risks) and lastly, consider to adjust **collateral valuation** and **pricing;**
- The material C&E risks, including non- financial risks, must be structurally included in **stress-testing** and, subsequently, in the evaluation of **capital adequacy** under various C&E risk scenarios to ensure resilience;
- The governance structure should ensure a proper allocation of **roles and responsibilities** on each level, management body including subcommittees and 1st, 2nd and 3rd line to assist, advise and monitor C&E risks;
- **Data** is fundamental in integrating C&E factors into risk management and is linked to all components;
- **Disclosures** on C&E risks should provide information to stakeholders that is transparent, comparable and reliable.

2

Risk Identification, Measurement and Monitoring

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C&E transmission channels (credit risk): *what is the risk for the bank?*

Material C&E risk	Transmission channel	Risk for the bank
Flood (fluvial, pluvial, coastal, groundwater) • **Pole rot** following drought • **Subsidence** following drought **Legal and regulatory changes regarding greenhouse gas emissions**	• Flooding may lead to significant damage to the property, requiring a devaluation of assets which ultimately leads to an increase in LGDs and hence expected losses. • Lower valuation for the mortgages with potential pole rot risk leading to an increase in LGD • Decreasing valuation of collateral with lower energy labels leading to an increase in LGD	**Impact on value** → **LGD** **Loan increase** Given the risks, a client may incur additional costs and therefore increase the loan. This may affect both LGD (increased L) as well as higher PD (reduced repayment ability)
Flood (fluvial, pluvial, coastal, groundwater) • **Pole rot** following drought • **Subsidence** following drought **Legal and regulatory changes regarding greenhouse gas emissions**	• Increasing costs for the borrowers related to repairs and adaptation solutions reducing the borrower's repayment ability and increasing PD • Higher insurance premiums due to increased frequency of insurance claims in flood-prone areas, leading to an increase in PD • Increasing costs for the borrowers to repair the foundation damages or investments in new foundation reducing the borrower's repayment ability and increasing PD • No insurance coverage leading to an increase in PD • Increasing costs for the borrowers related to adaptation works required to make houses more sustainable, reducing the borrower's repayment ability	**Reduced repayment ability** → **PD**

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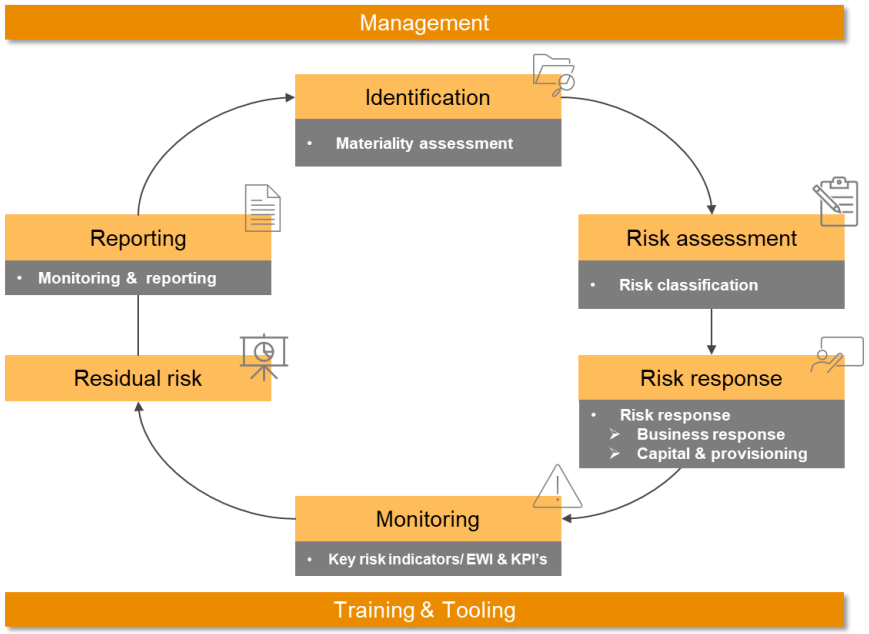
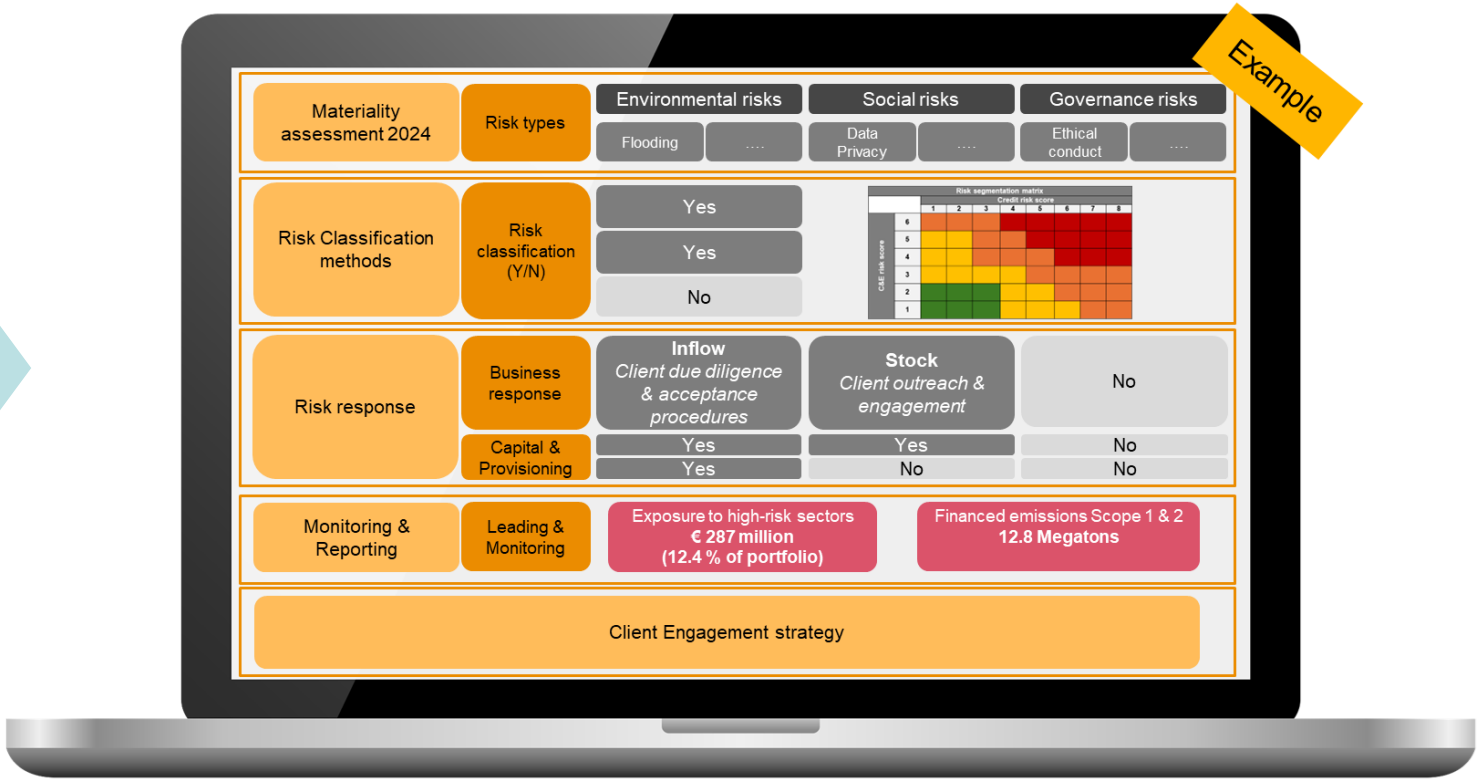
Implementation in the risk management framework





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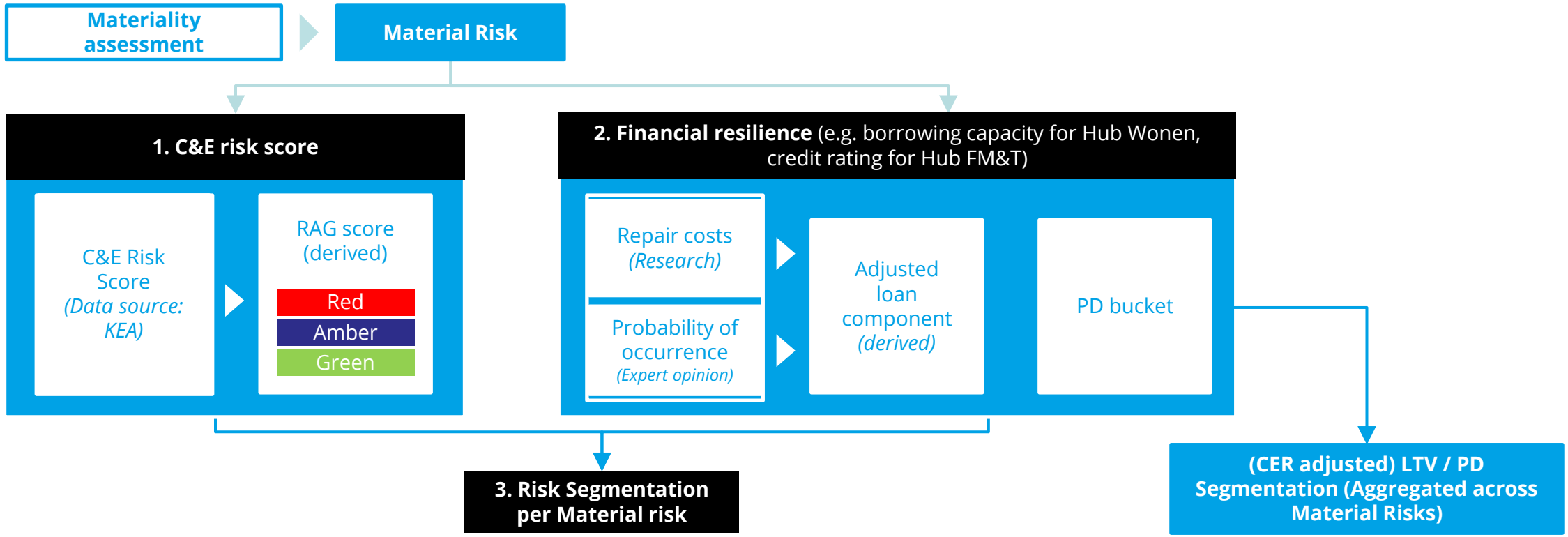
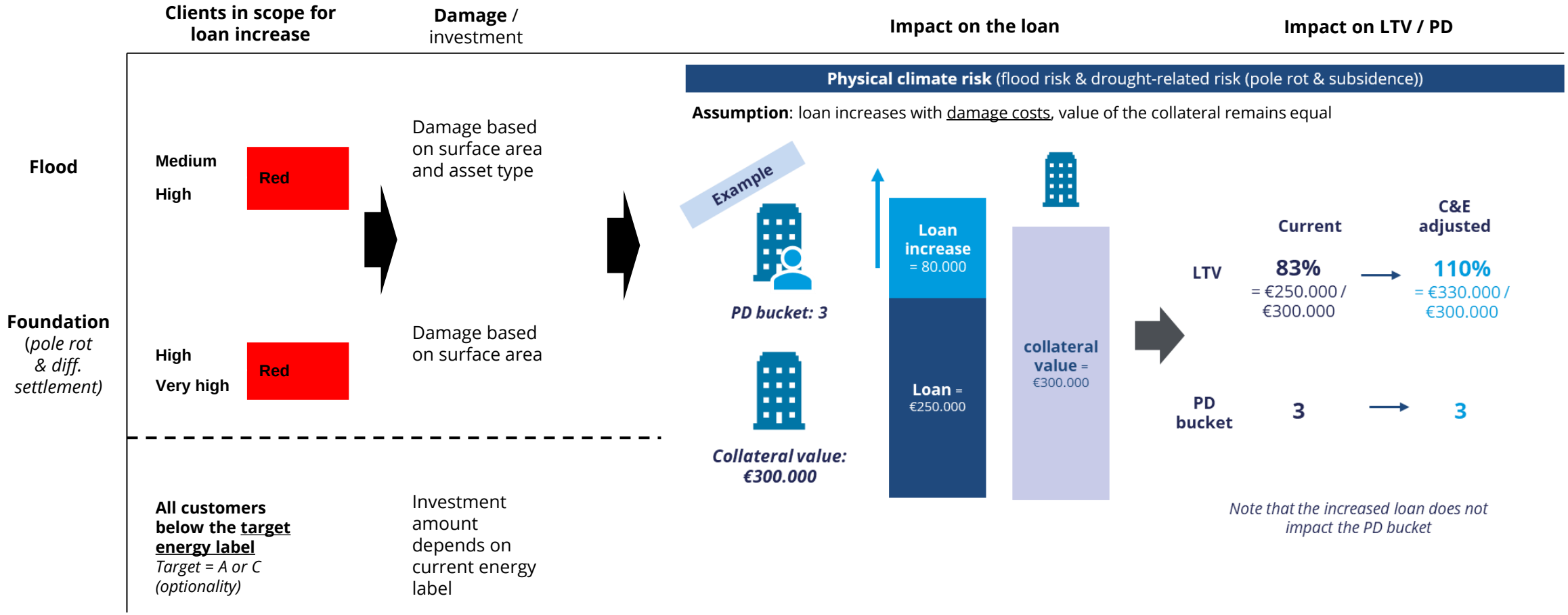
Portfolio overarching approach for classification (segmentation) of clients based on climate- and environmental risks

- The schematic overview below shows the general, Hub-overarching approach to classify clients based on the material C&E risks they are exposed. It consists of 1) a pure **C&E risk score**, combined with 2) a metric that is used as a proxy for **financial resilience**.
- For Hub Ondernemen, the results are available in PowerBi:
  1. Per material risk, e.g. risk segmentation for pole rot combined with financial resilience metric.
  2. Aggregated across all material risks, i.e. aggregated C&E risk combined with financial resilience metric.



The ‘ability to absorb C&E costs in the loan’ is chosen as the financial resilience factor – physical risks example



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Client classification with the C&E segmentation matrix

C&E segmentation matrix (C&E-SM) approach

- To identify borrowers with a potentially increased credit risk due to C&E risks, De Volksbank:
  1. Identifies vulnerable houses with the **pure C&E risk score**
  2. Identifies vulnerable borrowers with the *C&E segmentation matrix (C&E-SM)*, which is used as a proxy for **financial resilience** to potential C&E costs**.**
- The C&E segmentation matrix identifies borrowers that are vulnerable to C&E risks, **i.e borrowers that cannot absorb the costs that are associated with these risks within the acceptable loan limits**. This is the case for borrowers that are currently within the applicable loan limits (Point A – see picture on the right) and, due to costs associated with C&E risks, may move outside these loan limits (Point B). To determine Point B for every borrower, the possible future costs of a C&E risk (if it materializes) is added to the current loan of the client. This results in:
  - C&E adjusted LTI
  - C&E adjusted LTV
- **Borrowers that move to the Red buckets may have an increased credit risk due to C&E risks**

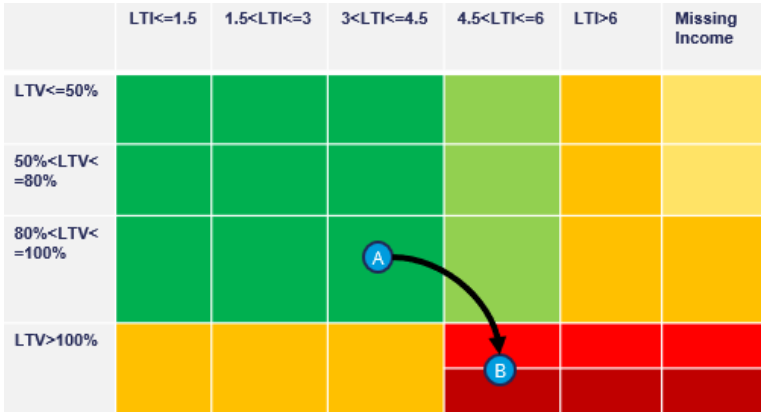
Calculation method of C&E adjusted LTI & LTV

- Starting point (Point A): the C&E segmentation matrix clusters all customers in a segment based on LTV (on the vertical axis) and LTI (on the horizontal axis), without any consideration of C&E risks.
- C&E adjusted LTI and LTV (Point B) calculation:
  - For physical risks (flood & drought): the potential repair costs are added to the *Loan*. The *Value* is not changed.
  - For transition risk: the investment costs are added to the *Loan*. The *Value* increases as well (with 70% of the investment costs).
- Key assumptions [2]:
  1. Physical risks: borrowers are either assumed to incur C&E costs or not (binary approach). The selection of borrowers in scope of these costs is based on the *Klimaateffectatlas.*
  2. Transition risks: borrowers below the target energy label are assumed to incur costs to achieve the target.
  3. Damage and investments:
     1. Flood damage: €33.300,42
     2. Foundation damage: €80.000
     3. Energy label investment: 2,4% - 17,0% of the house value, depending on the current label

Use of the C&E segmentation matrix

1. Risk classification: the C&E-SM assesses the impact of climate-related risks on the risk profile of existing clients by using the LTV and LTI loan limits as indication for the credit risk profile.
2. Risk monitoring & reporting: the C&E-SM will serve as input for metrics in the credit risk report for RRE.
3. Targeted client outreach: the C&E-SM will be used to target clients with high (layered) C&E risk and support them to reduce the risk if there is perspective for action (e.g. improve the energy label).

C&E segmentation matrix [2]



3

Enhancing ESG data quality through data imputation

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Overcome key ESG data challenges

In today's rapidly evolving business landscape, the demand for **transparency** and **accountability** in sustainability reporting remains strong. However, **geopolitical developments** and **omnibus legislation** are shifting the focus from merely **reporting** to actively steering on **ESG performance**. This shift emphasizes the need for accurate, reliable data not just for reporting purposes, such as the Corporate Sustainability Reporting Directive (CSRD), but also to unlock ESG data that enables companies to manage and improve their sustainability performance more effectively.

Overcome key challenges

Creating reliable sustainability reporting and performance management involves several essential elements, being:

- **Standardize** metrics and frameworks to facilitate benchmarking
- **Integrate** ESG data into existing IT landscape
- **Use** supporting technology to collect accurate and reliable ESG source data and complex ESG calculations
- **Adapt** to the rapid evolution of ESG regulations and stakeholders' expectations
- **Improve** data quality for both internal and external data
- **Achieve** more efficient and automated processes to reduce manual effort

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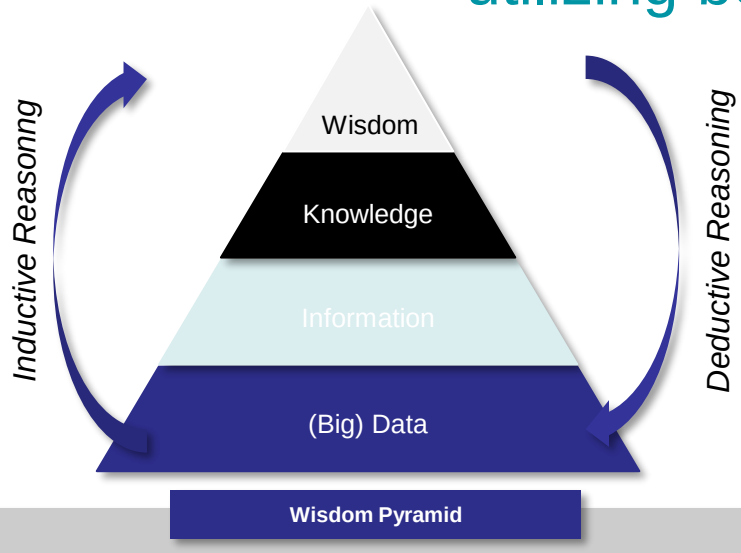
We have two imputation methods to deal with missing data, utilizing both a bottom-up and top-down approach



Wisdom Pyramid

The wisdom pyramid illustrates the progression from data to wisdom, where we build upon each layer, emphasizing the relationship between data and wisdom.

We base our 2 imputation methods to bridge data gaps in our short-term tactical solution on the Wisdom Pyramid where we can take both a bottom-up (inductive reasoning) and a top-down (deductive reasoning) approach to bridge data gaps utilizing both data and wisdom.

Inductive Reasoning: We investigate the **data** and build up our understanding of it so that we can use statistical methods to gain **knowledge** and **wisdom** to impute data in a bottom-up approach

Deductive Reasoning: We apply general **knowledge** and **wisdom** to specific instances or cases to impute **data** through a top-down approach.

	Statistical Imputation	VS	**Rule-based Imputation**
	Statistical imputation refers to a technique of filling missing data by using various statistical methods. Statistical imputation aims to estimate missing values based on existing (real) data points and statistical relationships.		Rule-based imputation refers to methods of filling missing data by applying predefined rules to derive the missing values. These rules are based on existing knowledge, benchmarks, theories or patterns observed in the data.
	Statistical imputation can be done using either inductive or deductive reasoning		Rule-based imputation is done only via deductive reasoning
Inductive Reasoning	✓		
Deductive Reasoning	✓		✓

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We have two imputation methods to deal with missing data, utilizing both a bottom-up and top-down approach

Statistical Imputation refers to the procedure of using alternative values in place of missing data. These alternative values are derived from already existing data in different mathematical ways.

Statistical imputation is often used when there is no logic answer to a missing data field. Hence, missing data is completely at random.

What

When

How

Confidence Interval

When employing statistical imputation, it's crucial to incorporate **confidence intervals to represent the reliability** of the imputed values. By incorporating confidence intervals, we provide a range in which the true value is likely to fall, rather than a single point estimate.

Depending on the nature of the data, the amount and pattern of missing data and the assumptions we are comfortable in making, we can decide between the number of imputation methods available to us.

Overview of statistical Imputation methods (non-exhaustive)

01

Univariate Analysis
A single variable is analyzed independently. Common techniques for handling missing data include Mean/Median/Mode imputation, Random Sampling, and Regression Imputation for time series data.

02

Bivariate Analysis
Two variables are analysed concurrently to understand the relationship between them. Common approaches include Simple Linear Regression for continuous variables and Logistic Regression for categorical variables. The strength and nature of the correlation between the two variables can guide the imputation strategy.

03

Multivariate Analysis
Multiple variables are considered simultaneously. There are numerous options available including but not limited to K-Means, Hot-deck imputation, Expectation-Maximization algorithm etc. These can be explored based on different use-cases.

Example – **Situation**: Missing emissions data from SME loans (Scope 3)

Case company

Bank

- Needs to comply with **CSRD**
- In the process of calculating **scope 1, 2 and 3 GHG emissions**
- Currently calculating **financed emissions on their SME loan portfolio** (15 – Investments)

After reviewing their available data on the emissions of their SME loans, the company finds out they **only have 15% of the emission data of their SME loans**. The company has contacted their clients to collect the missing data and the **clients indicated that they do not collect / record this data as of yet** and can therefore not provide the required information to company X.

Company X would still like to know and report **as accurately as possible** total scope 3 emissions and total GHG emissions to meet CSRD compliance. The information will be subject to a **limited assurance audit**.

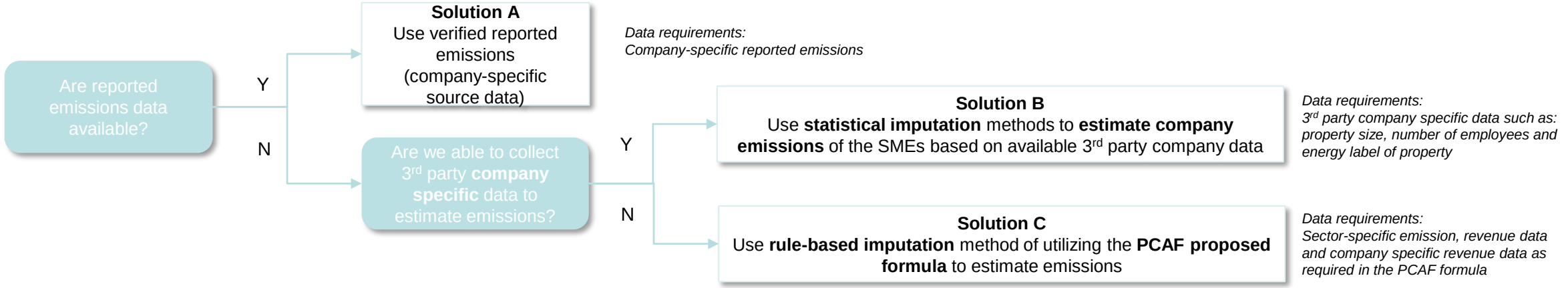
As the company is **not able to collect or accurately estimate the missing data** itself, it is looking for solutions externally. The company has to decide on what approach to follow in order **to fill the identified data gaps**. As the company has to **report on short notice** (<1 year) the company chooses the intermediate solution and uses a **tactical approach.**

Example – **Approach:** Missing emissions data from SME loans (Scope 3)

There are 3 different data gap bridging solutions that are in line with PCAF.

Which solution is selected will depend on the answer to 2 key data availability questions:

1. Do we have the company's reported emissions data?
2. Are we able to collect 3rd party data that can be used to estimate emissions?



The suggested approach consists of 2 key steps:

1. **Collect data** depending on the data requirements for the appropriate solution to bridge data gap
2. Calculate **Financed Emission** for each SME based on available data using one of the 3 solutions

Along the process of bridging data gaps there will be checks performed on **Data Quality** to ensure trustworthiness of the outcome

- DQ checks will be performed on I) Internal data, II) SME emission data, II!) third party data and IV) outcome of the different calculation methods

Example – **Collect data:** Missing emissions data from SME loans (Scope 3)

Step 1. **Collect data** depending on the data requirements for the appropriate solution to bridge data gap

$$Financed\ Emission = \sum_{c} Attribution\ factor_c \times Company\ emissions_c \quad (with\ c = borrower\ or\ investee\ company)$$

A. Emissions data that companies have reported with the bank or through annual reports of companies

B. 3rd party company specific data by gathering or linking to other online databases

For example: property size, number of employees and energy label

C. Sector specific emission and revenue data through publicly available data sources and company specific revenue data sourced internally

	Attribution factor		C		A	C			B			
Company name	Outstanding amount	Balance sheet	Sector	Total revenue	Reported scope 1&2 GHG emssions (tCO2)	Sector revenue	Sector GHG emission (tCO2)	Number of employees	Total property m2	Construction year of property	Property energy label	Does the company have a sustainability strategy?
Company A	€ 125.000	€ 2.000.000	Horeca	€1.700.000	122	€ 22,39 x 10^9	1,73 x 10^6	9	900	2012	A	Y
Company B	€ 40.000	€ 760.000	Horeca	€600.000		€ 22,39 x 10^9	1,73 x 10^6	3	400	1993	B	N
Company C	€ 78.000	€ 1.020.000	Mobility	€1.000.000		€ 104,43 x 10^9	3,46 x 10^6	5	32000	2018	A	Y
Company D	€ 14.000	€ 490.000	Horeca	€400.000		€ 39,65 x 10^9	0,53 x 10^6					
Company E	€ 160.000	€ 1.700.000	Energy	€500.000		€ 22,39 x 10^9	1,73 x 10^6	2	600			N

Simplefied overview of example dataset

Reported company emissions data that is collected for Solution A can also be used for Solution B in:

1. training the emission estimation model; and
2. validating the emission estimation model

Reported company emissions data for validating the emission estimation model does not necessarily have to be a company with a SME loan with the bank. Reported emissions of non-client companies can also be used to validate the emission estimation model

Example – **Calculate**: Missing emissions data from SME loans (Scope 3)

Step 2. Calculate **Financed Emission** for each SME based on available data using one of the following three methods

A. Using SMEs **actual GHG emission data** to calculate financed emission

Example. Company A reports on its scope 1 and scope 2 GHG emission, the financed emission can now be calculated

$$Financed\ Emission(tCO2) = Attribution\ factor \times Company\ emissions = \frac{125.000}{2.000.000} \times 122 = 7{,}63\ tCO_2$$

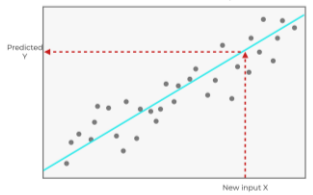
B. Use of company data to **estimate GHG emission** using a **statistical imputation model**

Example. Use regression* to **estimate company emission** of the SMEs based on the company data collected in step 1
We use data fields collected that has correlation with tCO2 emissions to create a linear regression formula
and find coefficients for all the inputs. After calculating GHG emissions, **financed emissions** can be calculated via the formula used in step A.

Intercept / Variable	Coefficients
Intercept	0
Number of employees	0,058
Total property m2	0,21
Property energy label	0,81
Year of construction of property	-0,38
Sustainability strategy (Y/N)	0,89

$$GHG\ emissions\ (tCO2) = Intercept + \#\ Employees\ * 0{,}058 + Property\ size\ * 0{,}21 + Property\ energy\ label\ * 0{,}81 * Year\ of\ property\ * -0{,}38 * Sustainability\ strategy * 0{,}089$$

More advanced statistical imputation methods is not appropriate to use when there is low data availability.
Once the level of data available improves, statistical methods such as KNN can be considered



C. Use of sector data to **estimate GHG emission** via **rule-based imputation using the PCAF proposed formula**

Example. For company D we don't have enough company data to estimate GHG emissions via method (B) therefore we make use of sector averages

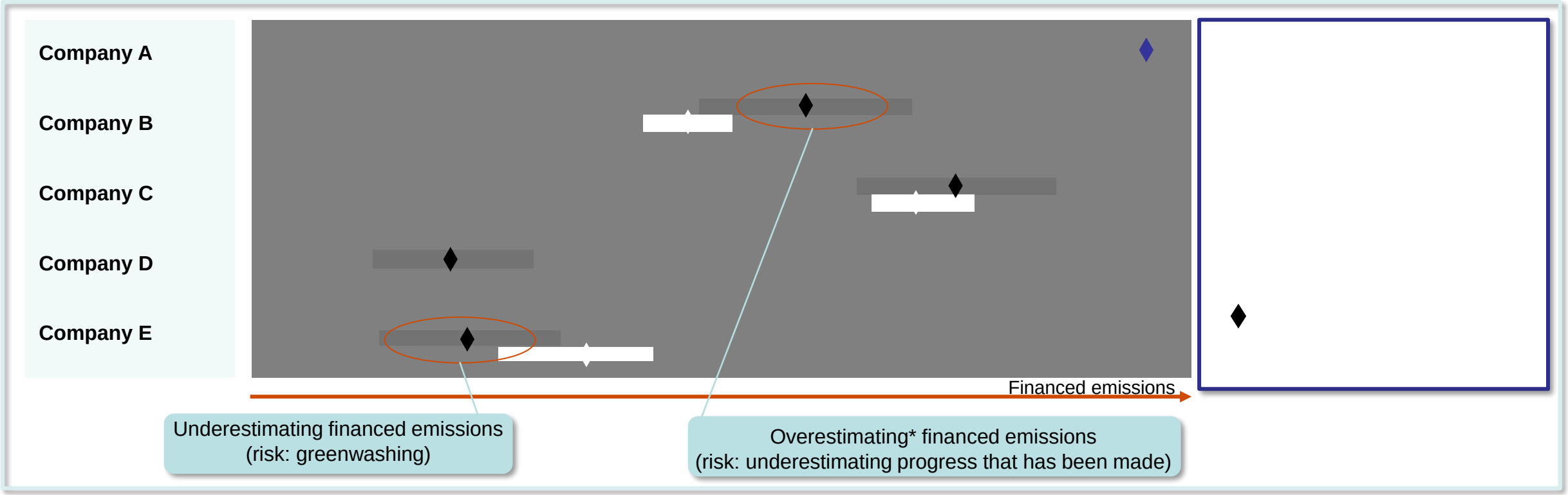
$$Financed\ emissions\ (tCO2) = attribution\ factor\ * \frac{Company\ Revenue}{Sector\ Revenue} \times Sector\ GHG\ emission$$

Company name	Outstanding amount	Balance sheet	Sector	Total revenue	Scope 1&2 GHG emissions (tCO2)	Sector revenue	Sector GHG emission (tCO2)	Enriched data	(A) Actual GHG emission (tCO2)	(B) Estimated GHG emission using company data (tCO2)	(C) Estimated GHG emission using sector data (tCO2)	Actual/Estimated Financed emission (tCO2)
Company A	€ 125.000	€ 2.000.000	Horeca	€1.700.000	122	€ 22,39 x 10^9	1,73 x 10^6	…	122	120,8	131,35	7,63
Company B	€ 40.000	€ 760.000	Horeca	€600.000		€ 22,39 x 10^9	1,73 x 10^6	…		39,2	46,35	2,06
Company C	€ 78.000	€ 1.020.000	Mobility	€1.000.000		€ 104,43 x 10^9	3,46 x 10^6	…		31,6	33,13	2,42
Company D	€ 14.000	€ 490.000	Horeca	€400.000		€ 39,65 x 10^9	0,53 x 10^6				30,91	0,88
Company E	€ 160.000	€ 1.700.000	Energy	€500.000		€ 22,39 x 10^9	1,73 x 10^6	…		10,3	6,68	0,97

Example – **Outcome**: Missing emissions data from SME loans (Scope 3)

The financed emission for each SME is was calculated by using one (or more) of the following methods:

- A. Using scope 1 and scope 2 emission data provided by the SME (Company A);
- B. Using company data to estimate emissions of the SME using the linear regression model (Company B, C & E);
- C. Using average sector data to estimate emission of the SME as suggested by PCAF (Company D)



Overestimation: When using sector data (method C), we overestimate the financed emissions compared to using company data (method B).

Thank you!